Allen-Bradley

Solid-State Contactor Specifications

Bulletin Number 156, Series B

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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.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

General								
		Single-Phase and Single-Phase with Current Monitoring		Dual- and Three-Phase		Single-Phase with Analog Control		
Nominal Voltage Rating		230V AC	400/480/600V AC	230V AC	400/480 /600V AC	230V AC	400/480V AC	600V AC
Operational Voltage Range		24…265V AC	42…660V AC	24…280V AC	48…660 V AC	90…265V AC	200…550V AC	410…660V AC
Blocking Voltage		650Vp	1200Vp	650Vp	1200Vp	650Vp	1200Vp	1200Vp
Operational frequency		45…65 Hz						
Power Factor Minimum		≥ 0.5 @ 230V AC rms	≥ 0.5 @ 600V AC rms	≥ 0.5 @ 230V AC rms	≥ 0.5 @ 600V AC rms	≥ 0.9 @ 230V AC rms	≥ 0.9 @ 480V AC rms	≥ 0.9 @ 600V AC rms
Rated Insulation Voltage — Input to output, output to case		4000V AC rms						
Relay ON Indication		Green LED, ON when control input is detected						
Overtemp Alarm ON Indication★		Red LED, on when the solid-state contactor (SSC) temperature switching element (SCR) temperature is exceeded. SSC output (load) will switch OFF (Green LED: OFF). When overtemperature condition is removed, red LED will go OFF and normal operation will continue on the control input cycle.						
Overtemp Alarm★	*I* max.	50 mA DC	50 mA DC	50 mA DC	50 mA DC	—	—	—
	U max.	50V DC	50V DC	50V DC	50V DC	—	—	—
Standards Compliance		cULus						
Environmental								
Operating Temperature		-30…+70 °C (-22…+158 °F)						
Storage Temperature		-40…+100 °C (-40…+212 °F)						
RoHS Compliance		Yes						
Vibration		6 G (per EN50155)						
Pollution Degree		2						
Mechanical								
Housing Material		PBT, Flame Retardent						
Heat Sink Material		Black Anodized Aluminum						
Din Rail Mount Base		Electroplated Steel						
Mounting		Vertical						
Approximate Weight	22.5 mm	0.225 kg (0.5 lb)						
	45 mm	0.43 kg (0.95 lb)						
	45 mm with Integrated Fan	0.46 kg (1.0 lb)						
	90 mm	0.75 kg (1.65 lb)						
	90 mm with Integrated Fan	0.78 kg (1.72 lb)						

Contactor Type		Single Phase		Dual- and Three-phase
Package Size		**22.5 mm**	**45 and 90 mm**	**45 and 90 mm**
Control Terminals	Screw Type	M4	M3	M3
	min wire size	1 x 0.5 mm^2 (1 x 20 AWG)	1 x 0.5 mm^2 (1 x 20 AWG)	**(one wire min. & max.)** 1 x 0.5 mm^2 (1 x 20 AWG)…1 x 4.0 mm^2 (1 x 12 AWG)
	max wire size	2 x 2.5 mm^2 (2 x 14 AWG)	1 x 4.0 mm^2 (1 x 12 AWG) or 2 x 2.5 mm^2 (2 x 1 4 AWG)	**(two wire min. & max.)** 2 x 0.5 mm^2 (2 x 20 AWG)…2 x 2.5 mm^2 (2 x 1 4 AWG)
	max torque	2 N•m	0.6 N•m	0.6 N•m
	bit type	posidrive 1 bit	posidrive 0 bit	posidrive 0 bit
Power Terminals	Screw Type	M4	M5	M3
	min wire size	1 x 0.5 mm^2 (1 x 20 AWG)	1 x 4.0 mm^2 (1 x 12 AWG)	**(one wire min. & max.)** 1 x 0.5 mm^2 (1 x 20 AWG)…1 x 4.0 mm^2 (1 x 12 AWG)
	max wire size	2 x 2.5 mm^2 (2 x 14 AWG)	1 x 25 mm^2 (1 x 3 AWG) or 2 x 10 mm^2 (2 x 6 AWG)	**(two wire min. & max.)** 2 x 0.5 mm^2 (2 x 20 AWG)…2 x 2.5 mm^2 (2 x 14 AWG)
	max torque	2 N•m	2.5 N•m	0.6 N•m
	bit type	posidrive 1 bit	posidrive 2 bit	posidrive 0 bit

★ Alarm capability exists on 1-phase 75 and 90 A, 5…24V DC control and 3-phase 32 A, 5…24V DC control units.

Control Input				
	Single-Phase, Single-Phase with Current Monitoring, and Single-Phase with Analog Control		Dual- and Three-Phase	
Control voltage range (±10%)	DC	AC/DC	DC	AC/DC
Control Voltage Range	4…32V	24…275V AC/24…48V DC	5…32V DC	24…275V AC/24…190V DC
Pick Up Voltage	3.8V DC	22V AC/DC	4.7V DC	22V AC/DC
Reverse Voltage	32V DC	—	32V DC	—
Drop Out Voltage	1.2V DC	6V AC/DC	1.2V DC	6V AC/DC
Maximum Input Current	12 mA	17 mA	24 mA	15 mA
Maximum Response Time Pick Up and Drop Out	1/2 Cycle	1 Cycle	1 Cycle	1 Cycle

Power Output													
			Rated Operational Current‡♦										
		Housing Size [mm]	AC51 @ 25 °C	AC53a @ 25 °C	Min. Oper. Current	Max. Repetitive Overload Current (ACrms) t = 1 s	Non-Repetitive Surge Current (ACrms) Tj = 25 °C t = 10 ms	Max. Off-State Leakage Current @ Rated Voltage and Frequency Tj = 25 °C t = 10 ms	I^2t for Fusing t = 10 ms♣	Max. SCCR (65 kA) Fuse Current §	On-State Voltage Drop @ Rated Current Tj = 25 °C t = 10 ms	Critical dV/dT Off-State
Single-Phase	156-B20…1	22.5	20 A	5 A	350 mA	35 A	300 A	3 mA	450 A^2s	20 A	1.6 Vrms	500 V/uS
	156-B30…1	22.5	30 A	15 A	250 mA	125 A	600 A	3 mA	1800 A^2s	40 A	1.6 Vrms	500 V/uS
	156-B45…1	45	45 A	20 A	400 mA	150 A	1150 A	3 mA	6600 A^2s	60 A	1.6 Vrms	500 V/uS
	156-B50…1	45	50 A	30 A	500 mA	200 A	1900 A	3 mA	18000 A^2s	90 A	1.6 Vrms	500 V/uS
	156-B70…1	90	70 A	30 A	500 mA	200 A	1900 A	3 mA	18000 A^2s	90 A	1.6 Vrms	500 V/uS
	156-B75…1	45 with fanΔ	75 A	30 A	500 mA	200 A	1900 A	3 mA	18000 A^2s	90 A	1.6 Vrms	500 V/uS
	156-B90…1	90 with fanΔ	90 A	30 A	500 mA	200 A	1900 A	3 mA	18000 A^2s	90 A	1.6 Vrms	500 V/uS
Dual-Phase	156-B25…2	45	25 A	15 A	250 mA	125 A	600 A	3 mA	1800 A^2s	40 A	1.6 Vrms	500 V/uS
	156-B32…2	90	32 A	15 A	250 mA	125 A	600 A	3 mA	1800 A^2s	40 A	1.6 Vrms	500 V/uS
Three-Phase	156-B20…3	45	20 A	15 A	250 mA	125 A	600 A	3 mA	1800 A^2s	40 A	1.6 Vrms	500 V/uS
	156-B25…3	90	25 A	15 A	250 mA	125 A	600 A	3 mA	1800 A^2s	40 A	1.6 Vrms	500 V/uS
	156-B32…3	45 with fanΔ	32 A	15 A	250 mA	125 A	600 A	3 mA	1800 A^2s	40 A	1.6 Vrms	500 V/uS
Single-Phase with Current Monitoring	156-B30…	45	30 A	15 A	150 mA	125 A	600 A	5 mA	1800 A^2s	40 A	1.6 Vrms	1000 V/uS
	156-B50…	45	50 A	30 A	500 mA	200 A	1900 A	5 mA	18000 A^2s	90 A	1.6 Vrms	1000 V/uS
Single-Phase with Analog Control	156-B30…	45	30 A	—	150 mA	55 A	325 A	3 mA	525 A^2s	30 A	1.6 Vrms	1000 V/uS
	156-B50…	45	50 A	—	500 mA	200 A	1900 A	3 mA	18000 A^2s	90 A	1.6 Vrms	1000 V/uS

‡ AC51 indicates a resistive load. For details, refer to IEC 60947-4-3. AC53a indicates an inductive (motor) load. For details, refer to IEC 60947-4-2.

♣ To potentially protect the solid-state contactor from a short-circuit condition, select a semiconductor fuse with an I^2T value less than the one indicated below for the SSC.

§ Provides Type 1 protection using a Class J or CC fuse.

Δ Includes an integrated fan in the heat sink assembly. Fan will automatically switch on when necessary (approximately 125 °C internal temp.). DC control Includes overtemperature alarm cutout.

♦ Current per each phase.

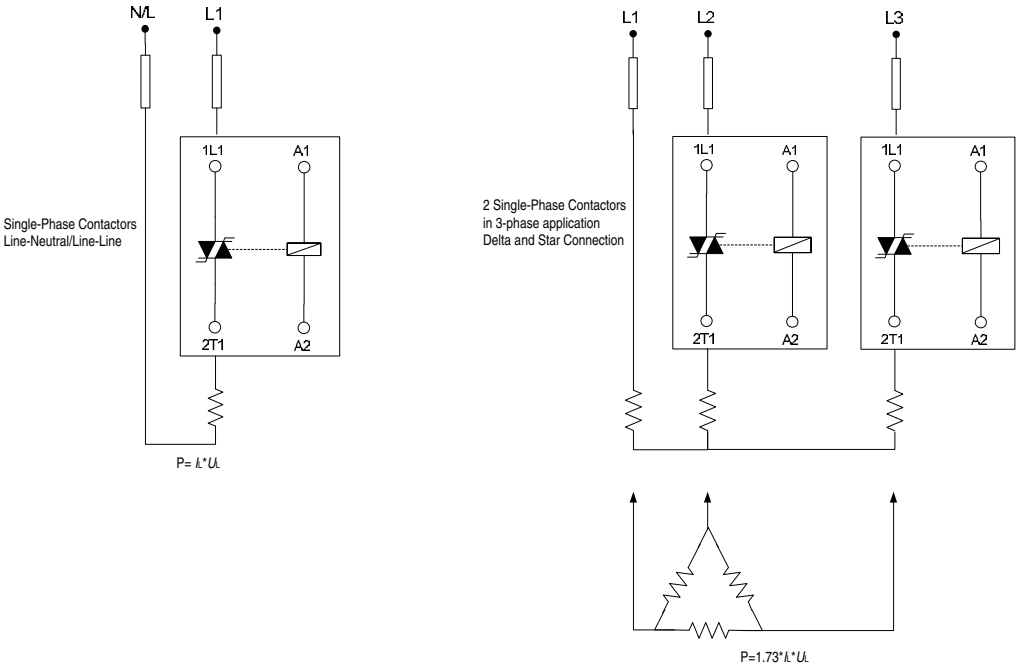
Power Dissipation		
	Size [A]	Power Dissipation [W/A]
Single-Phase	20	1.10
	30	0.95
	45	0.90
	50	0.85
	75	0.90
	70	0.90
	90	0.93
Dual-Phase	25/32	2.80
Three-Phase	20/25/32	1.92
Single-Phase with Current Monitoring	30	1.00
	50	0.85
Single-Phase with Multi-Function Analog Control	30	0.95
	50	0.85

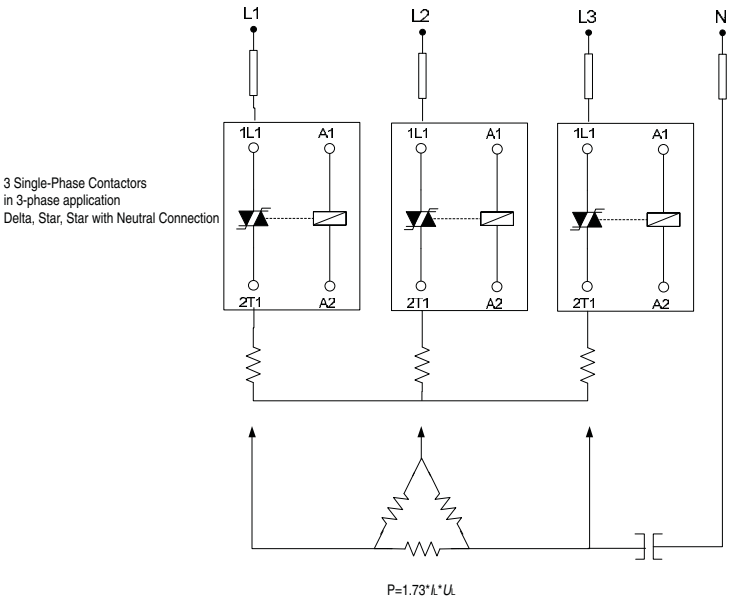
Additional Specifications that only apply to the Single-Phase with Current Monitoring Contactor		
Supply Status Indication		Green LED, Half Intensity
Control Status Indication		Green LED
Overtemp Alarm Trip Indication		Red LED, Intermittent
Alarm Indication (except for overtemp alarm)		Red LED
Power Supply Voltage, Vcc		24V DC +/- 15%
Maximum Supply Currrent		22 mA (per device)
Maximum Control Input Current		1.5 mA
Maximum PLC Current @ 24 VDC		275 uA (per device)
Alarm Output Current, Maximum		50 mA DC
Alarm Output Voltage	NPN (N.O.)	1 + 0.15 Io
	PNP (N.O.)	VCC - 1 - 0.15 Io
Maximum number of Parallel Outputs		≤ 50
Current Monitoring Measurement Range	30 A	0.3 … 30 A AC rms
	50 A	0.5 … 50 A AC rms
Minimum Teach Current	30 A	0.3 A AC rms
	50 A	0.5 A AC rms
Minimum Partial Load Current	30 A	50 mA AC rms
	50 A	83 mA AC rms

Additional Specifications that only apply to the Single-Phase with Multi-Function Analog Control Contactor			
Load Status Indication		Red LED	
Control Status Indication		Green LED	
Current Controlled Input Specifications	Control Current Range	4…20 mA	
	Max. Allowable Current	50 mA	
	Pick Up Current	4.2 mA	
	Drop Out Current	3.9 mA	
	Reverse Polarity Protected	Yes	
	Voltage Drop	10V DC @ 20 mA	
Voltage Controlled Input Specifications	Supply Voltage Range, Vss♣	20…28V AC/DC	
	Supply Current♣	18 mA @ 24V DC 23 mA @ 24V AC	
	Control Voltage Range, Vcc	0…10V DC	
	Control Input Current	0.1 mA @ 10V DC	
	Reverse Polarity Protected	Yes	
	Pick up Voltage	0.5V DC	
	Drop out Voltage	0.05V DC	
Output Power Range		0…99%	
Transfer Characteristics - Output Power %		Current Control Level	Voltage Control Level
	0%	4 mA	0V DC
	25%	8 mA	2.5V DC
	50%	12 mA	5V DC
	75%	16 mA	7.5V DC
	99%	20 mA	10V DC
Output Power Resolution	Mode 1 - Phase Angle	1/300 @ 50 Hz , 1/300 @ 60 Hz	
	Mode 2 - Full Cycle	1/64 @ 50 Hz , 1/64 @ 60 Hz	
	Mode 3 - 1 Sec Burst	1/50 @ 50 Hz , 1/60 @ 60 Hz	
	Mode 4 - 3 Sec Burst	1/150 @ 50 Hz , 1/180 @ 60 Hz	
	Mode 5 - 10 Sec Burst	1/500 @ 50 Hz , 1/600 @ 60 Hz	

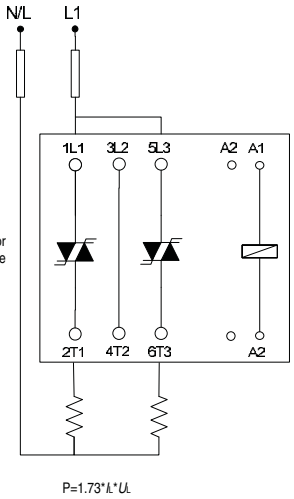
♣ The 0…10V DC type contactor requires a 24V AC/DC supply to power the control circuitry of the solid-state contactor.

Applications for Non-Motor Loads

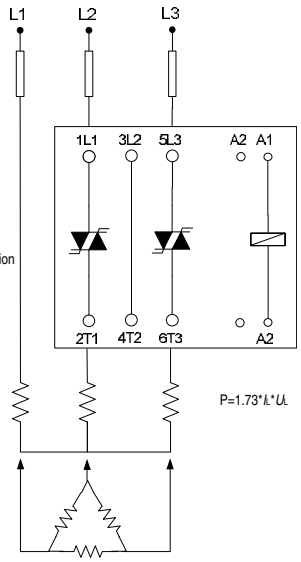




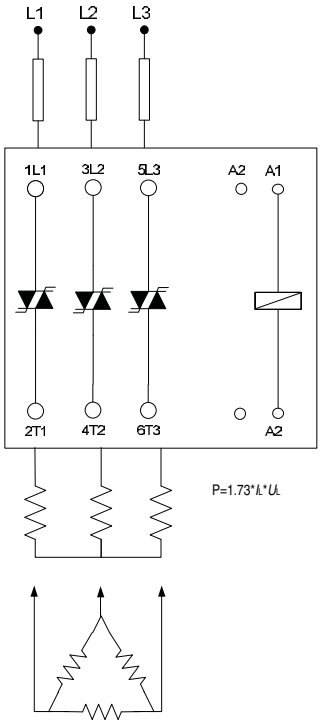
Dual-Phase Contactor
Line-Neutral/Line-Line



Dual-Phase Contactor
in 3-phase application
Delta and Star Connection

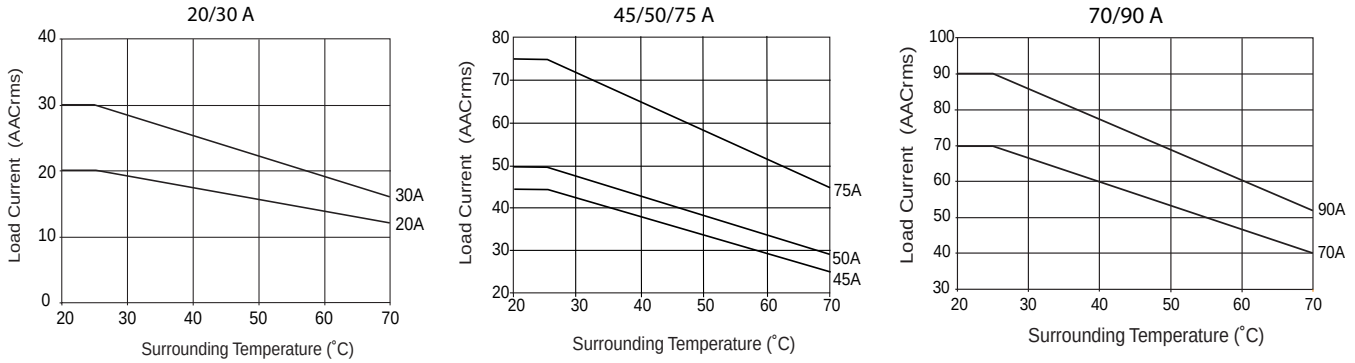


Three-Phase Contactor
Delta and Star Connection

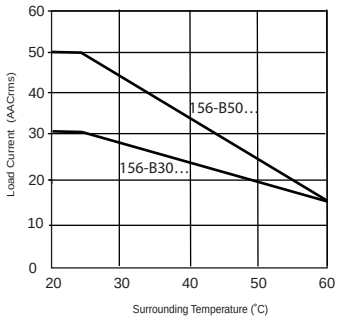


Load Versus Ambient Temperature Derating Curves

Single-Phase (Standard)

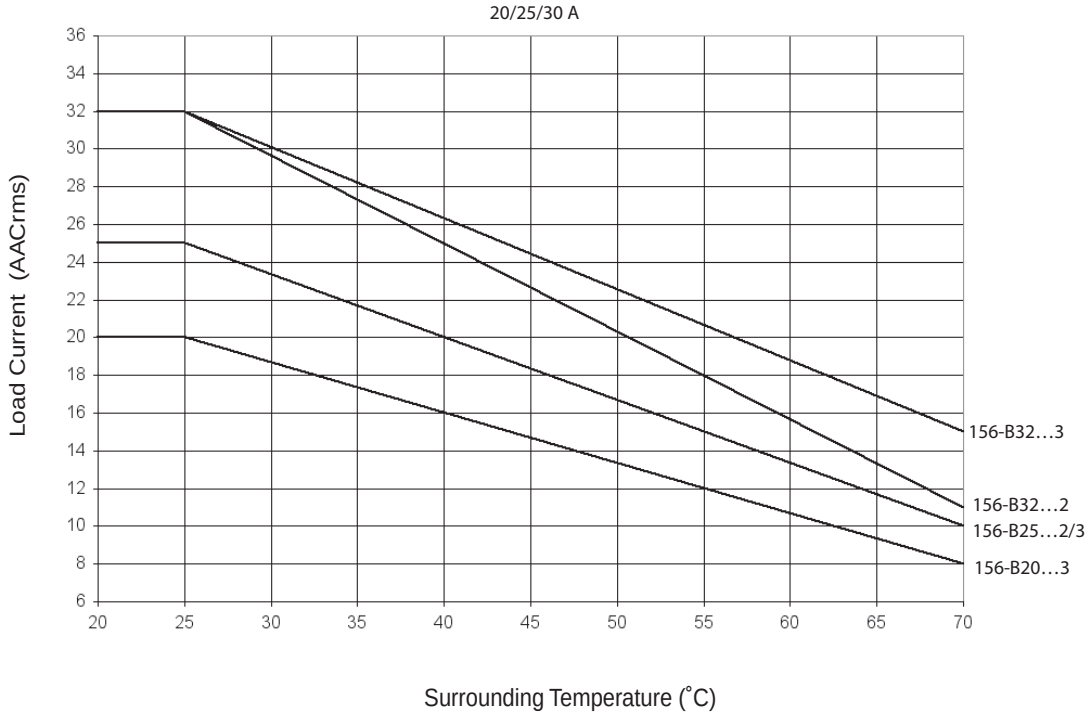


Single-Phase (Current Monitoring and Multifunction Analog)

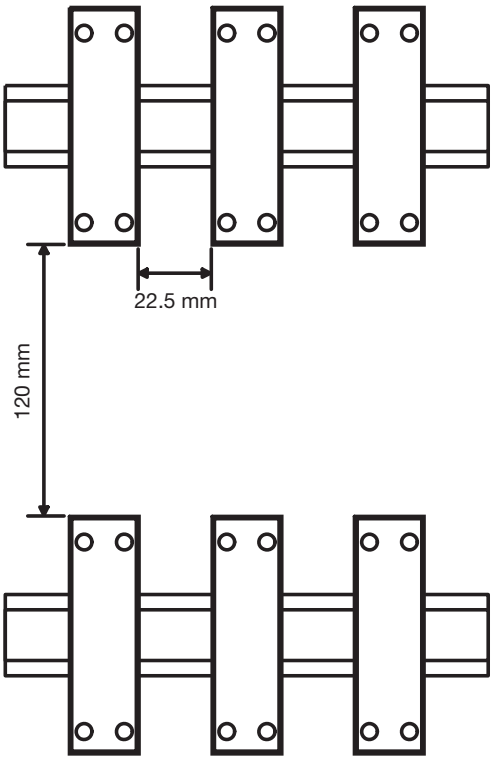


Note: Based on 100% duty cycle

Dual- and Three-Phase

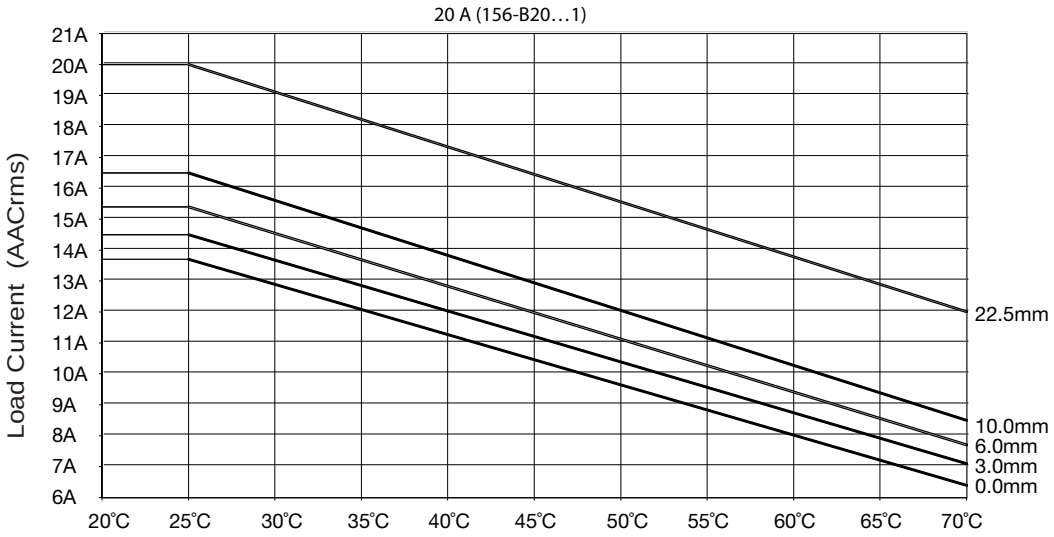


Panel Mounting Recommended Contactor Spacings

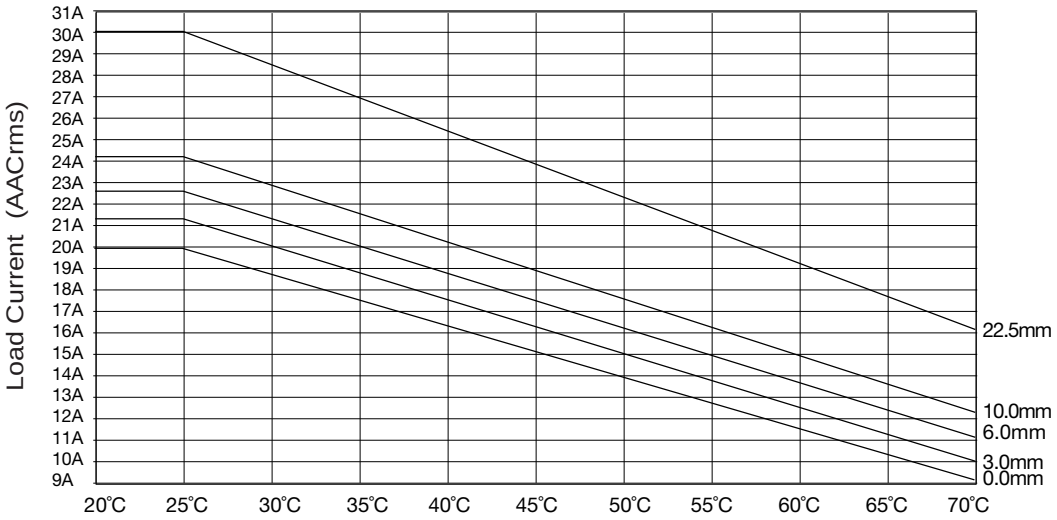


Panel Mounting Load Derating vs. Spacing Curves

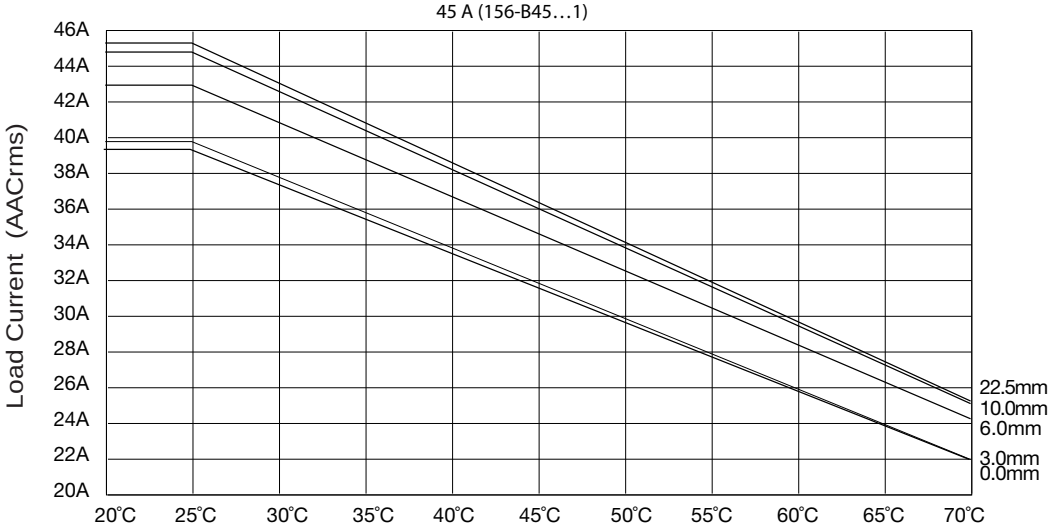
Single-Phase



30 A (156-B30…1)

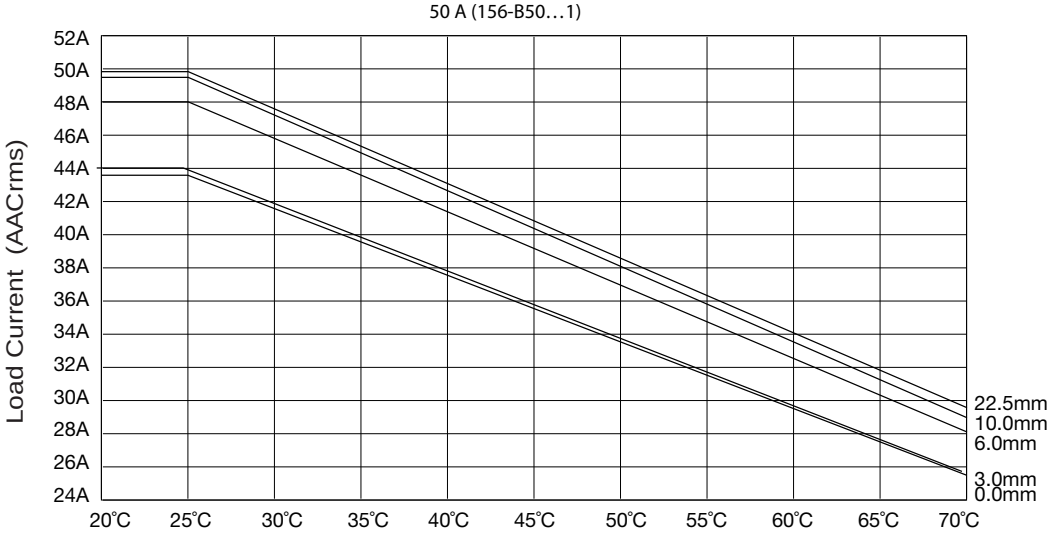


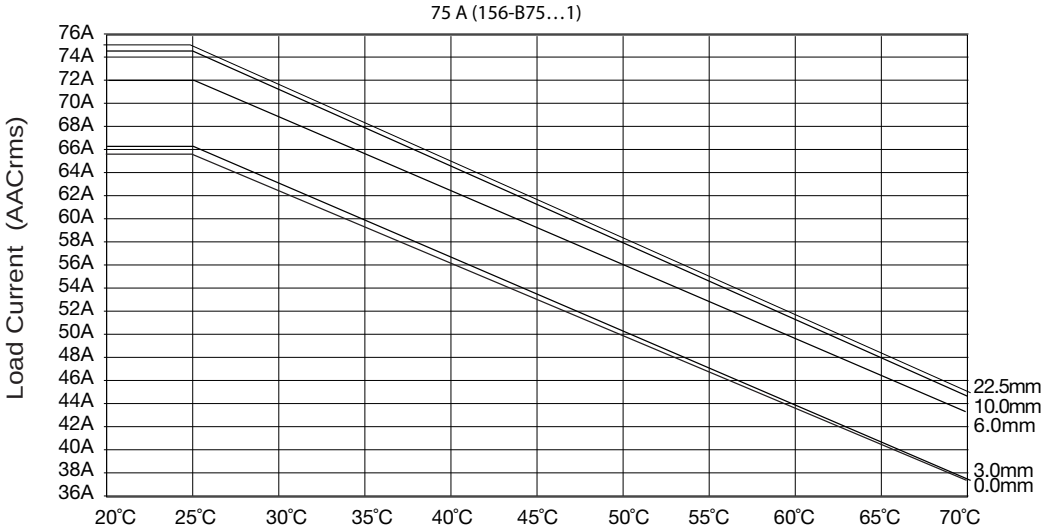
45 A (156-B45…1)



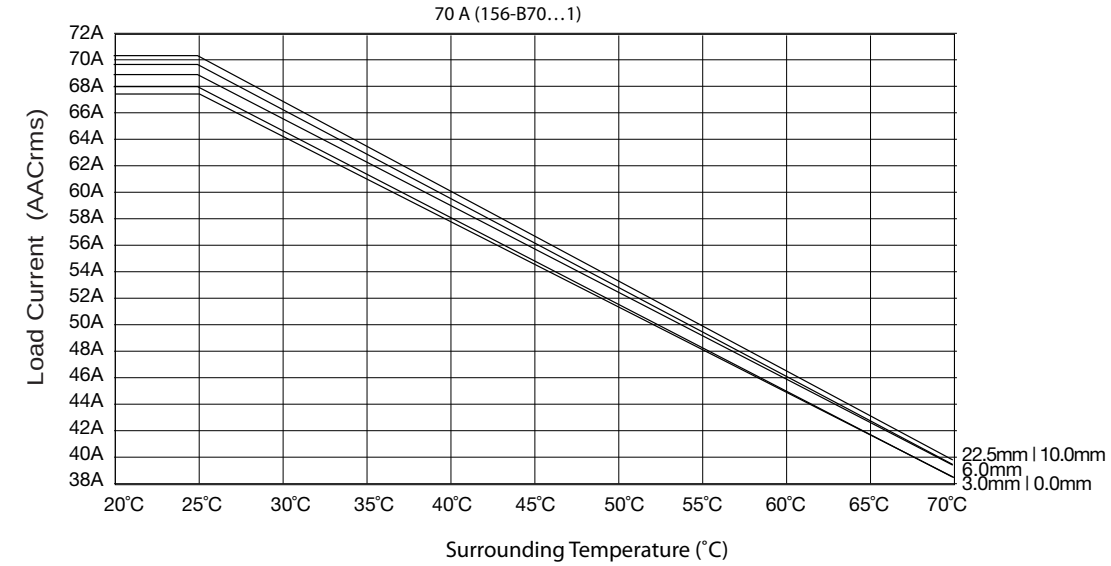
Single-Phase

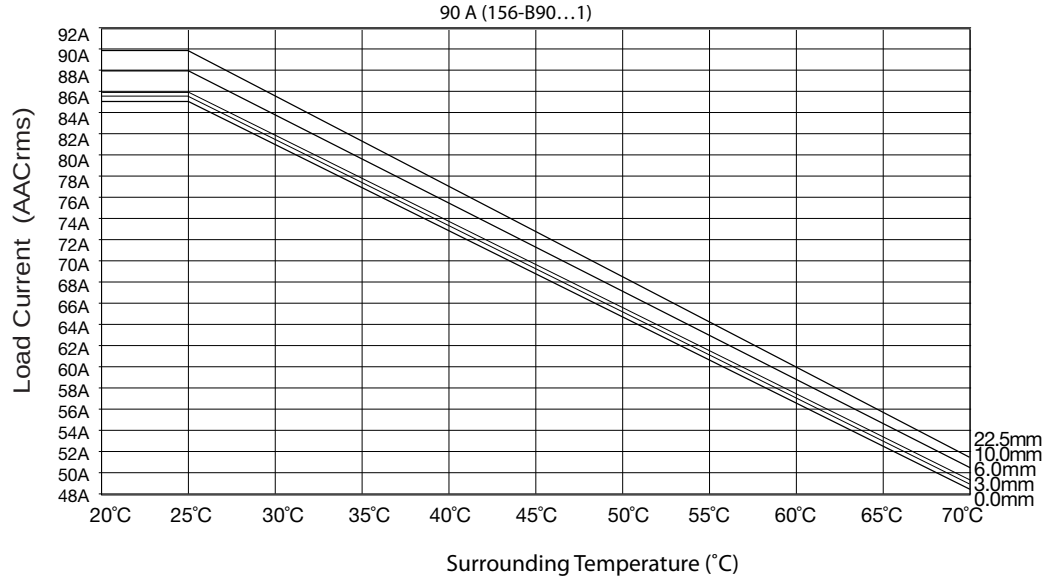
50 A (156-B50…1)





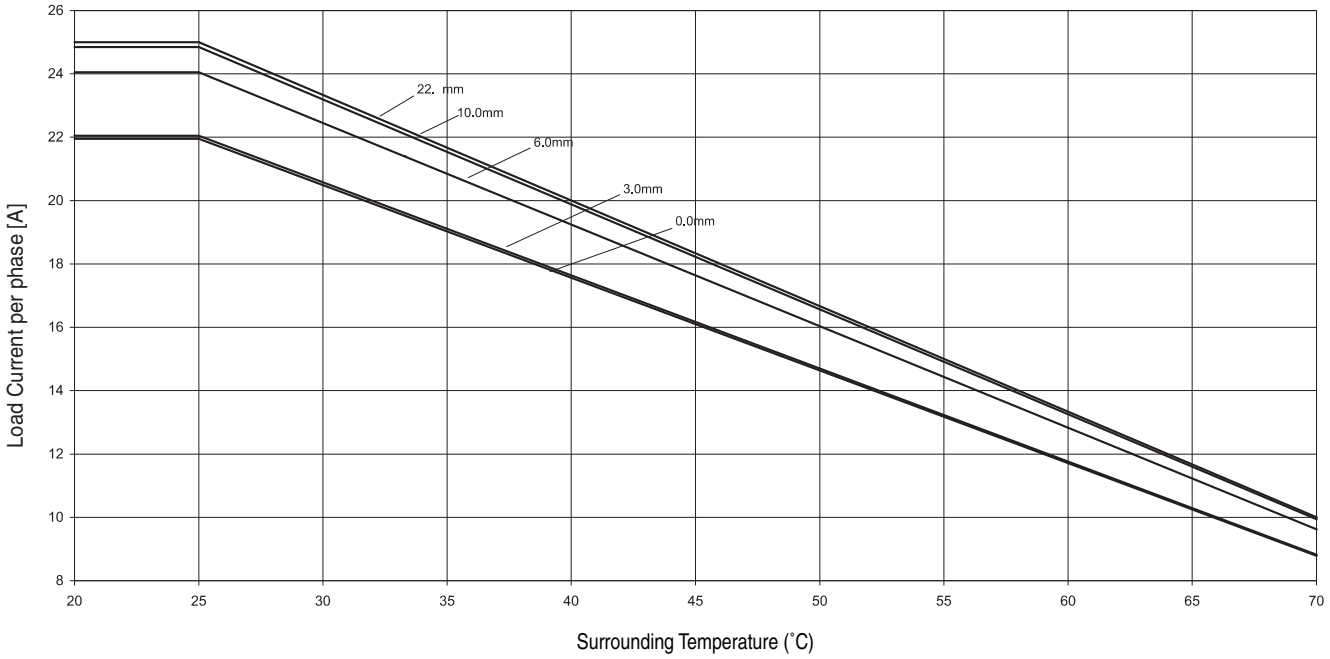
Single-Phase



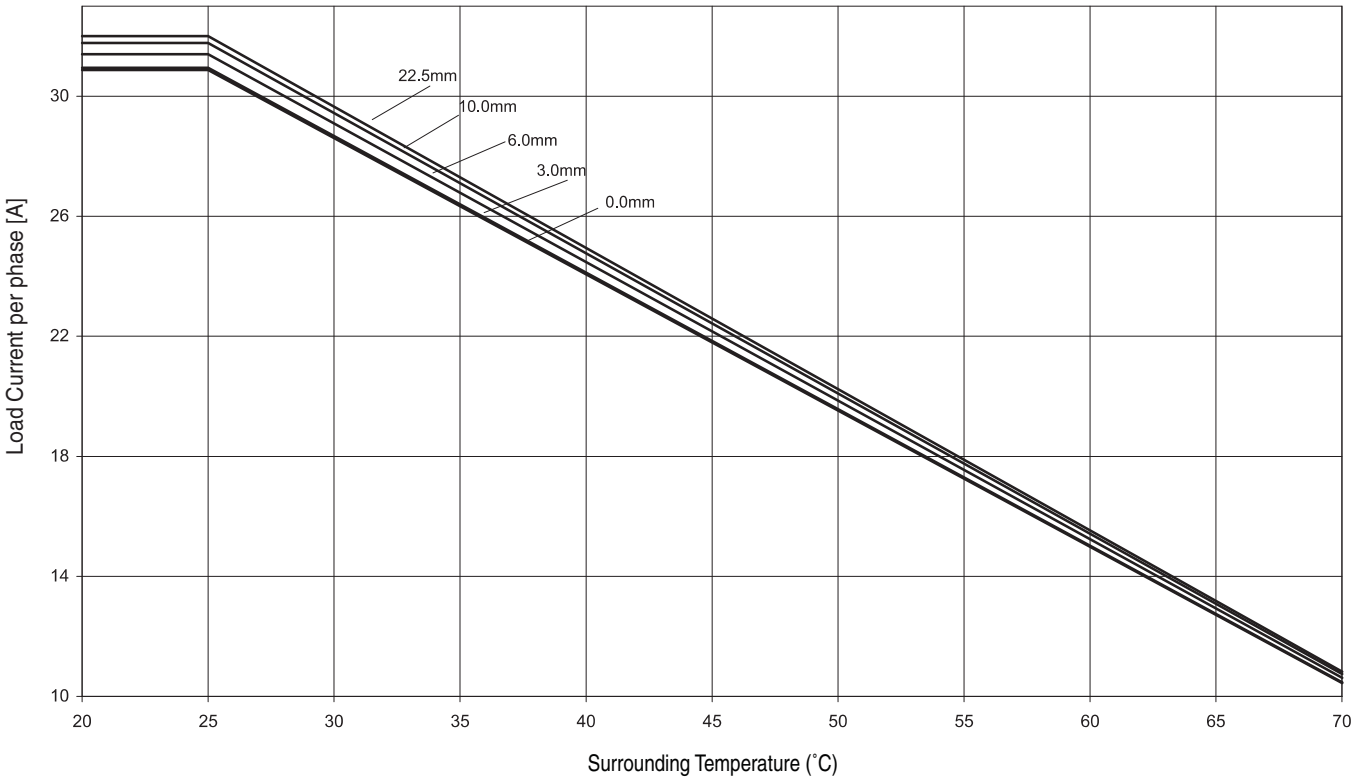


Dual-Phase

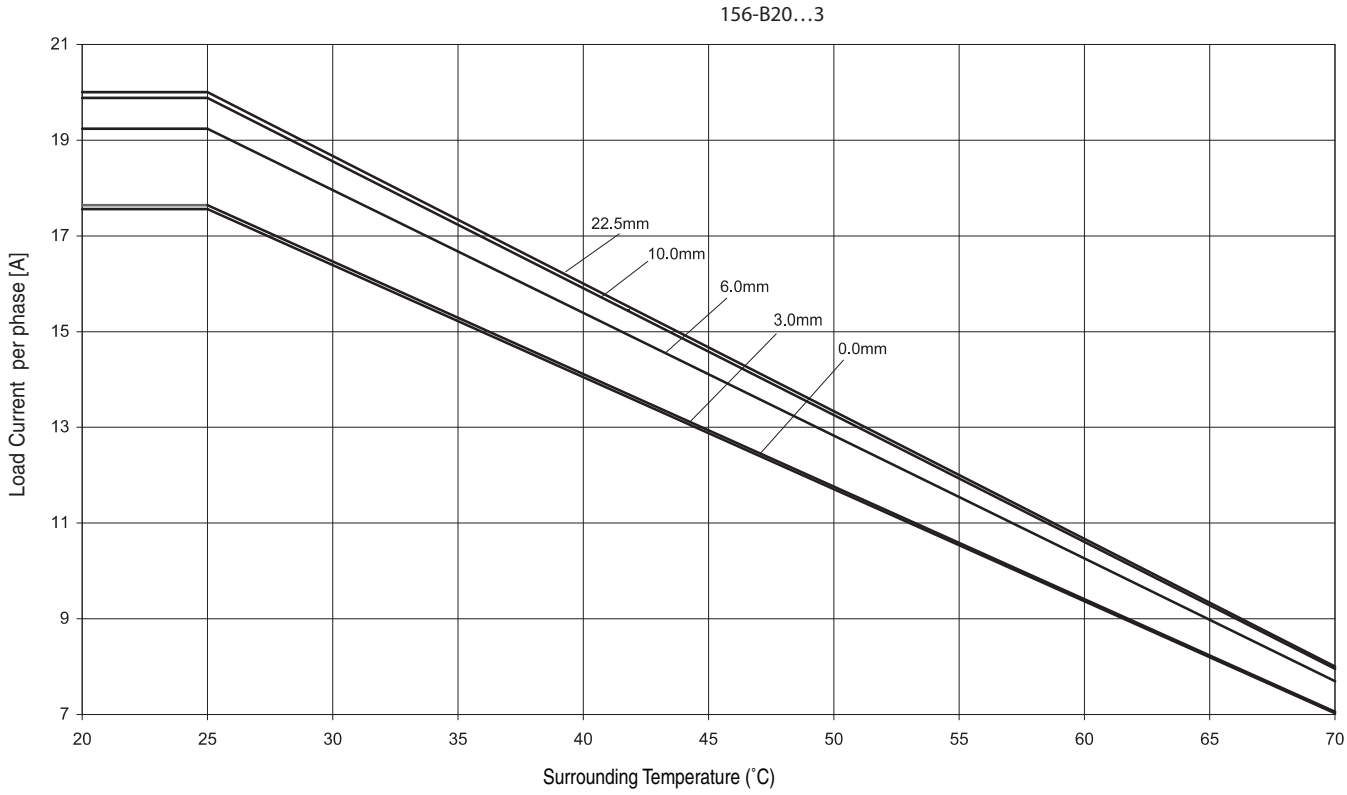
156-B25…2

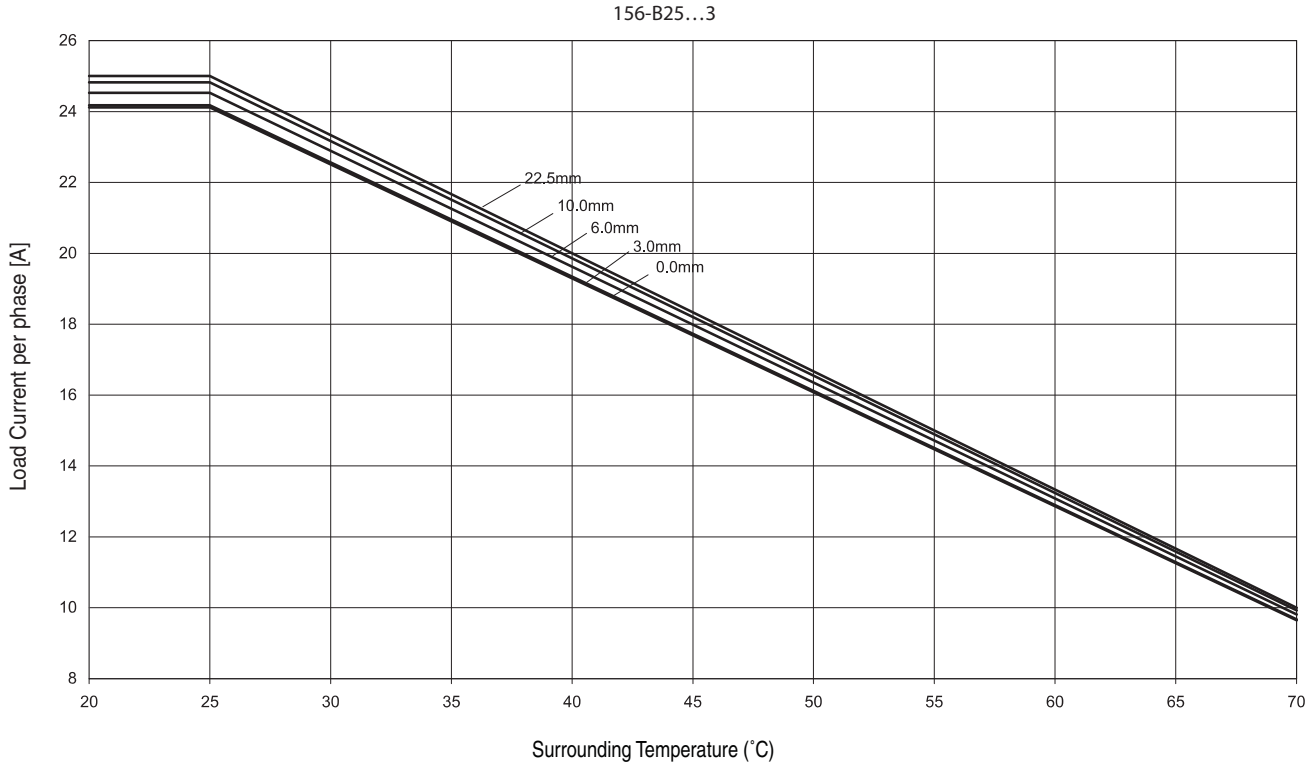


156-B32…2

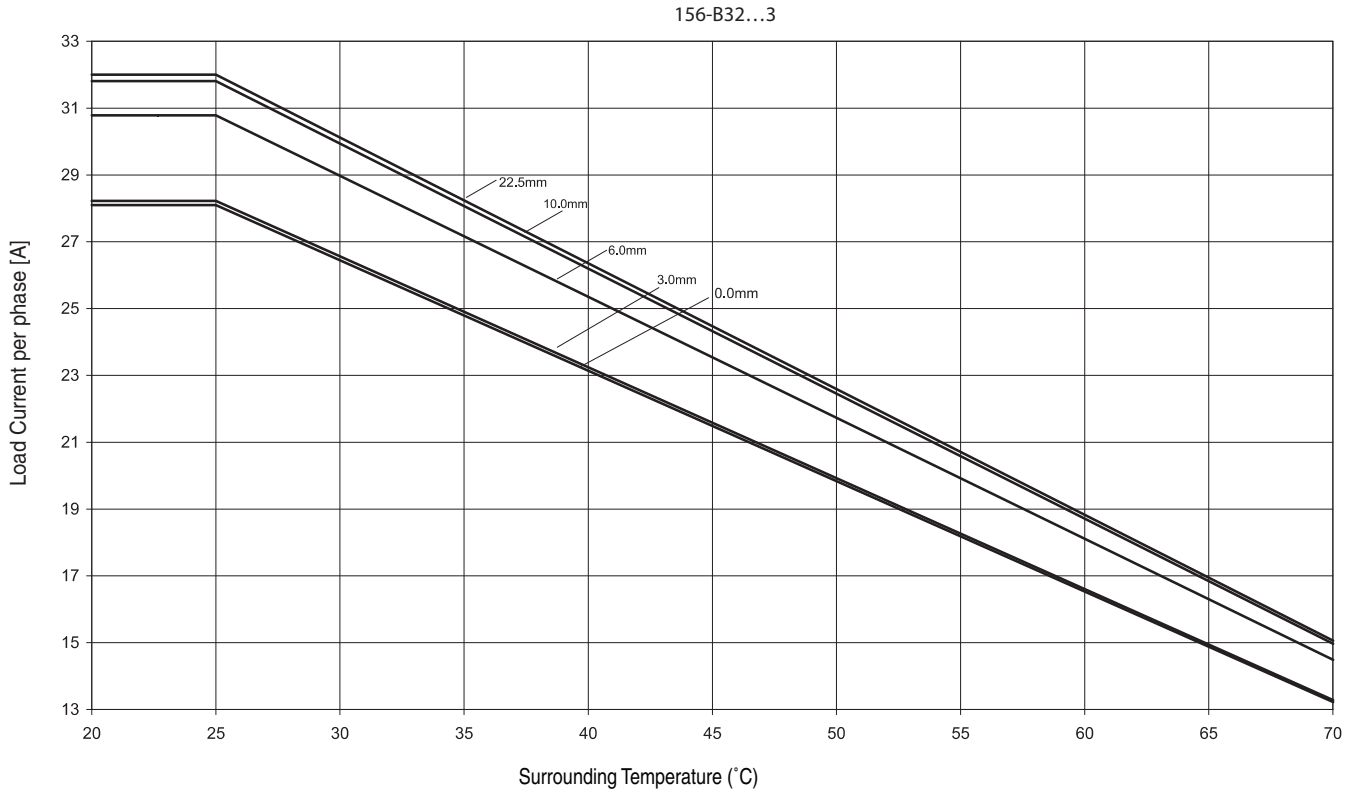


Three-Phase

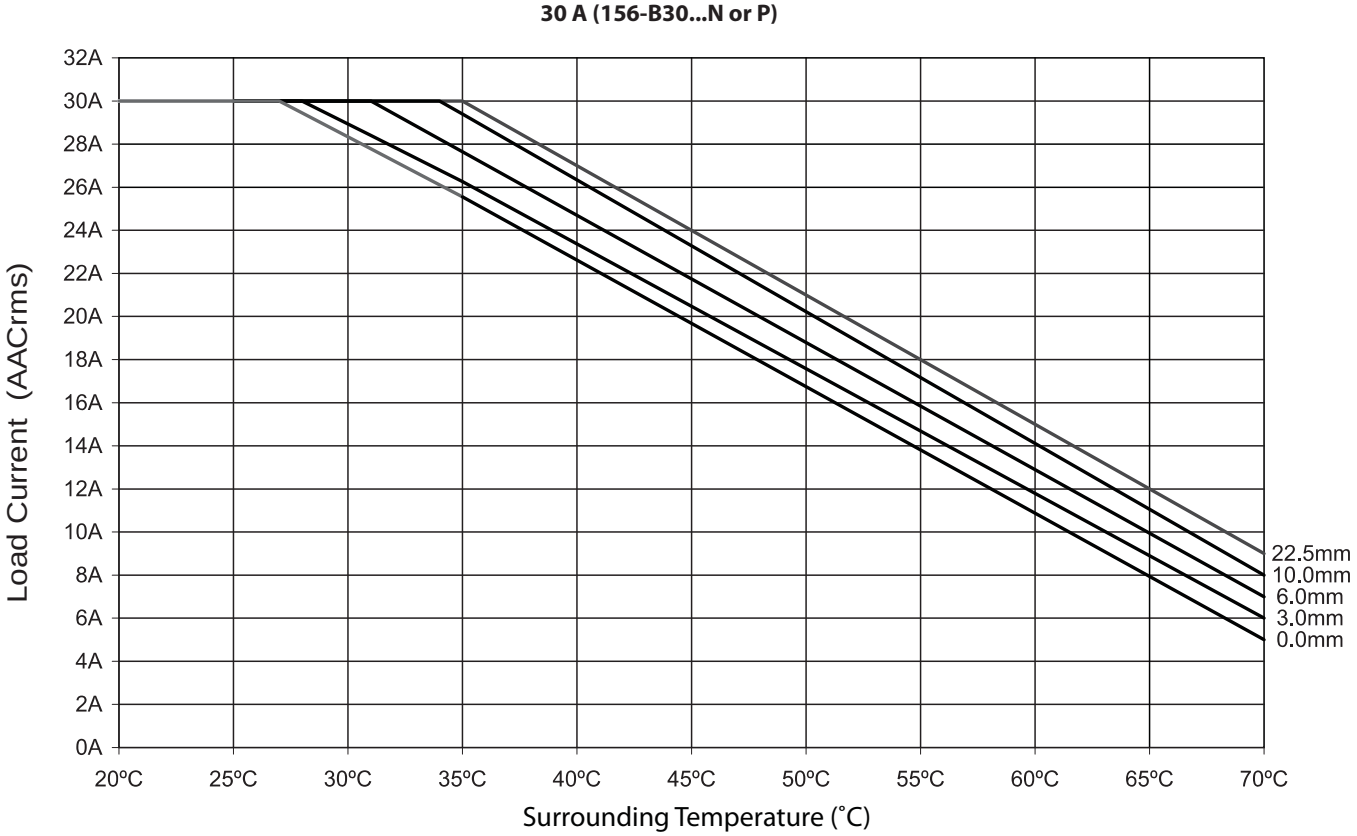

156-B20…3
Load Current per phase [A]
21
19
17
15
13
11
9
7
20
25
30
35
40
45
50
55
60
65
70
Surrounding Temperature (˚C)
22.5mm
10.0mm
6.0mm
3.0mm
0.0mm


156-B25…3
Load Current per phase [A]
26
24
22
20
18
16
14
12
10
8
20
25
30
35
40
45
50
55
60
65
70
Surrounding Temperature (˚C)
22.5mm
10.0mm
6.0mm
3.0mm
0.0mm

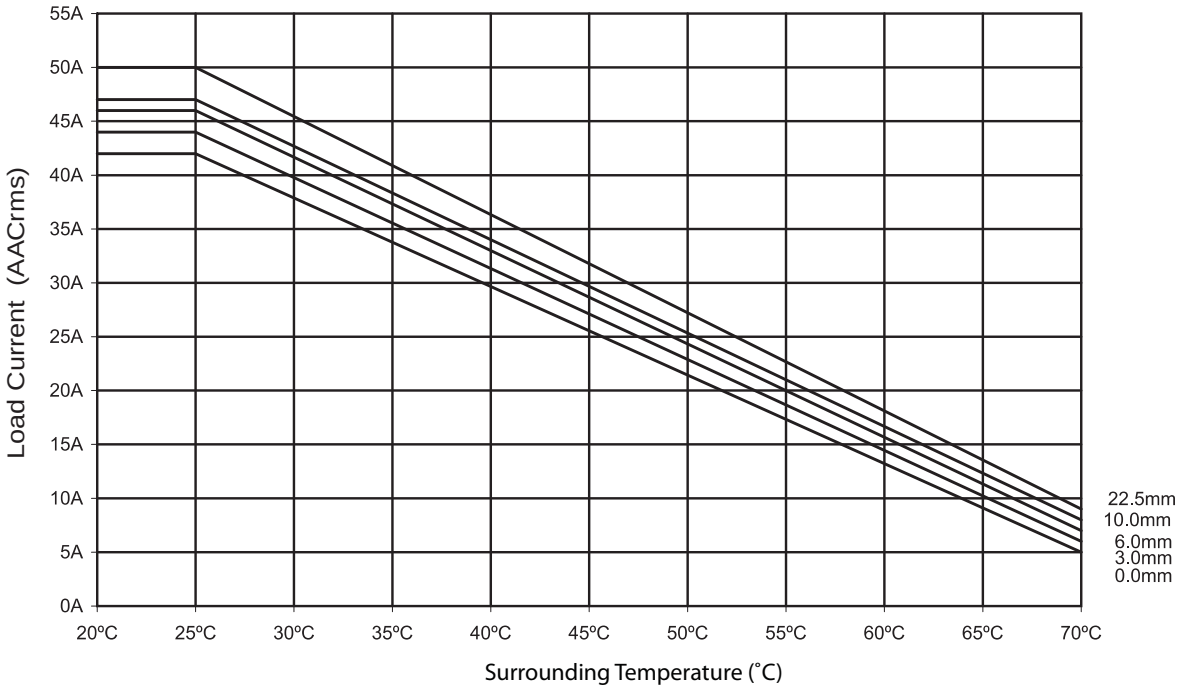
Three-Phase



Single-Phase with Current Monitoring

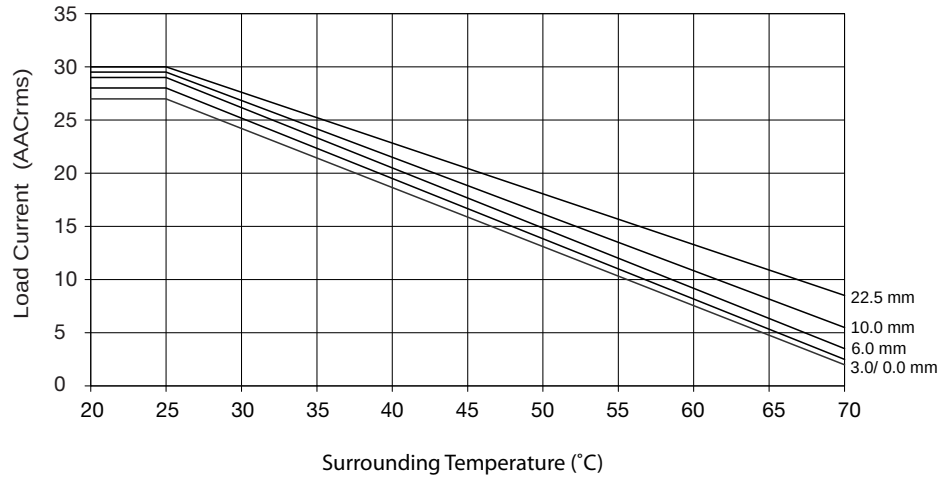


50A (156-B50...N or P)

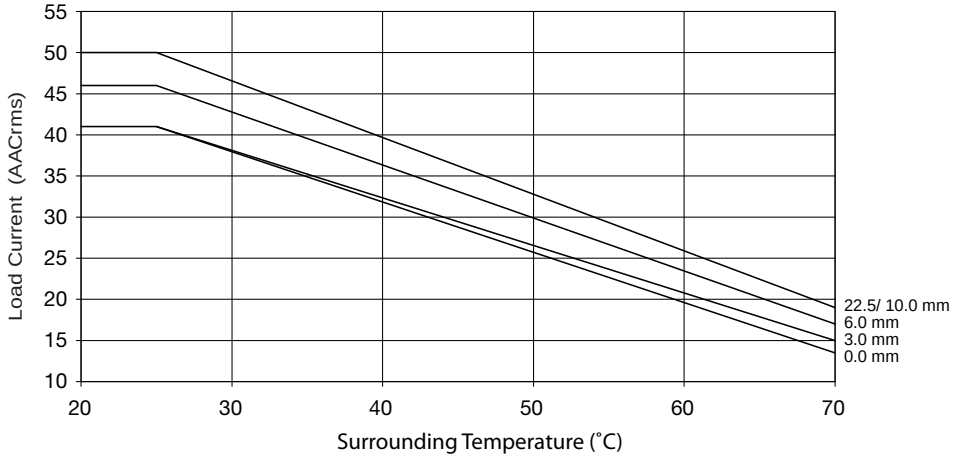


Multi-function Analog

30A (156-B30...C1 or V1)

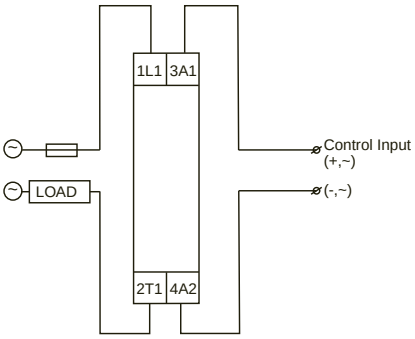


50A (156-B50...C1 or V1)



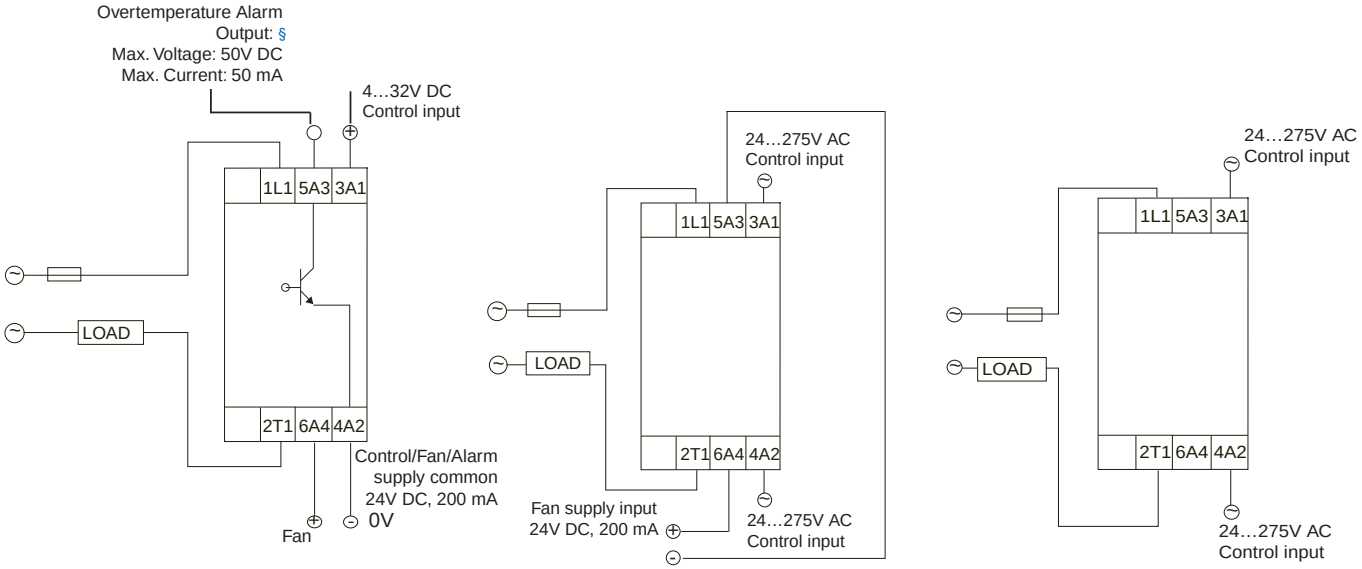
Typical Wiring Diagrams

Single-Phase



156-B…1

22 mm Device



DC control with fan ❄
Example: 156-B75CB1

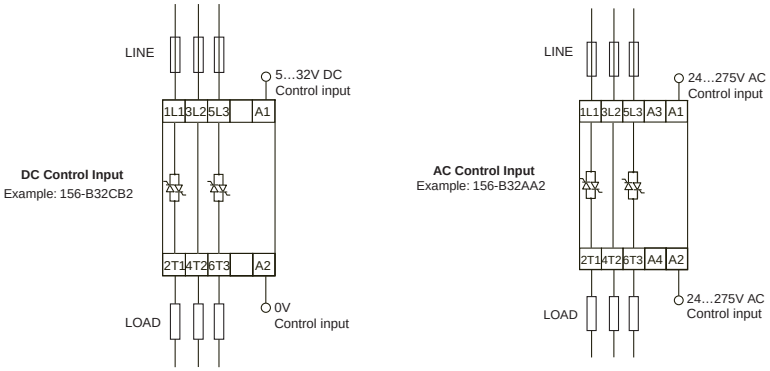
AC control with fan ❄
Example: 156-B75CA1

AC control without fan ❄
Example: 156-B50CA1

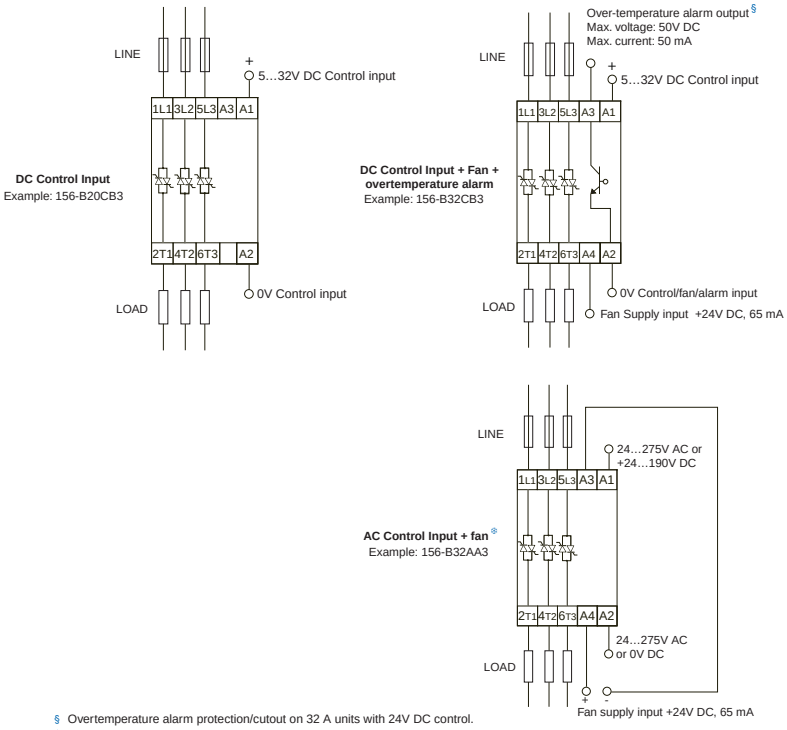
45 or 90 mm Device

§ Overtemperature alarm protection/cutout on 75 and 90 A units with 24V DC control.
❄ Integrated fan comes with 75 and 90 A units. Fan must be wired to 24V DC source for contactor to operate.

Dual-Phase

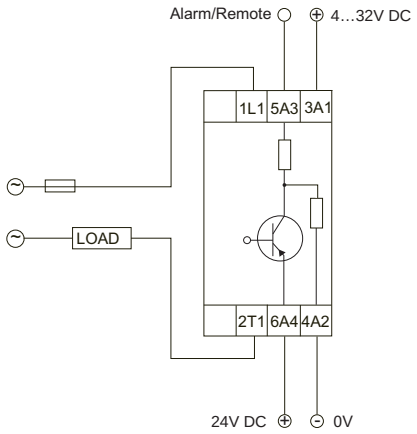


Three-Phase



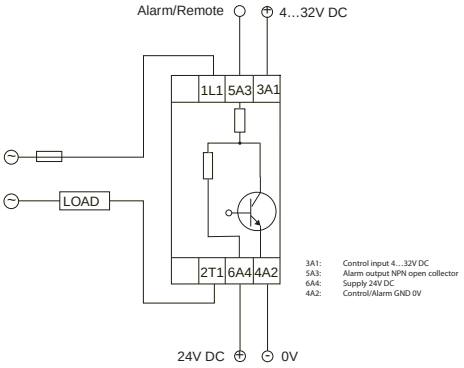
§ Overtemperature alarm protection/cutout on 32 A units with 24V DC control.
❄ Integrated fan comes with 32 A units. Fan must be wired to 24V DC source for contactor to operate.

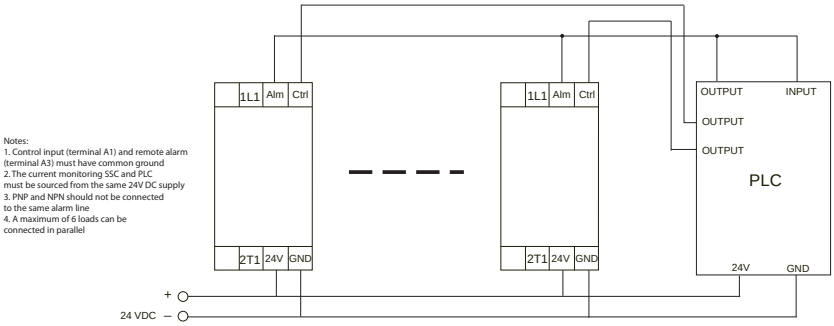
Single-Phase with Current Monitoring (PNP)



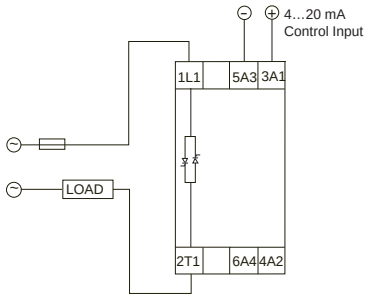
3A1: Control input 4…32V DC
5A3: Alarm output PNP open collector
6A4: Supply 24V DC
4A2: Control/Alarm GND 0V

Single-Phase with Current Monitoring (NPN)

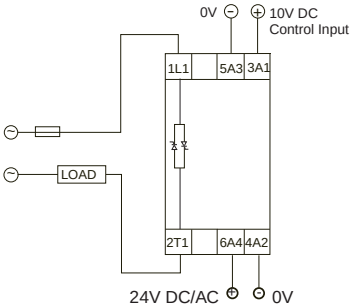




Multi-function Analog



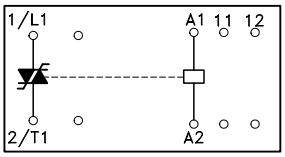
3A1 - 5A3: Control input current
Example: 156-B30BC1



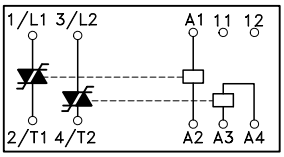
3A1 - 5A3: Control input voltage, Vcc
4A2 - 6A4: Supply input voltage, Vss
Example: 156-B30BV1

‡ Requires a 24V AC/DC supply to power the control circuitry of the solid-state contactor.

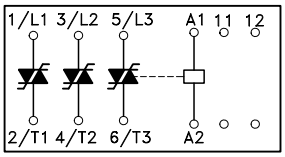
Single-phase



Dual-phase



Three-phase

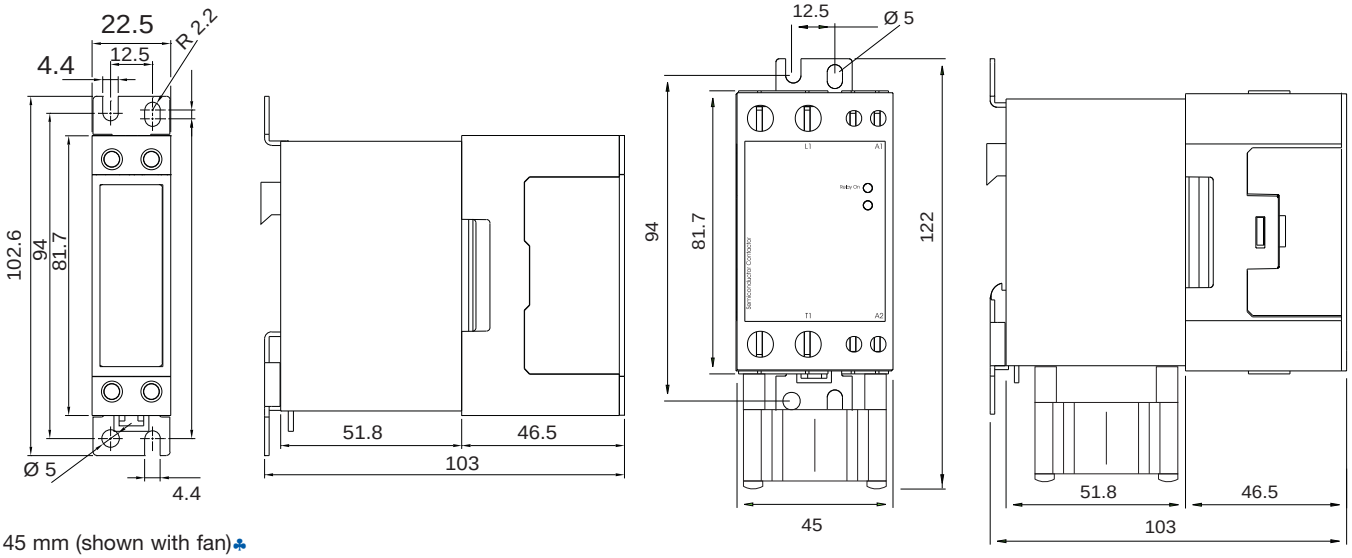


Approximate Dimensions

Dimensions in millimeters. Dimensions are not intended for manufacturing purposes.

Refer to column 3 of the Power Output table on page 4-172 for cat. no. dimension reference.

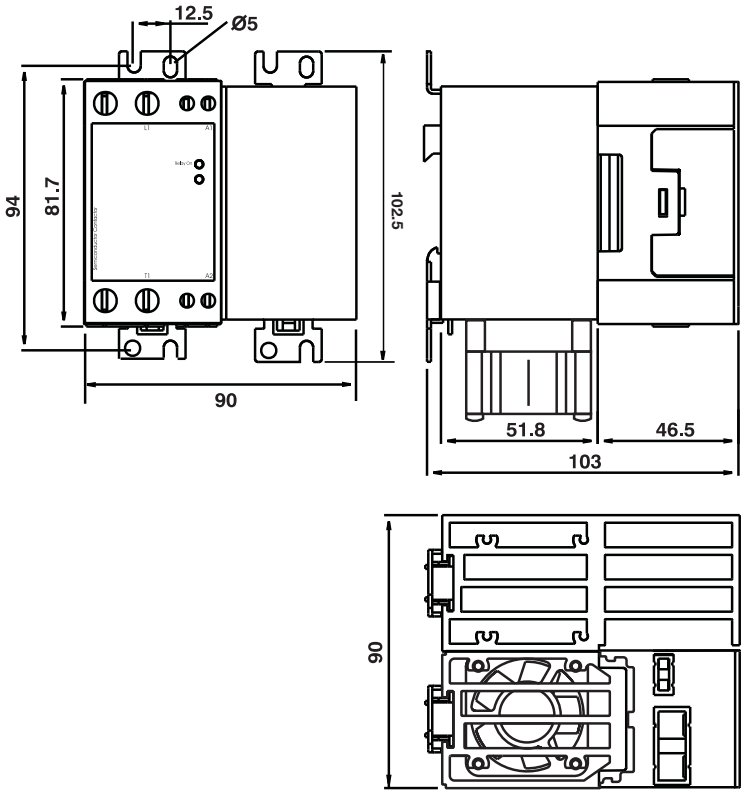
22.5 mm



45 mm (shown with fan)♣

♣ The fan adds approximately 28 mm to the height of the SSC. Subtract 28 mm for the approximate height of SSCs without fans. Refer to page 4-169 for products with fans.

90 mm (shown with fan)♣

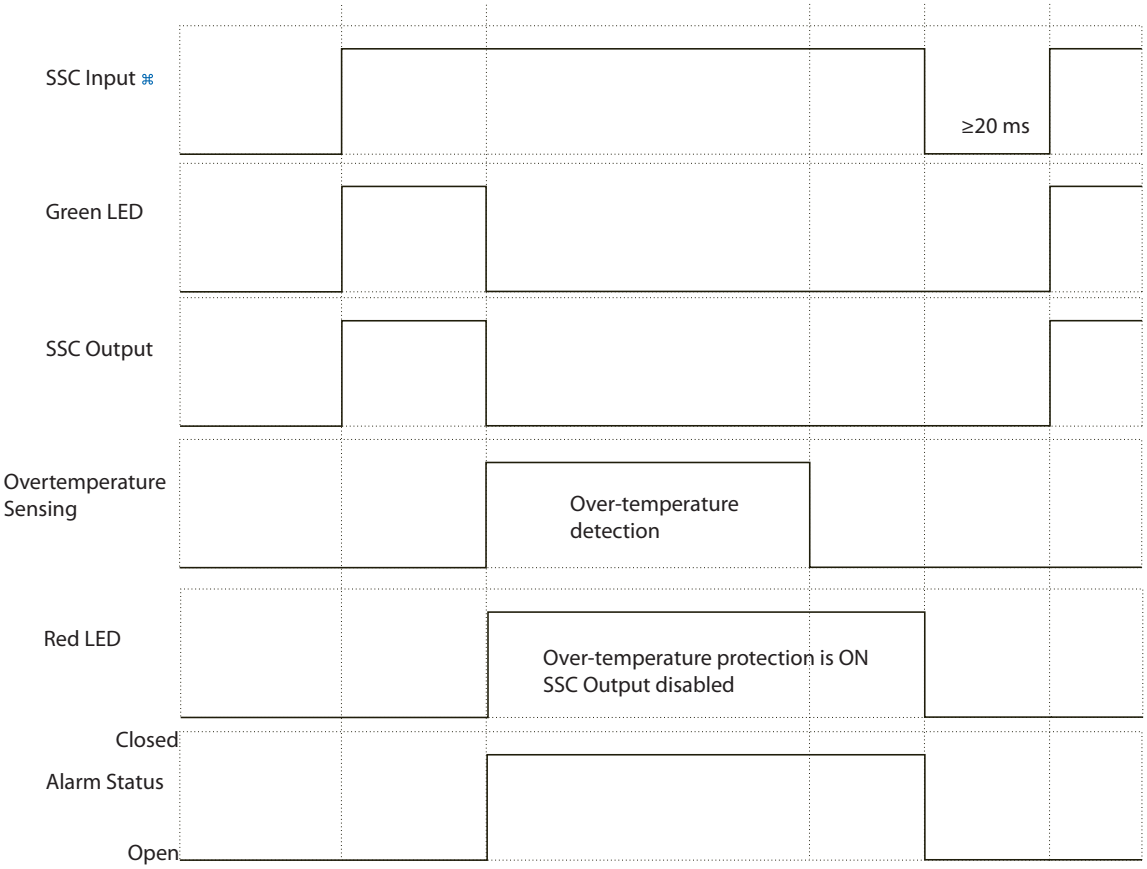


♣ The fan adds approximately 28 mm to the height of the SSC. Subtract 28 mm for the approximate height of SSCs without fans. Refer to page 4-169 for products with fans.

Overtemperature Alarm Cutout/Protection Operation

The Bulletin 156-B… Solid-State Contactor (SSC) with a fan (Cat. Nos. 156-B75...1, 156-B90...1, and 156-B32...3) has an overtemperature alarm, cutout/protection feature. The cutout feature protects the SSC electronic switching circuit from overtemperature damage by automatically switching off the output (load) when the core temperature of the SSC exceeds 125 °C (257 °F). In this condition the fan will be running unless there is a fan circuit issue. When the cutout occurs the SSC red LED will light and if the alarm contact is wired it will close to notify a monitoring device such as the PLC of the condition. The following diagram provides additional details.

Note: For a standard unit without an overtemperature alarm. The SCO protective cutout feature still functions. When the unit cools to within allowable limits it returns to operation.



⌘ After over-temperature condition is removed, SSC can be reset by switching OFF the control input for more than 20 ms and switching back ON: this will switch ON the SSC output

Product Description

The Bulletin 156-B… P or …N Current-Monitoring Solid-State Contactor (SSC) is a single-phase device that is sensitive to variations in load current conditions. This microprocessor-based device can detect a partial load failure and ensure the highest process quality. Current sensing is integrated inside to eliminate the need to install an external current transformer. A membrane TEACH button on the front is used to effect a simple "teach in" of the normal operating current setpoint. Alarm delay time is set by a potentiometer. Typical conditions that can be detected are heater break or open-circuit, blown fuse, semiconductor short-circuit and faulty power connection.

Alarm Operation

Current Setpoint

The current setpoint is the nominal operating current that is expected when all the heater loads are functioning properly. If the heater loads are faulty or the supply voltage is not close to the nominal level, the wrong setpoint will be stored during TEACH.

Initialization

As shipped, no setpoint is stored in the SSC flash memory. Both green and red LEDs will flash intermittently to indicate that a setpoint must be stored using the TEACH procedure. The load will **not** go on when the control is applied until a TEACH command is successful.

Local Functions

Local functions can be activated by using the TEACH push button on the front of the SSC. While an alarm is being issued by any SSC connected to the common alarm line or a remote command is being issued, no local commands are accepted.

Local TEACH

Press and hold the TEACH button for approximately 3 seconds. The red LED will flash after each second. After the LED flashes 3 times, release the button. If the "teach" command was accepted, the heater loads are automatically switched ON. The red LED will flash quickly 10 times. When the current setpoint has been stored successfully, the red and green LEDs will scroll intermittently to indicate that the TEACH procedure has been completed. The load will now be switched on or off according to the control input's status.

It is very important to hold the button down for only 3 flashes of the red LED to make a successful TEACH. If the TEACH procedure is not successful, the SSC will automatically reset to factory default (i.e., no setpoint stored).

Local RESET

When an alarm has occurred the device can be locally RESET by pressing the TEACH button for 1 second. The red LED will flash once. This will reset the alarm. If the alarm condition has been cleared the SSC will return to normal operation. If the alarm condition is still active, the SSC will automatically go back to alarm status.

Local TEST

In the absence of a signal on the "control input" terminal, a local TEST can be made by pressing and holding the TEACH button for 5 seconds. After the red LED flashes 5 times, release the button. The SSC will switch ON the load for 1 second. This test detects if there is an undercurrent or heater break alarm condition.

Remote Setup Procedure

Remote functions can be activated with a PLC or any other logic controller by applying timed pulses to the alarm terminal: >10V for Cat. No. 156-B…P and <10V for 156-B…N.

Remote TEACH

Apply a 3-second pulse. The red LED will flash after each second. After the LED flashes 3 times and the remote "teach" command has been accepted, the heater loads (of all SSCs connected to the same alarm line) are automatically switched ON and the red LED will flash quickly 10 times. When the current setpoint has been stored successfully, the red and green LEDs will scroll intermittently to indicate that the TEACH procedure has been completed. The load(s) will now be switched on or off according to the control input's status

Remote RESET/ UNBLOCK

When an alarm has occurred the SSC can be remotely RESET by applying a 1-second pulse. A 1-second pulse will also unblock local TEACH of all SSCs connected to the same alarm line. The red LED will flash once. This will reset the alarm. If the alarm condition has been cleared the SSC will return to normal operation. If the alarm condition is still active, the SSC will automatically go back to alarm status.

Remote BLOCK

Applying a 5-second pulse will force the SSC to block local TEACH. After this, no local TEACH commands are accepted. To unblock this condition, a remote RESET must be issued. If the 24V supply is removed, local TEACH BLOCK is lost. Another REMOTE BLOCK must be issued.

Alarm DELAY
A potentiometer on the front of the SSC allows a time delay on the heater break alarm between 0…40 s.

For heaters having a low cold resistance, the time for the inrush current to decay to a value less than 13% of the current set-point plus an additional 20 ms must be added to the potentiometer alarm delay setting.

For an alarm signal to occur, the alarm condition must persist throughout this time period. The alarm output is enabled only after this time delay has passed. However, if the control input is disabled for a period of time equal to four times the delay setting, the internal alarm delay timer is reset automatically. (See Alarm Operation graphs.)

SSC remains OFF due to Line Voltage Loss or Thyristor Open Circuit Failure (Reaction Time = 85 ms)
The SSC generates one pulse with duration of 7 seconds on the alarm terminal. This alarm is non-latching. The red LED remains ON after this alarm condition until a RESET is issued.

Heater Break
A Heater Break alarm is given if the current measured through the SSC is 13% less than the current setpoint stored in the flash memory for a period of time greater or equal to the alarm delay potentiometer setting. The SSC generates one pulse with duration of 8 seconds on the alarm terminal. The alarm signal is non-latching. The red LED remains ON after this alarm condition until a RESET is made. If the measured current changes to within 10% of the Current Setpoint, before the Alarm DELAY time has elapsed, the Alarm DELAY timer is reset.

Overtemperature or Overcurrent
This alarm occurs if any one of following two conditions is true:
1. The SSC detects an internal over-temperature condition at any time during operation and switches off the output. The red LED flashes intermittently.
2. A current above the nominal SSC rating is measured during current setpoint TEACH. This action erases the current setpoint from flash memory and both red and green LEDs will flash intermittently until a TEACH procedure with an acceptable current is carried out.
In both cases, the SSC generates one pulse with duration of 9 seconds on the alarm terminal. The alarm signal is non-latching.

Thyristor Short-Circuit (Reaction time = 110 ms)
The SSC generates one pulse with duration of 10 seconds on the alarm terminal. The alarm signal is non-latching.
The red LED remains ON after this alarm condition until a RESET is made.

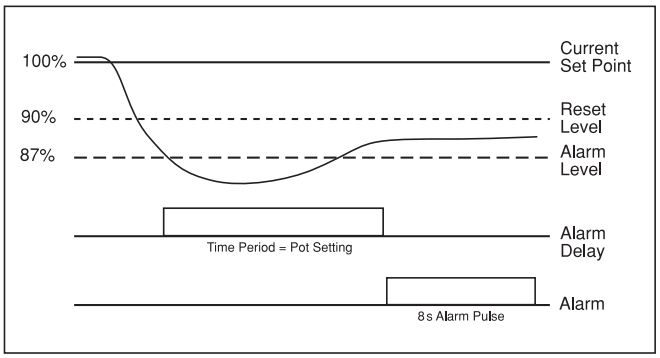
Alarms Connected in Parallel to one PLC Input and one PLC Output
For REMOTE operation, up to 50 SSCs can be connected in parallel to at least one PLC input. This PLC input must also be connected in parallel to the PLC output. The PLC input must be programmed to detect alarms while the PLC output must be programmed to supply the pulses required for REMOTE Setup. When more than one SSC is present, pulses from the PLC output or alarm pulses from any device will cause the red LEDs on all devices in parallel to flash intermittently for a max. of 6.25 seconds. After this time, it is only SSCs with an alarm condition that will have their red LED on.

Example:

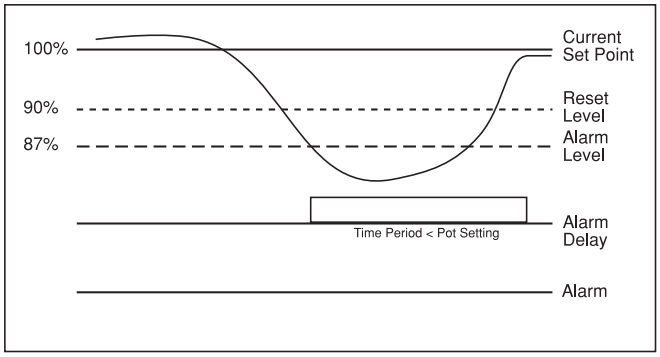
Set the alarm delay setting to 2 s (minimum). If the full load current is set at 30 A, then there will be an alarm condition if the current is under 26.1 A for more than 2 s. (Any fluctutation in the load current that is present for <2 s will not be signalled – this is intended to eliminate false alarms due to short duration undervoltage conditions on the supply phase). If the control input goes off within the 2 s, the alarm timer will not be reset provided the control input goes on again within 8 s (4x2 s).

Alarm Operation

Alarm Condition

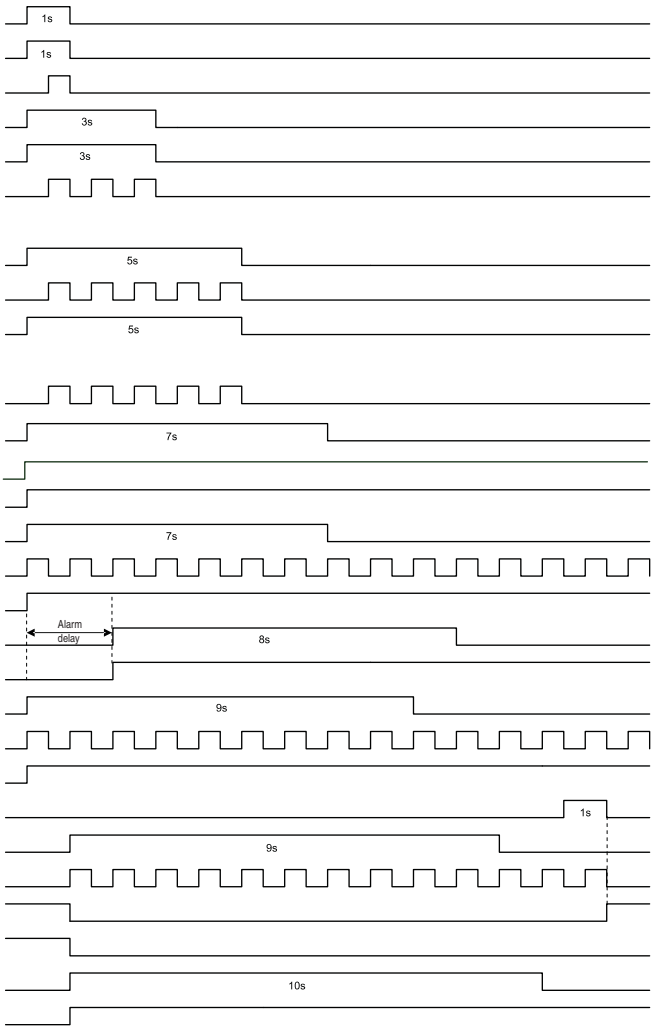


Reset Condition



Setup and Alarms

RESET	Remote reset	PLC output to alarm terminal high >1 s (<2 s)
	Local reset	Push and hold button for >1 s (<2 s)
	Visual indication	Red LED ON
TEACH	Remote teach	PLC output to alarm terminal high >3 s (<4 s)
	Local teach	Push and hold button for >3 s (<4 s)
	Visual indication	Red LED ON
TEST	Remote test	Not available
	Local test	Push and hold button for >5 s (<6 s)
	Visual indication	Red LED ON
BLOCK	Remote block	PLC output to alarm terminal high >5 s (<6 s)
	Local block	Not available
	Visual indication	Red LED ON
ALARMS	SSC remains OFF due to line voltage loss or thyristor open circuit fault	Transistor alarm non-latching pulse (7 s)
	Control input ON	Green LED — full intensity
	Visual indication	Red LED ON (latching)
	Current under-range detected during TEACH	Transistor alarm non-latching pulse (7 s)
	Visual indication	Red and Green LEDs flashing together
	Control input	Green LED — full intensity
	Heater break alarm	Transistor alarm non-latching pulse (8 s)
	Visual indication	Red LED ON (latching)
	Current over-range detected during TEACH	Transistor alarm non-latching pulse (8 s)
	Visual indication	Red and Green LEDs flashing together
	Control input	Green LED — full intensity
	Reset	Local or remote 1 s pulse
	Over-temperature alarm	Transistor alarm non-latching pulse (9 s)
	Visual indication	Red LED flashing
	SSC output	Output is switched off during an OTP alarm
	Control input	Green LED — full intensity
	Thyristor short-circuit	Transistor alarm non-latching pulse (10 s)
	Visual indication	Red LED ON (latching)



Product Description

The Bulletin 156-B… Analog Control Solid-State Contactor (SSC) is a single-phase device that provides proportional output power in relation to the analog control signal level applied. This microprocessor-based device provides 5 different switching modes integrated into one package. A selector switch on the front of the device is used for the selection of the preferred mode of operation, i.e., either Phase Angle, Distributed Full Cycle, or Burst Control. This multi-function selection makes this SSC ideal for the control of a variety of loads, including heaters and lamps. The control signal can be either 4…20 mA or 0…10V DC. 4 mA or 0V correspond to zero output power, and 20 mA or 10V DC correspond to full output power.
The product is ready to mount on DIN Rail or chassis and comes with an integral heatsink.

Operation

MODE 1:
The Phase Angle switching mode works in accordance with the phase angle control principle, i.e. the output switching point in the AC sine wave depends on the signal level applied at the input. The SSC switches off every time the output current crosses zero. See Figure 1.
MODE 2:
The Distributed mode provides a number of full cycles, evenly distributed over a fixed period of 1.28 s @ 50 Hz (1.07 s @ 60 Hz), depending on the control input. Example: with 50% control input, the SSC output will be on for one cycle and off for one cycle. See Figure 2.
MODE 3, 4, 5:
The Burst Switching mode generates a number of full cycles, depending on the control input over fixed periods of 1 s, 3 s or 10 s for MODES 3, 4 and 5 respectively.
Example: with Mode 4 (3-second burst) configured and 50% control input, the SSC output will be on for 1.5 s and off for 1.5 s. See Figure 3.
Modes 2, 3, 4 and 5 use the zero switching principle, thus ensuring a reduced level of radiated and wire-conducted noise. The Distributed and Burst Switching modes are not recommended for light control due to light-flickering.

LED Indication
The top RED LED indicates the load status. It goes ON whenever the load is activated. The Green LED gives indication of the status of the control input.
Upon application of control current (for the cat. no. 156-Bxx…C1) to terminals A1 – A3, the Green LED will be dimly lit, with its intensity increasing with an increase in control current.
For the cat. no. 156-Bxx…V1, the Green LED will be ON (flickering) upon application of the supply voltage to terminals A2 – A4. Once a control voltage is applied to terminals A1 – A3, the Green LED will be fully ON, if greater than a threshold voltage (approx 0.5V). Note that the first time the device (voltage control version) is to be activated, the mains voltage has to be present for the Green LED to indicate the control status.

Mode Selection

- Mode 1 Phase Angle Switching
- Mode 2 Distributed Control
- Mode 3 Burst Switching (1 s period)
- Mode 4 Burst Switching (3 s period)
- Mode 5 Burst Switching (10 s period)

Transfer Characteristics

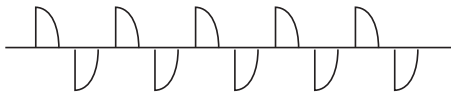
Output power as a function of control input

Control Current [mA]	Control Voltage [V DC]	Output Power [%]§
4	0	0
8	2.5	25
12	5	50
16	7..5	75
20	10	99

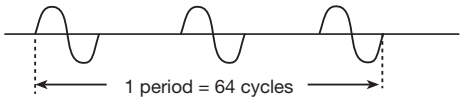
§ Time for SSC to process analog changes: 15…20 ms

Functional Diagram

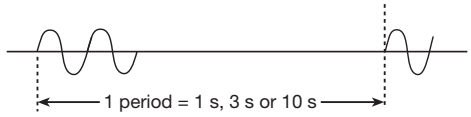
MODE 1
Phase angle
Figure 1



MODE 2
Distributed Full Cycle
Figure 2



MODE 3, 4, 5
Burst 1 s, 3 s, 10 s
Figure 3



Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

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