Table of Contents

The Altech Advantage 4-5

Application Examples 6-9

Circuit Breaker Types



R-Series
UL1077 Recognized Supplementary Protectors 10-16

Accessories 17



TR11-Series
UL1077 Recognized Supplementary Protectors 18-20



V-EA Series
UL508 Manual Motor Controllers “Suitable as Motor Disconnect” 21-33



UL508 and UL1077 Busbar Systems & Accessories 34-43

MA-Series
Three Phase Adjustable Trip Miniature Circuit Breakers/
Manual Motor Controllers 44-45



Accessories 46-47



MS-Series
Three Phase Adjustable Trip Economy Manual Motor Controllers 48

Accessories 39



L-Series
AC or DC UL489 Miniature Molded Case Circuit Breakers 50-56

Accessories 57



UL489 Busbar Systems & Accessories 58-65



TD/TS Series
UL489 Listed Molded Case Circuit Breakers 66-69

Accessories 70-77



FI Earth Leakage Circuit Breakers 78-79

EK Series of Enclosures for Circuit Breakers 80

UL508 Old to New Part Number Cross Reference 81-83

Index 84-89

Terms and Conditions 90

The Altech Advantage

In today's very competitive marketplace you need reliability, so you need to use circuit breakers that are high quality and technically correct for your application. Altech is a US leader in DIN rail mounted breakers with ratings up to 63A. Only Altech offers DIN rail mounted breakers that meet UL489, UL508 or UL1077 approvals with a short circuit interrupt capacity of up to 10kA. No other manufacturer offers this complete line. This assures you the right product for your application requirements.

If your application requires a manual motor controller, Altech is the leading US supplier of UL508 Manual Motor Controllers (MMC). In AC, we offer up to 60A in 1 to 3 poles at 480Y/277VAC. With 6 trip curves, Altech has the largest selection in the industry. This ensures you the selectivity you require for your application designs. Our MMCs have a 10kA short circuit withstand capacity, this is the highest rating in the industry. The AC version is rated up to 60A and is DC rated in 2 poles up to 80VDC.



UL508

Manual Motor Controllers (MMC)

Provides the following features according to NEC®:

- Overload protection
- Switching function
- Disconnect function*

**when suitable for disconnect means*

508 listed
E137938

C22.2 No.14 certified
LR104391

(up to 25A certain trip curves)

Modern Look and Color

Dark blue handle and terminal caps enhance appearance and match imprint.

Marking Window

Large marking area with clear swivel window screen.

Standard Dual Connection Terminal

Standard box & ring tongue terminal are unique for the industry.

Reinforced Housing

Added ridges and new housing design improves overall product strength.

The Altech Advantage



When you need branch circuit protection, Altech offers UL489 Miniature Molded Case Circuit Breakers in both AC and DC voltages. The AC version offers dual voltage rated circuit breakers at 0.2-63A/240VAC and 0.2-32A/480Y/277VAC in 1-3 poles. Altech is the only company that offers a 14kA, 20A C curve single phase breaker at 277V AC. The DC version offers 0.2-63A at 125V (1 pole) and 250V (2 pole).

UL489

Miniature Molded Case Circuit Breakers (MMCCB)
Molded Case Circuit Breakers (MCCB)

Provides the following features according to NEC®:

- Overload protection
- Switching function
- Disconnect function
- Short circuit protection



When your application requires supplemental protection for control circuits and on the load side of branch circuit protectors Altech has solutions. We offer a competitive line of AC Supplementary Protectors, up to 63A, in 1 to 3 poles at 480Y/277VAC with a 10kA short circuit withstand rating.

UL1077

Supplementary Protectors (SP)

Provides the following features according to NEC®:

- Overload protection

Other products found in this catalog:

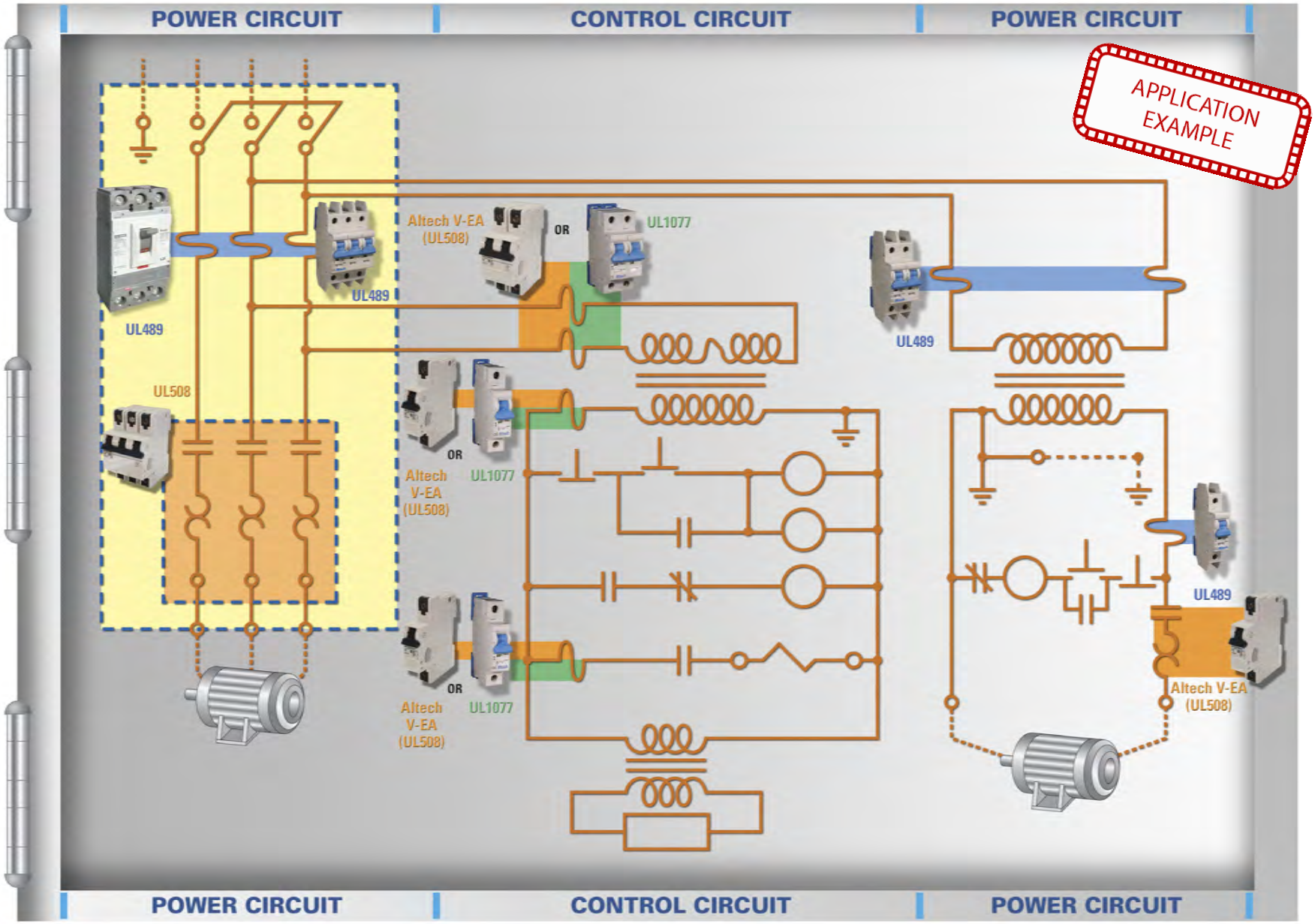
UL508 and UL489 Busbar Systems

Front panel mount UL1077 Recognized Supplementary Protectors

Large UL489 Listed Molded Case Circuit Breakers



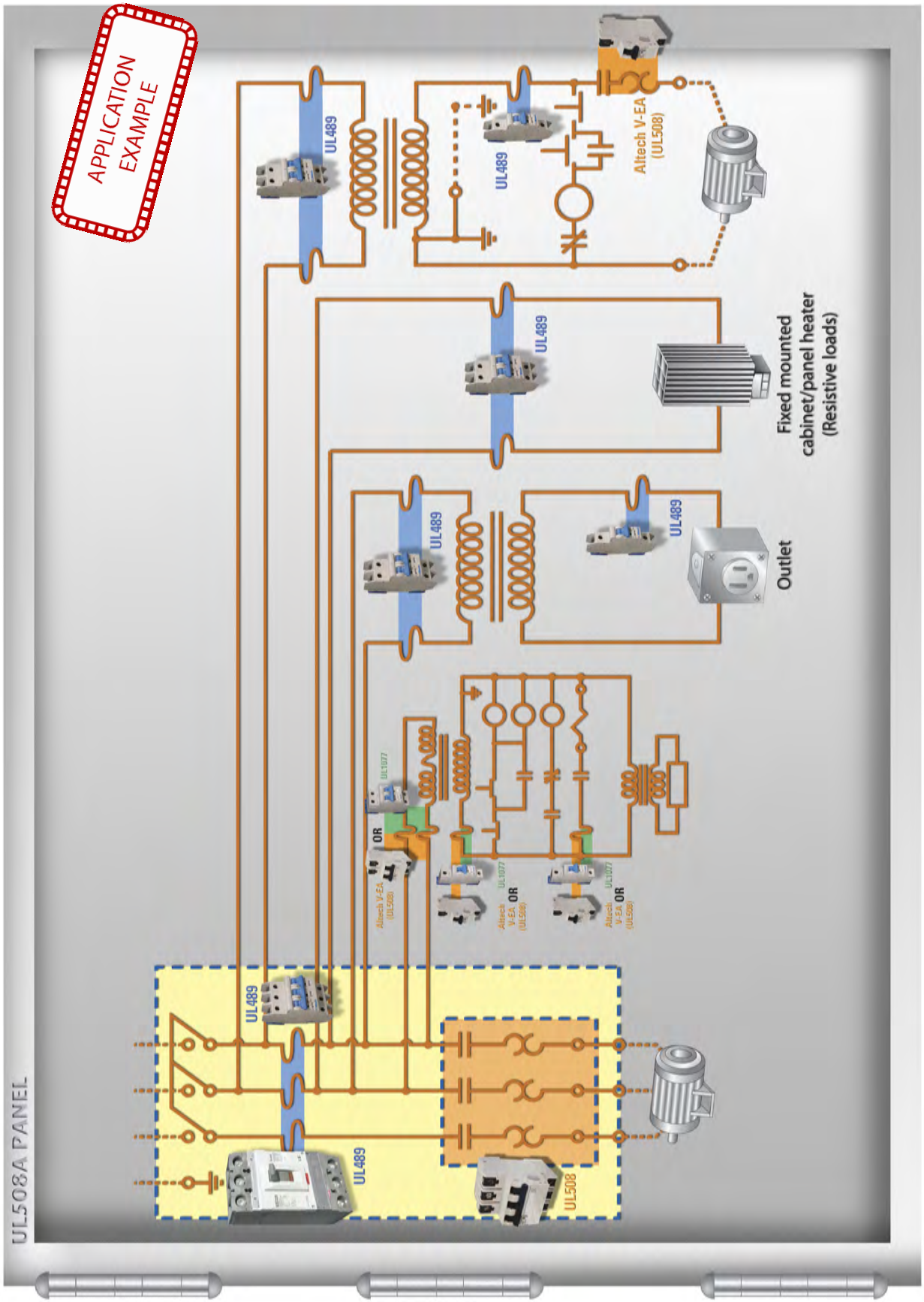
Typical UL508A Panel



Disclaimer: This is an application example. Installation should be done by a qualified electrician under the guidance of UL/NEC® specifications.

Variation of UL508A Panel

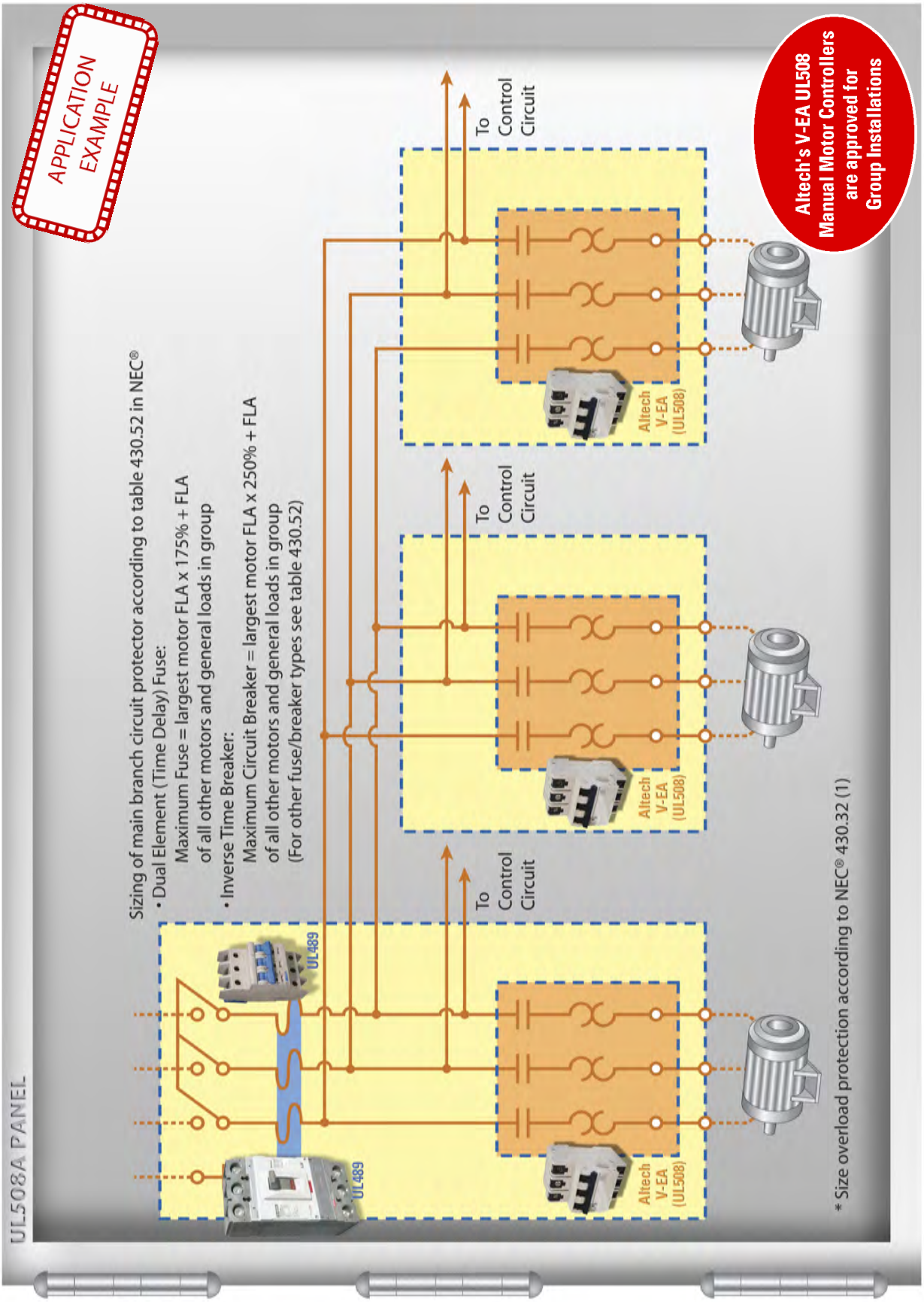
(see NEC® article 430.53 for reference and more information).



Disclaimer: This is an application example. Installation should be done by a qualified electrician under the guidance of UL/NEC® specifications.

Typical Motor Group Installation

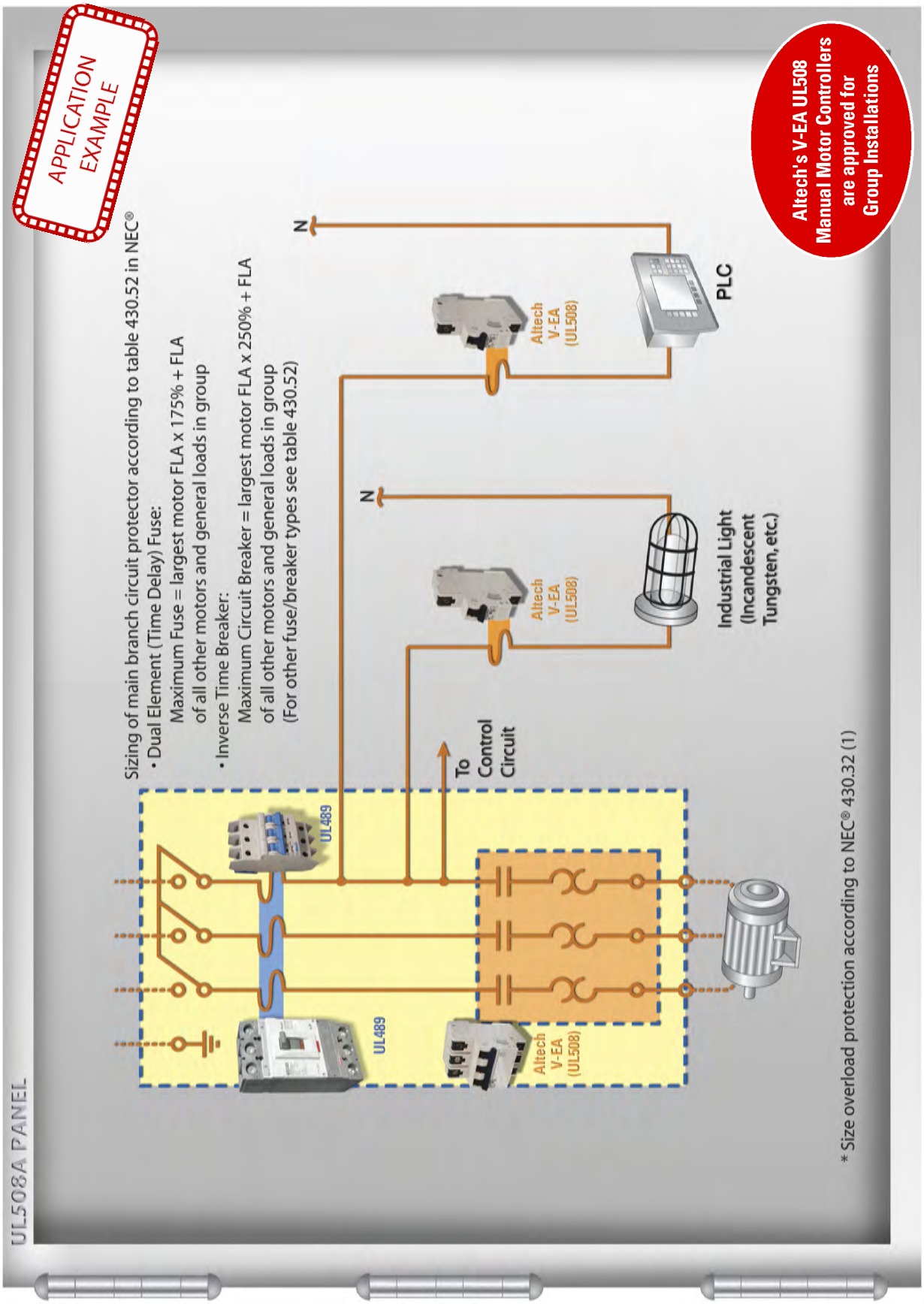
(see NEC® article 430.53 for reference and more information).



Disclaimer: This is an application example. Installation should be done by a qualified electrician under the guidance of UL/NEC® specifications.

Typical Motor Group Installation

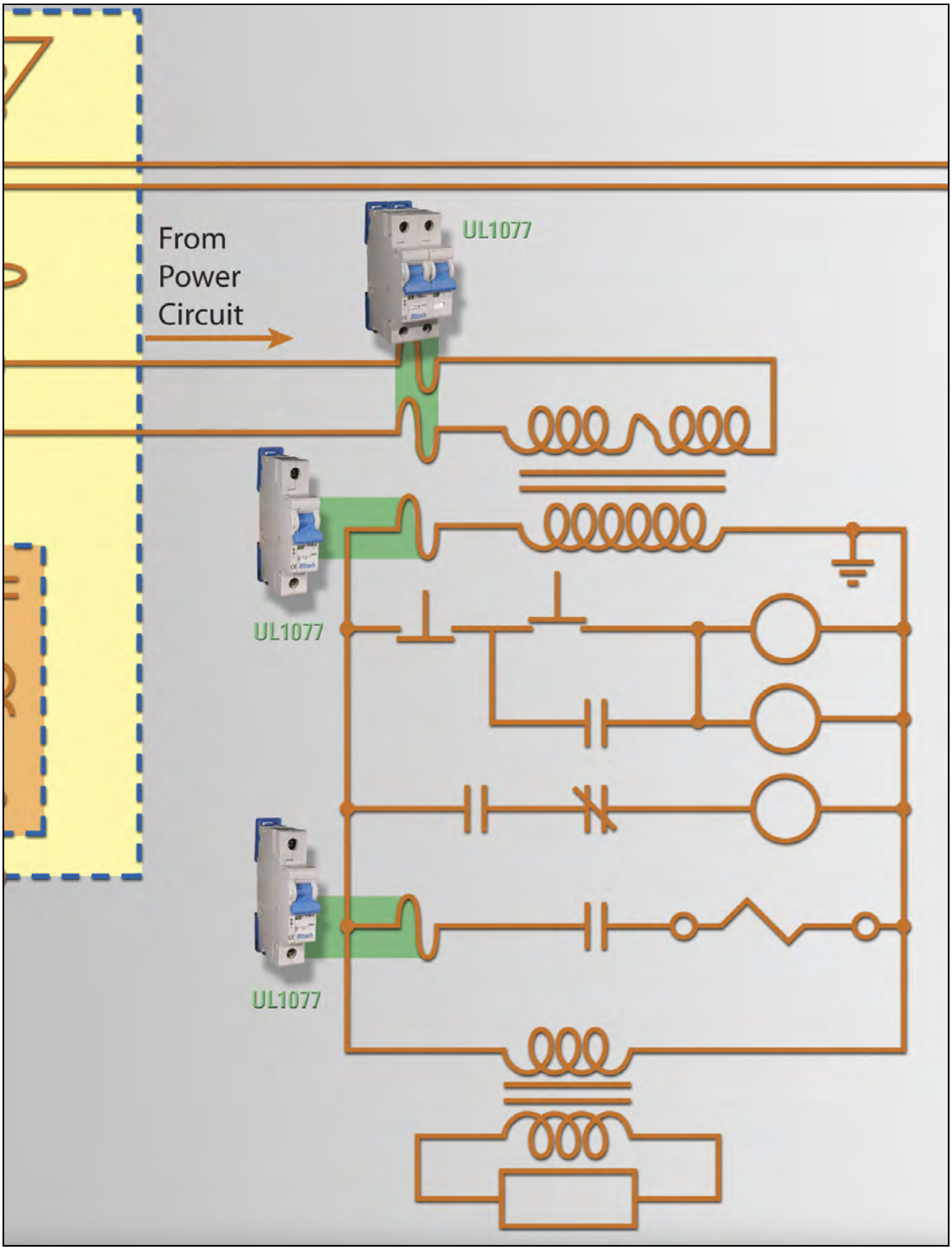
(see NEC® article 430.53 for reference and more information).



Disclaimer: This is an application example. Installation should be done by a qualified electrician under the guidance of UL/NEC® specifications.

Typical UL1077 Application

Control Circuit of a UL508A Panel

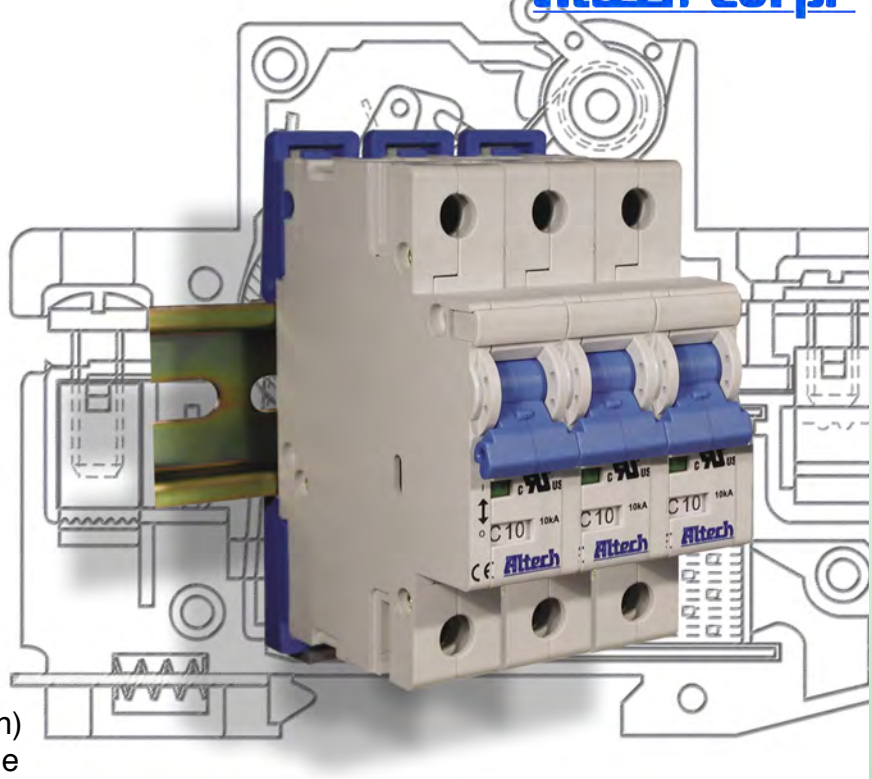


Disclaimer: This is an example application. Installation should be done by a qualified electrician under the guidance of UL/NEC® specifications..

R-Series

E301611

UL1077 Recognized Supplementary Protector



- DIN Rail Mounted
- 17.5mm width per pole
- Thermal Magnetic
- 480Y/277V AC, 50/60Hz
- 10kA Short Circuit Withstand Capacity
- Positive Trip indicator (Green - off/tripped, Red - on)
- Applications (on the load side of Branch Circuit Protection) include: Sensitive Electronics, Power Supplies, Appliance circuits, etc.

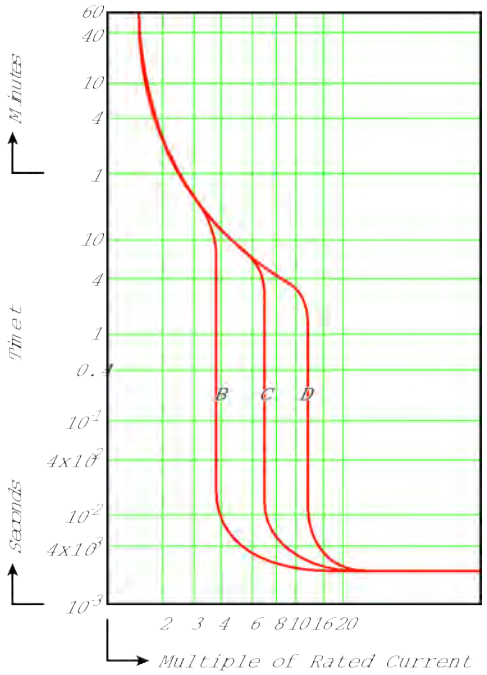
Voltage Rating	480Y/277VAC
Short Circuit Withstand Rating (UL - Ratings)	0.5-6A (RC): 10kA with no back-up fuse 8-63A (RC): 10kA with UL-listed Class J back-up fuse; 5kA with no back-up fuse
Interrupting Capacity (IEC/EN60898/60947-2)	0.5-63A (RC): 10kA
Calibration Temperature	30°C (86°F)
Operating Temperature	-25° to 60°C (-13° to 140°F)
Storage Temperature	-25° to 75°C (-13° to 167°F)
Terminal Size Acceptability:	
Solid Wire	18 AWG -10 AWG
Stranded Wire	18 AWG -3 AWG (Line/Load reversible)
Terminal Torque	2.8 Nm (25 lb-in.)
Terminal Protection Degree	IP20
Vibration Resistance	3g (18-50Hz)

SHORT CIRCUIT WITHSTAND RATINGS FOR R-SERIES SUPPLEMENTARY PROTECTOR

Trip Curve	Amp Range	Backup Protection	
		UL-Listed Class J Fuse up to 10kA	No Backup Fuse Required up to:
All	0.5 - 6A	4xRC*	10kA
All	8 - 63A	4xRC*	5kA

*up to nearest rated current

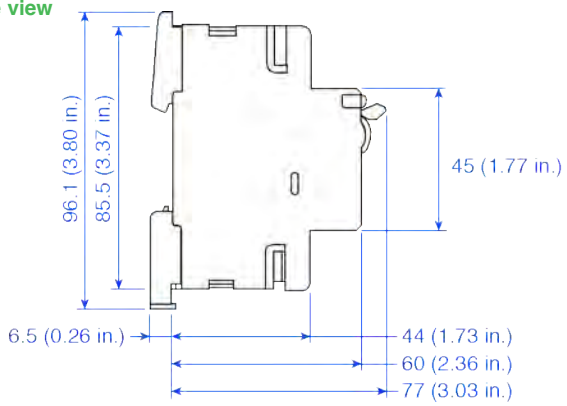
DC voltage rating: 48 VDC (self-certified).



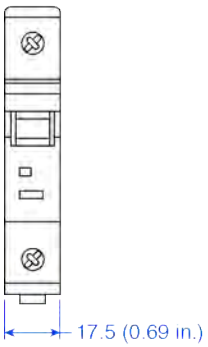
Time versus Current Trip Curve

For the exact trip curve, please refer to page 16.

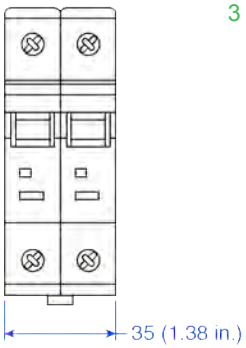
Dimensions in mm
side view



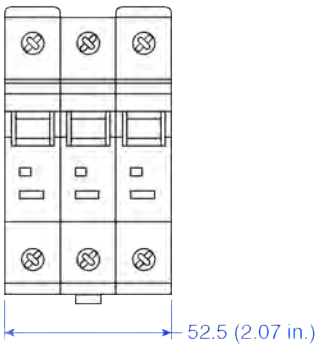
1 POLE



2 POLE



3 POLE



Trip-Characteristics*				Applications					
Characteristic Trip Boundaries				Lighting Wiring Protection Control Circuits	Business Equipment Appliances	Control Transformers	Power Supplies	General Electronics	Reactive Load
Thermal Trip		Magnetic Trip							
Must not Trip>100ms	Must Trip <1hr	Must not Trip>100ms	Must Trip at 100ms						
B-Characteristics									
1.13xRC	1.45xRC	3xRC	5xRC						
C-Characteristics									
1.13xRC	1.45xRC	5xRC	10xRC						
D-Characteristics									
1.13xRC	1.45xRC	10xRC	20xRC						

**The value of each characteristic is shown vertically beneath its corresponding heading.*

Warning!
This information should only be used as a selection guide. The use of a Miniature Circuit Breaker/Supplementary Protector in an application with a certain Trip-Characteristic always requires prototype testing! It is the responsibility of the circuit design engineer to select the appropriate Miniature Circuit Breaker/Supplementary Protector for his specific application.

B-Trip Characteristic

Application Examples:
Business equipment, wiring protection, lighting, appliances, control circuits and some electronic applications. Relatively long thermal trip delay but low magnetic trip point.

c UL us CE

E301611



One Pole

Rated Current	Type/ Cat. No.
0.5A	1BU05R
1.0A	1BU1R
2.0A	1BU2R
3.0A	1BU3R
4.0A	1BU4R
5.0A	1BU5R
6.0A	1BU6R
8.0A	1BU8R
10A	1BU10R
12A	1BU12R
13A	1BU13R
15A	1BU15R
16A	1BU16R
20A	1BU20R
25A	1BU25R
30A	1BU30R
32A	1BU32R
40A	1BU40R
50A	1BU50R
60A	1BU60R
63A	1BU63R

Standard Pack: 12

Weight:
0.5A - 63A: 1.6kg (3.54 lb.)



Two Pole

Rated Current	Type/ Cat. No.
0.5A	2BU05R
1.0A	2BU1R
2.0A	2BU2R
3.0A	2BU3R
4.0A	2BU4R
5.0A	2BU5R
6.0A	2BU6R
8.0A	2BU8R
10A	2BU10R
12A	2BU12R
13A	2BU13R
15A	2BU15R
16A	2BU16R
20A	2BU20R
25A	2BU25R
30A	2BU30R
32A	2BU32R
40A	2BU40R
50A	2BU50R
60A	2BU60R
63A	2BU63R

Standard Pack: 6

Weight:
0.5A - 63A: 1.6kg (3.54 lb.)



Three Pole

Rated Current	Type/ Cat. No.
0.5A	3BU05R
1.0A	3BU1R
2.0A	3BU2R
3.0A	3BU3R
4.0A	3BU4R
5.0A	3BU5R
6.0A	3BU6R
8.0A	3BU8R
10A	3BU10R
12A	3BU12R
13A	3BU13R
15A	3BU15R
16A	3BU16R
20A	3BU20R
25A	3BU25R
30A	3BU30R
32A	3BU32R
40A	3BU40R
50A	3BU50R
60A	3BU60R
63A	3BU63R

Standard Pack: 4

Weight:
0.5A - 63A: 1.66kg (3.67 lb.)



Four Pole
Please contact Altech.

Non-standard current ratings available. Minimum quantities may apply. Please contact Altech for further details.

C-Trip Characteristic

Application Examples:
Lighting, wiring protection, appliances, business equipment, and control circuit applications. Relatively long thermal trip delay and medium magnetic trip point.

c UL us CE
E301611



One Pole

Rated Current	Type/ Cat. No.
0.5A	1CU05R
1.0A	1CU1R
2.0A	1CU2R
3.0A	1CU3R
4.0A	1CU4R
5.0A	1CU5R
6.0A	1CU6R
8.0A	1CU8R
10A	1CU10R
12A	1CU12R
13A	1CU13R
15A	1CU15R
16A	1CU16R
20A	1CU20R
25A	1CU25R
30A	1CU30R
32A	1CU32R
40A	1CU40R
50A	1CU50R
60A	1CU60R
63A	1CU63R

Standard Pack: 12

Weight:
0.5A - 63A: 1.6kg (3.54 lb.)



Two Pole

Rated Current	Type/ Cat. No.
0.5A	2CU05R
1.0A	2CU1R
2.0A	2CU2R
3.0A	2CU3R
4.0A	2CU4R
5.0A	2CU5R
6.0A	2CU6R
8.0A	2CU8R
10A	2CU10R
12A	2CU12R
13A	2CU13R
15A	2CU15R
16A	2CU16R
20A	2CU20R
25A	2CU25R
30A	2CU30R
32A	2CU32R
40A	2CU40R
50A	2CU50R
60A	2CU60R
63A	2CU63R

Standard Pack: 6

Weight:
0.5A - 63A: 1.6kg (3.54 lb.)



Three Pole

Rated Current	Type/ Cat. No.
0.5A	3CU05R
1.0A	3CU1R
2.0A	3CU2R
3.0A	3CU3R
4.0A	3CU4R
5.0A	3CU5R
6.0A	3CU6R
8.0A	3CU8R
10A	3CU10R
12A	3CU12R
13A	3CU13R
15A	3CU15R
16A	3CU16R
20A	3CU20R
25A	3CU25R
30A	3CU30R
32A	3CU32R
40A	3CU40R
50A	3CU50R
60A	3CU60R
63A	3CU63R

Standard Pack: 4

Weight:
0.5A - 63A: 1.66kg (3.67 lb.)



Four Pole
Please contact Altech.

Non-standard current ratings available. Minimum quantities may apply. Please contact Altech for further details.

D-Trip Characteristic

Application Examples:
Control transformers, power supplies and reactive loads. Relatively long thermal trip delay and very high magnetic trip point.

c UL us CE
E301611



One Pole

Rated Current	Type/ Cat. No.
0.5A	1DU05R
1.0A	1DU1R
2.0A	1DU2R
3.0A	1DU3R
4.0A	1DU4R
5.0A	1DU5R
6.0A	1DU6R
8.0A	1DU8R
10A	1DU10R
12A	1DU12R
13A	1DU13R
15A	1DU15R
16A	1DU16R
20A	1DU20R
25A	1DU25R
30A	1DU30R
32A	1DU32R
40A	1DU40R
50A	1DU50R
60A	1DU60R
63A	1DU63R

Standard Pack: 12

Weight:
0.5A - 63A: 1.6kg (3.54 lb.)



Two Pole

Rated Current	Type/ Cat. No.
0.5A	2DU05R
1.0A	2DU1R
2.0A	2DU2R
3.0A	2DU3R
4.0A	2DU4R
5.0A	2DU5R
6.0A	2DU6R
8.0A	2DU8R
10A	2DU10R
12A	2DU12R
13A	2DU13R
15A	2DU15R
16A	2DU16R
20A	2DU20R
25A	2DU25R
30A	2DU30R
32A	2DU32R
40A	2DU40R
50A	2DU50R
60A	2DU60R
63A	2DU63R

Standard Pack: 6

Weight:
0.5A - 63A: 1.6kg (3.54 lb.)



Three Pole

Rated Current	Type/ Cat. No.
0.5A	3DU05R
1.0A	3DU1R
2.0A	3DU2R
3.0A	3DU3R
4.0A	3DU4R
5.0A	3DU5R
6.0A	3DU6R
8.0A	3DU8R
10A	3DU10R
12A	3DU12R
13A	3DU13R
15A	3DU15R
16A	3DU16R
20A	3DU20R
25A	3DU25R
30A	3DU30R
32A	3DU32R
40A	3DU40R
50A	3DU50R
60A	3DU60R
63A	3DU63R

Standard Pack: 4

Weight:
0.5A - 63A: 1.66kg (3.67 lb.)

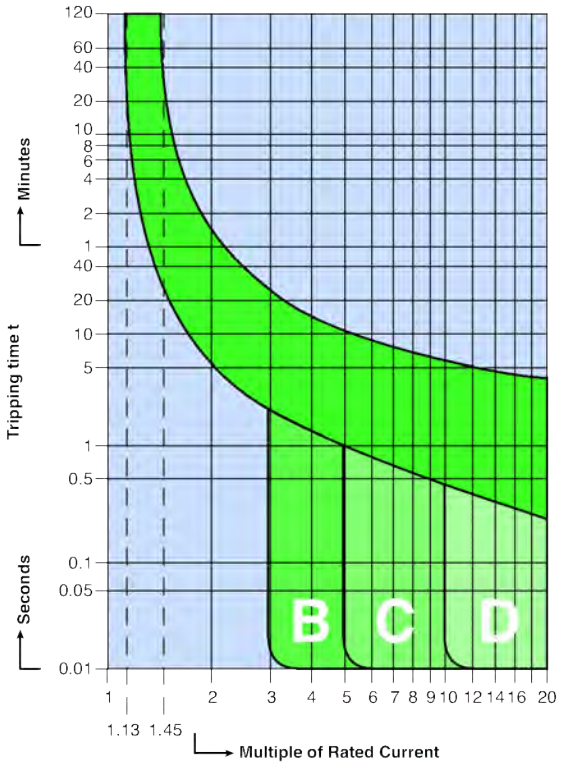


Four Pole
Please contact Altech.

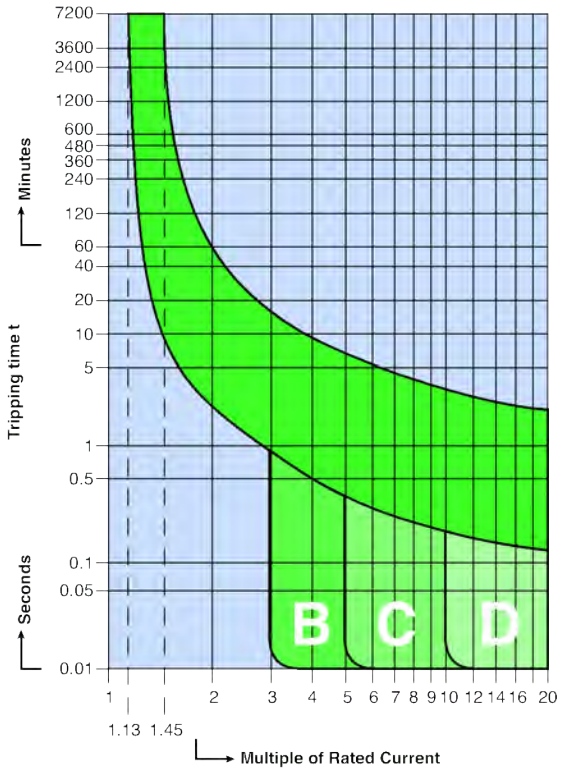
Non-standard current ratings available. Minimum quantities may apply. Please contact Altech for further details.

R-Series Trip Curves

B, C and D Trip
Less than 10A



B, C and D Trip
10A and higher



Temperature and Power Loss Specifications

Rated current of MCB	Internal Impedances & Power Loss					MCB Temperature Compensation								
	Internal impedance	Power loss on CB	Maximum allowable impedance of breakdown loop (0.2/0.4s)			Effective rated current allowing for ambient temperature.								
	Z (m Ω)	P (W)	Z_s (Ω)			I cor (A)								
I_n (A)	Char. B,C,D	Char. B,C,D	Char.B	Char.C	Char.D	Ambient Temperature								
						-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C	60°C
0.50	6600	1.7	42.0	51.1	28.8	0.61	0.59	0.57	0.55	0.53	0.50	0.47	0.44	0.42
1.00	1650	1.7	46.0	25.6	14.4	1.21	1.18	1.14	1.10	1.05	1.00	0.93	0.88	0.83
2.00	370	1.5	23.0	12.8	7.2	2.42	2.36	2.28	2.20	2.10	2.00	1.86	1.76	1.67
3.00	210	1.9	15.3	8.5	4.8	3.63	3.54	3.42	3.30	3.15	3.00	2.79	2.64	2.50
4.00	126	2.0	11.5	6.4	3.6	4.84	4.72	4.56	4.40	4.20	4.00	3.72	3.52	3.33
6.00	51	1.8	7.7	4.3	2.4	7.30	7.10	6.80	6.60	6.30	6.00	5.60	5.30	5.00
8.00	21	1.3	5.8	3.2	1.8	9.70	9.40	9.10	8.80	8.40	8.00	7.40	7.00	6.70
10.00	14.8	1.5	4.6	2.6	1.4	12.1	11.8	11.40	11.00	10.50	10.00	9.30	8.80	8.30
13.00	11.3	1.9	3.5	2.0	1.1	15.7	15.3	14.80	14.30	13.70	13.00	12.10	11.50	10.80
16.00	7.5	1.9	2.9	1.6	0.9	19.4	18.9	18.20	17.60	16.80	16.00	14.90	14.10	13.30
20.00	6.3	2.5	2.3	1.3	0.7	24.2	23.60	22.80	22.00	21.00	20.00	18.60	17.60	16.70
25.00	4.4	2.8	1.8	1.0	0.6	30.3	29.50	28.50	27.50	26.30	25.00	23.30	22.00	20.80
32.00	3.1	3.2	1.4	0.8	0.4	38.7	37.80	36.50	35.20	33.60	32.00	29.80	28.20	26.70
40.00	2.5	4.0	1.2	0.6	0.4	48.4	47.20	45.60	44.00	42.00	40.00	37.20	35.20	33.30
50.00	2.2	5.5	0.9	0.5	0.3	60.5	59.0	57.00	55.00	52.50	50.00	46.50	44.10	41.70
63.00	1.6	6.4	0.7	0.4	0.2	76.2	74.30	71.80	69.30	66.20	63.00	58.60	55.50	52.50

Accessories

R-Series Supplementary Protector

E301611

Accessories can be factory or field mounted on R-Series supplementary protectors for enhanced control and monitoring capabilities. Field mounting kits include all necessary parts and instructions. Accessories can be gang mounted on a single controller (the Auxiliary Switch in the outside position). The mounting arrangement links the internal latch-pins for the tripping mechanisms, ensuring simultaneous trips. Handles are linked to simplify manual resetting.



Neutral Pole (63A/480Y/277 VAC)

Description	Type/ Cat. No.	Cable Max	Cable Min	Torque Max	Torque Min
Neutral	ALTN2	25mm² AWG 3	2.5mm² AWG 12	2Nm 17.5 lb-in	1.5Nm 12 lb-in

Standard Pack: 10

Weight: 1.25kg (2.77 lb.)



Shunt Trip



Undervoltage Trip

Shunt Trip and Undervoltage Trip

Description	Shunt Trip Type/Cat. No.	Operational Voltage	Rated Coil Current	Undervoltage Trip* Type/Cat. No.
AC Coil:				
12V AC	FA12ACR	8.4 - 13.2V	6A	UV12ACR
24V AC	FA24ACR	16.8 - 26.4V	2.8A	UV24ACR
48V AC	FA48ACR	33.6 - 52.8V	0.8A	UV48ACR
60V AC	FA60ACR	42 - 66V	~0.7A	UV60ACR
110V AC	FA110ACR	77 - 121V	0.5A	UV110ACR
120V AC	FA120ACR	84 - 132V	~0.5A	UV120ACR
230V AC	FA230ACR	161 - 253V	0.6A	UV230ACR
277V AC	FA277ACR	194 - 305V	~0.5A	UV277ACR
400V AC	FA400ACR	280 - 440V	0.5A	UV400ACR
DC Coil:				
12V DC	FA12DCR	8.4 - 13.2V	~6A	UV12DCR
24V DC	FA24DCR	16.8 - 26.4V	3A	UV24DCR
48V DC	FA48DCR	33.6 - 52.8V	2A	UV48DCR
110V DC	FA110DCR	77 - 121V	0.6A	UV110DCR

* Reset-Hold Voltage = 0.85 x V_E; Drop-Out Voltage = 0.2 x V_E

Standard Pack: 10

Weight: 1.1kg (2.43 lb.)

Terminal Size - min/max	2.5 mm² (12 AWG) / 25mm² (3 AWG)
Terminal Torque - min/max	1.5 Nm (12 lb. in.) / 2 Nm (17.5 lb. in.)



Auxiliary Contact (4A/230 VAC)

Description	Type/ Cat. No.	Cable Max	Cable Min	Torque Max	Torque Min
1 x CO	H1COR	2.5mm² AWG 12	0.5mm² AWG 20	0.5Nm 4 lb-in	0.33Nm 3 lb-in
2 x CO	H2COR				
1 x CO, 1 Signal & Test Button	HSTCOR				

Standard Pack: 15

Weight: H1COR: 0.5kg (1.32 lb.); H2COR, HSTCOR: 0.72kg (1.59 lb.)



Lock-out Adapter

(uses small suitcase lock)

Description	Type/ Cat. No.
Yellow	EASS2

Standard Pack: 10

Weight: 50g (1.76 oz.)

TR11 Series

E209569 up to 12 Amps

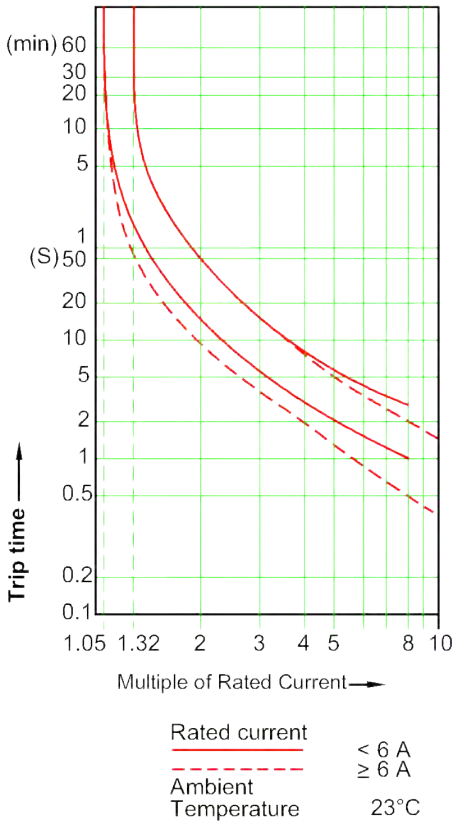
UL1077 Recognized Supplementary Protector/ Circuit Breaker for Equipment



Applications:
Protection of Control Transformers, UPS, Power strips, Solenoids etc., against damage due to overload conditions.

Current Rating	0.5 -16.0A	
Rated Voltage	240V AC, 50/60Hz, 32V DC / 24V DC (VDE)	
Initial insulation resistance	> 100 M ohms.	(As per EN 60934)
Dielectric strength	1.5 KV for One minute. 6 I_n ~ up to 9.0A	(As per EN 60934)
Overload Switching Capacity	4 I_n - up to 12.0A 60A Max. ~ from 10.0A to 12.0A 60A Max. - from 10.0A to 12.0A	(As per EN 60934)
Maximum Breaking Capacity	8x I_n for <6.0A 60A MAX. for ≥ 6.0A	
Power Loss	1 - 2 Watts	
Operating Temperature	Maximum 60°C Ambient	
Operational Life at 2xIn	1000 Cycles	
Limited short circuit current	1000 Amps PC 1	
Terminals	0.25" Quick connect	
Applicable Standards	EN 60934, CSA 22.2 No. 235, UL-1077	
Approvals	up to 16.0 A upto 12.0A	
Accessories	Dust Cover, DC-TR11 C (see page 20)	

Operating Characteristic



Time Current Characteristics:
The standard characteristic is valid for ambient temperatures of +23°C. If the device is to be used in an ambient temperature other than +23°C, allowances must be made when selecting the current rating according to the following guidelines:

Ambient temp. °C	-20	-5	0	+10	+20	+30	+40	+50	+60
Correction Factor	0.8	0.88	0.9	0.96	1	1.05	1.12	1.2	1.3

Example :
Normal Continuous Current : 1.8A
Ambient Temperature : 40°C
Correction Factor : 1.12
Recommended Current Rating : 1.8 x 1.12 = 2.016
Select the nearest : 2.0A

TR-11 Characteristics & Mounting Options

Application Examples:
Protection of Control Transformers, UPS, Power strips, Solenoids etc., against damage due to overcurrent conditions.

E209569

up to 12 Amps



Central Mounting

Standard Pack: 10

Weight:
0.27kg (0.6 lb.)

Rated Current	Type/ Cat. No.
0.5A	TR-11CX630.5A
0.9A	TR-11CX630.9A
1.0A	TR-11CX631A
1.2A	TR-11CX631.2A
1.5A	TR-11CX631.5A
1.8A	TR-11CX631.8A
2.0A	TR-11CX632A
2.2A	TR-11CX632.2A
2.5A	TR-11CX632.5A
2.7A	TR-11CX632.7A
3A	TR-11CX633A
3.3A	TR-11CX633.3A
4A	TR-11CX634A
5A	TR-11CX635A
6A	TR-11CX636A
6.5A	TR-11CY636.5A
7A	TR-11CY637A
8A	TR-11CY638A
9A	TR-11CY639A
10A	TR-11CY6310A
12A	TR-11CY6312A
15A	TR-11CY6315A
16A	TR-11CY6316A



Wing Clips*

Standard Pack: 10

Weight:
0.27kg (0.6 lb.)

Rated Current	Type/ Cat. No.
0.5A	TR-11WX630.5A
1.0A	TR-11WX631A
1.5A	TR-11WX631.5A
2.0A	TR-11WX632A
2.5A	TR-11WX632.5A
3A	TR-11WX633A
4A	TR-11WX634A
6A	TR-11WX636A
7A	TR-11WY637A
9A	TR-11WY639A
12A	TR-11WY6312A
16A	TR-11WY6316A



Snap Fitting*

Standard Pack: 10

Weight:
0.27kg (0.6 lb.)

Rated Current	Type/ Cat. No.
0.5A	TR-11SX630.5A
1.0A	TR-11SX631A
1.5A	TR-11SX631.5A
2.0A	TR-11SX632A
2.5A	TR-11SX632.5A
3A	TR-11SX633A
4A	TR-11SX634A
6A	TR-11SX636A
7A	TR-11SY637A
9A	TR-11SY639A
12A	TR-11SY6312A
16A	TR-11SY6316A



Integral Mounting*

Standard Pack: 10

Weight:
0.27kg (0.6 lb.)

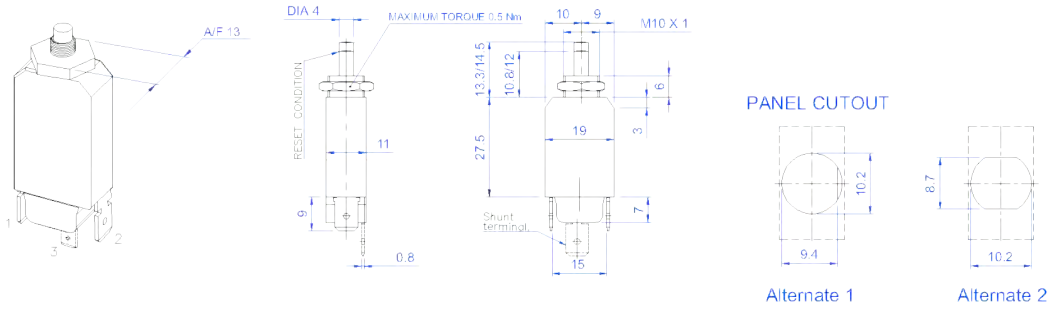
Rated Current	Type/ Cat. No.
0.5A	TR-11BX630.5A
1.0A	TR-11BX631A
1.5A	TR-11BX631.5A
2.0A	TR-11BX632A
2.5A	TR-11BX632.5A
3A	TR-11BX633A
4A	TR-11BX634A
6A	TR-11BX636A
7A	TR-11BY637A
9A	TR-11BY639A
12A	TR-11BY6312A
16A	TR-11BY6316A

*** SPECIAL ORDER ONLY. Contact Altech for more details.**

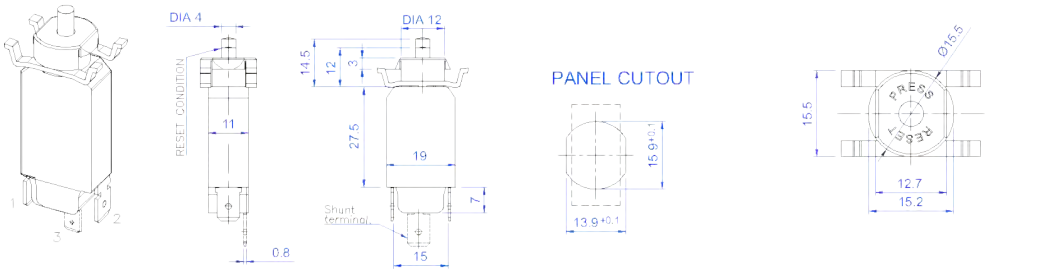
PCB Mounting and additional Shunt Terminal available, please contact Altech.

TR-11
Dimensions & Mounting Options

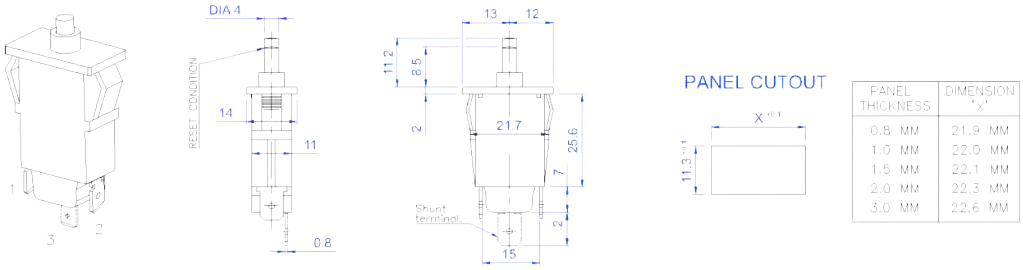
Central Mounting



Wing Clips

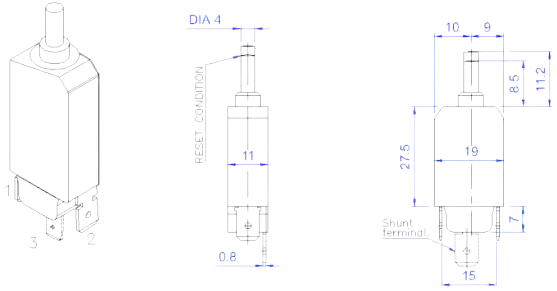


Snap Fitting

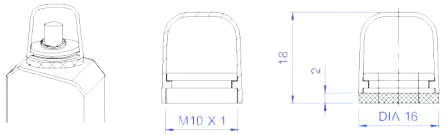


PANEL THICKNESS	DIMENSION 'X'
0.8 MM	21.9 MM
1.0 MM	22.0 MM
1.5 MM	22.1 MM
2.0 MM	22.3 MM
3.0 MM	22.6 MM

Integral Mounting



Dust Cover



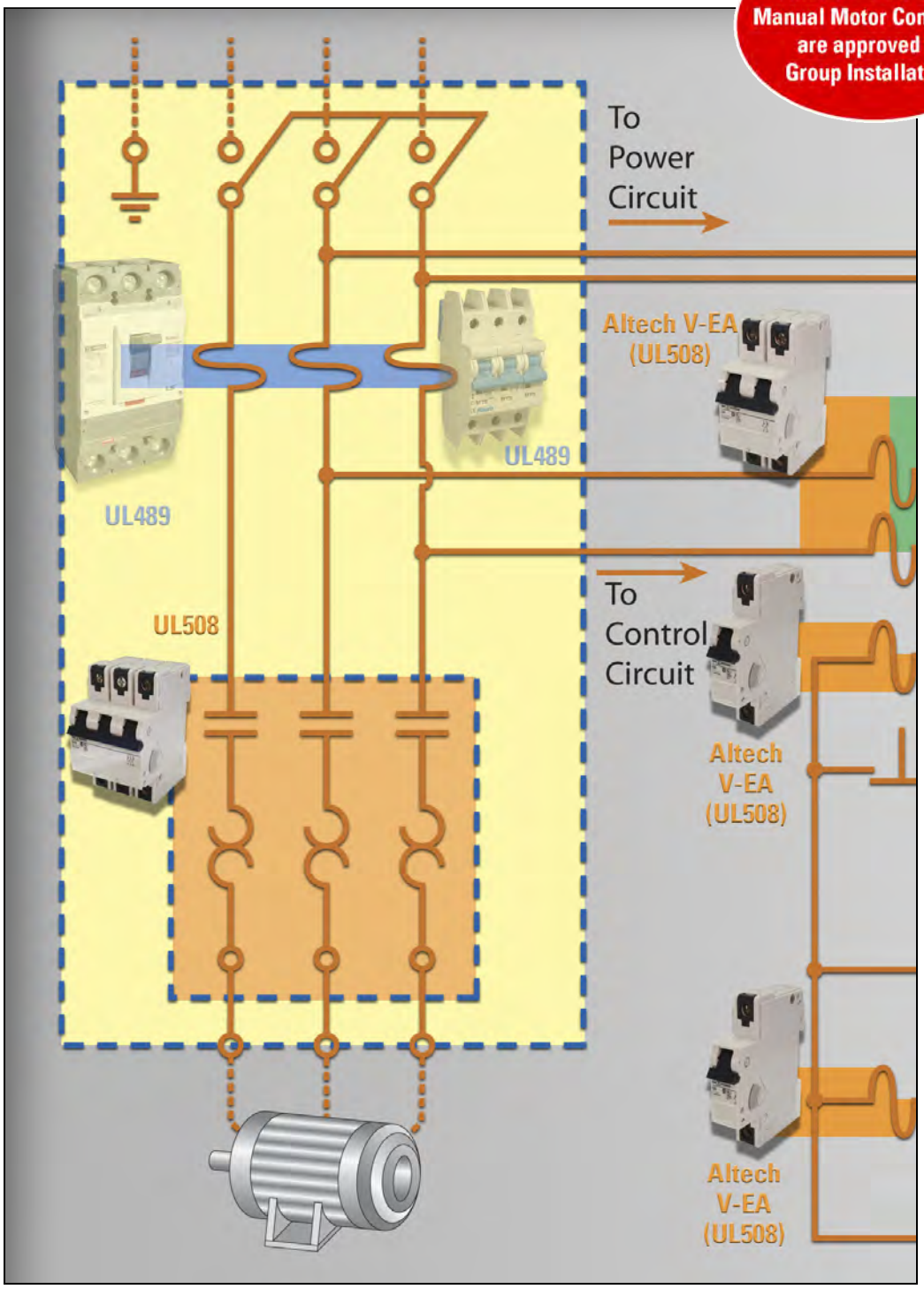
Cover is suitable for central mounting type circuit breaker to provide dust & splash protection (IP 54).
Type/Cat. No.: **DC TR11 C**

Dimensions in mm **(to convert to inches multiply by 0.03937)**

Typical UL508 Application

Power Circuit of a UL508A Panel

Altech's V-EA UL508 Manual Motor Controllers are approved for Group Installations

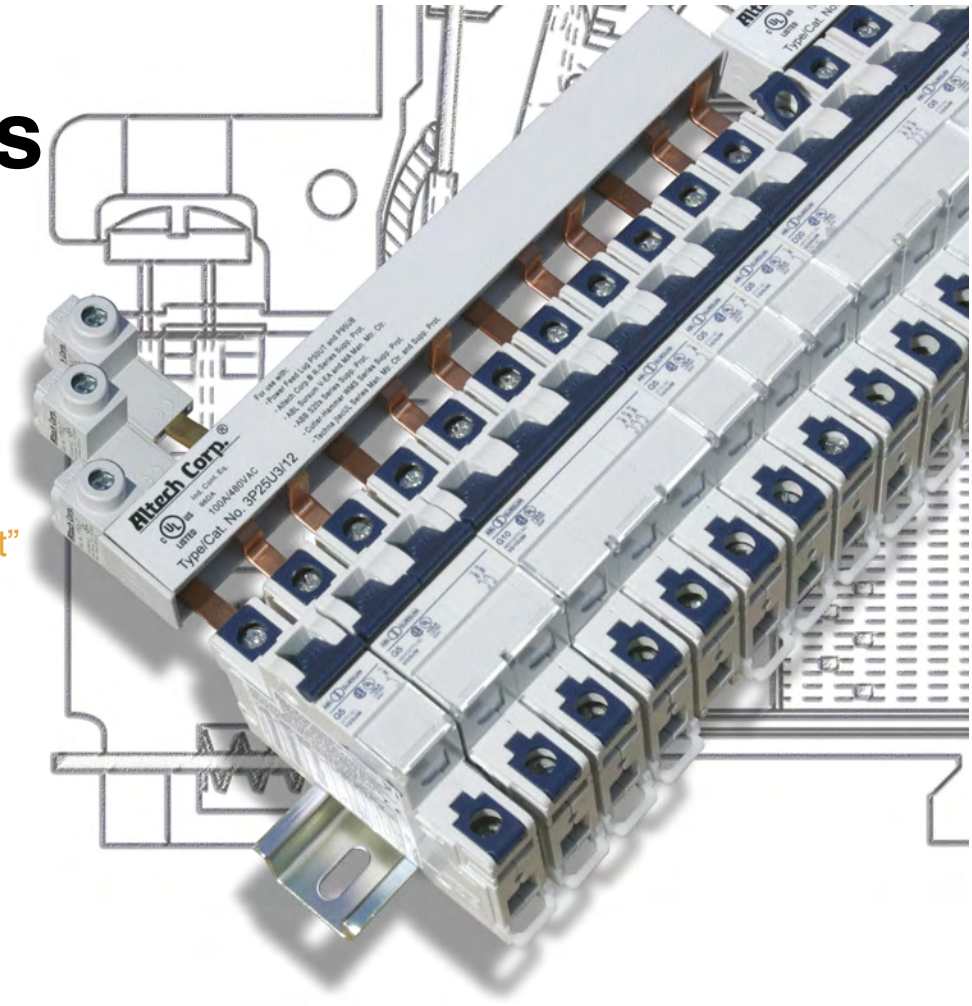


Disclaimer: This an application example. Installation should be done by a qualified electrician under the guidance of UL/NEC® specifications..

V-EA Series

508 listed
E137938

C22.2 No.14 certified
LR104391



UL508 Listed
Manual Motor Controllers
"Suitable as Motor Disconnect"

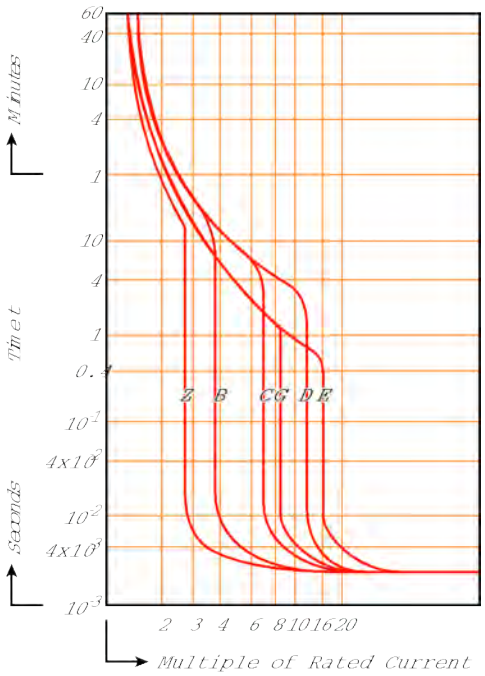
- DIN Rail Mounted
- 17.5mm width per pole
- Thermal Magnetic
- 480Y/277V AC, 50/60Hz
- 10kA Short Circuit Withstand Capacity
- Applications Include:
  - AC Motor Starting, Across the Line
  - AC General Use
  - AC Resistance
  - AC Discharge Lamps (Ballast)
  - AC Incandescent Lamps (Tungsten)

Voltage Rating	480Y/277VAC 0.3-25A: 1 pole - 42VDC; 2 Pole - 80VDC 30-60A: 1 pole - 24VDC; 2 Pole - 60VDC
Short Circuit Withstand Rating (UL/CSA - Ratings)	0.3-60A (RC): 10kA with UL-listed RK5 back-up fuse or MCCB
Group Short Circuit Withstand Rating (UL/CSA - Ratings)	0.3-10A (RC): 10kA; 12-60A (RC): 5kA no branch circuit protection required
Interrupting Capacity (VDE - Ratings)	0.3-63A (RC): 10kA
Calibration Temperature	40°C (104°F)
Operating Temperature	-25°C to 55°C (-13°F to 131°F)
Storage Temperature	-40°C to 70°C (-40°F to 158°F)
Terminal Size Acceptability	Top: 18-3 AWG; Bottom: 18-2 AWG (Line/Load reversible)
Terminal Torque	20 lb.in.
Terminal Protection Degree	IP20
Horse Power Ratings	see page 32
Mechanical Endurance Ratings	see page 33

SHORT CIRCUIT WITHSTAND RATINGS FOR V-EA MANUAL MOTOR CONTROLLER

Trip Curve	Backup Protection / Amp Range	UL-Listed RK5-Fuse up to 10kA	UL-Listed MCCB up to 10kA	No BCP Required up to:
all	0.3 - 10A	4xRC* min 15A, max 70A	4xRC* min 15A, max 70A	10kA
all	12 - 30/32A	4xRC* max 125A	4xRC* max 125A	5kA
all	40 - 50A	4xRC* max 200A	4xRC* max 200A	5kA
all	60 / 63A	4xRC* max 250A	4xRC* max 250A	5kA

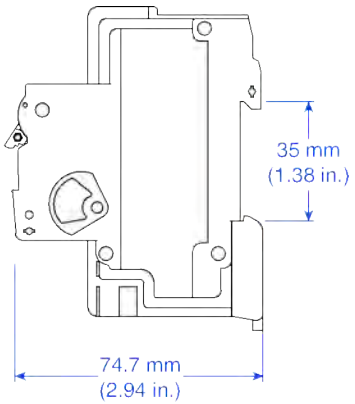
*up to nearest rated current

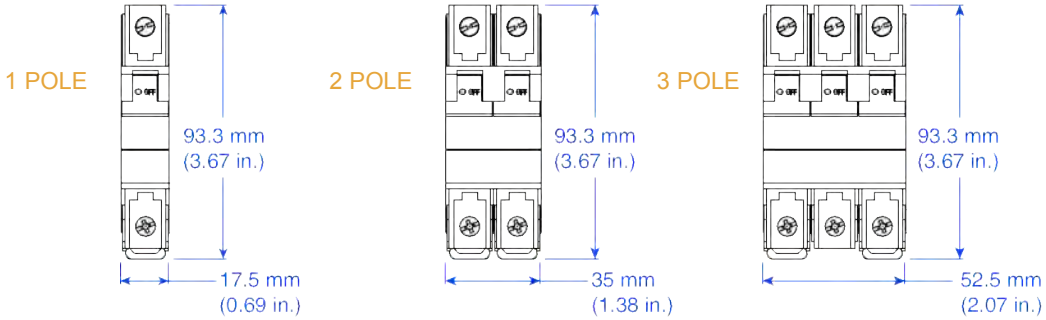


Time versus Current Trip Curve

For the exact trip curve, please refer to pages 30-31.

Dimensions in mm
side view





Application Overview

Trip-Characteristics*				Applications											
Characteristic Trip Boundaries				Lighting Wiring Protection Control Circuits	Business Equipment Appliances	Transformers	Power Supplies Heaters	Motors				General Electronics	Solenoid	Semi-conductors Components/ devices with low surge-current and short circuit withstand capabilities	Reactive Load
Thermal Trip		Magnetic Trip						General	Low Inrush	High Inrush	High Efficiency				
Must not Trip>100ms	Must Trip <1hr	Must not Trip>100ms	Must Trip at 100ms												
B-Characteristics				●	●							●			
1.13xRC	1.45xRC	3xRC	5xRC												
C-Characteristics				●	●				●						
1.13xRC	1.45xRC	5xRC	10xRC												
D-Characteristics						●	●			●					●
1.13xRC	1.45xRC	10xRC	16xRC												
E-Characteristics						●	●				●				
1.05xRC	1.35xRC	14xRC	18xRC												
G-Characteristics				●		●		●	●				●		
1.05xRC	1.35xRC	8xRC	10xRC												
Z-Characteristics												●		●	
1.05xRC	1.35xRC	2xRC	3xRC												

**The value of each characteristic is shown vertically beneath its corresponding heading.*

Warning!
This information should only be used as a selection guide. The use of a Miniature Circuit Breaker/Manual Motor Controller in an application with a certain Trip-Characteristic always requires prototype testing! It is the responsibility of the circuit design engineer to select the appropriate Miniature Circuit Breaker/Manual Motor Controller for his specific application.

B-Trip Characteristic

Application Examples:

Business equipment, wiring protection, lighting, appliances, control circuits, some motors and some electronic applications. Relatively long thermal trip delay but low magnetic trip point.

UL508 Listed
E137938



One Pole

Standard Pack: 12

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
1.0A	**1B1UM**	
1.6A	**1B1.6UM**	
2.0A	**1B2UM**	
2.5A	**1B2.5UM**	
3.0A	**1B3UM**	
3.5A	**1B3.5UM**	
4.0A	**1B4UM**	
5.0A	**1B5UM**	
6.0A	**1B6UM**	
8.0A	NA	
10A	**1B10UM**	
12A	NA	
13A	**1B13UM**	
15A	**1B15UM**	
16A	**1B16UM**	
20A	**1B20UM**	
25A	**1B25UM**	
30A	**1B30UM**	
32A	**1B32UM**	
40A	**1B40UM**	
50A	**1B50UM**	
60A	**1B60UM**	
63A	**1B63UM**	



Three Pole

Standard Pack: 4

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
1.0A	**3B1UM**	
1.6A	**3B1.6UM**	
2.0A	**3B2UM**	
2.5A	**3B2.5UM**	
3.0A	**3B3UM**	
3.5A	**3B3.5UM**	
4.0A	**3B4UM**	
5.0A	**3B5UM**	
6.0A	**3B6UM**	
8.0A	NA	
10A	**3B10UM**	
12A	NA	
13A	**3B13UM**	
15A	**3B15UM**	
16A	**3B16UM**	
20A	**3B20UM**	
25A	**3B25UM**	
30A	**3B30UM**	
32A	**3B32UM**	
40A	**3B40UM**	
50A	**3B50UM**	
60A	**3B60UM**	
63A	**3B63UM**	



Two Pole

Standard Pack: 6

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
1.0A	**2B1UM**	
1.6A	**2B1.6UM**	
2.0A	**2B2UM**	
2.5A	**2B2.5UM**	
3.0A	**2B3UM**	
3.5A	**2B3.5UM**	
4.0A	**2B4UM**	
5.0A	**2B5UM**	
6.0A	**2B6UM**	
8.0A	NA	
10A	**2B10UM**	
12A	NA	
13A	**2B13UM**	
15A	**2B15UM**	
16A	**2B16UM**	
20A	**2B20UM**	
25A	**2B25UM**	
30A	**2B30UM**	
32A	**2B32UM**	
40A	**2B40UM**	
50A	**2B50UM**	
60A	**2B60UM**	
63A	**2B63UM**	



Add-on Neutral Pole

Rating	Type/ Cat. No.	Approvals
0.3-63A/ 480Y/277V	**N63UM**	

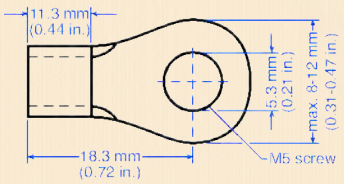
Standard Pack: 5

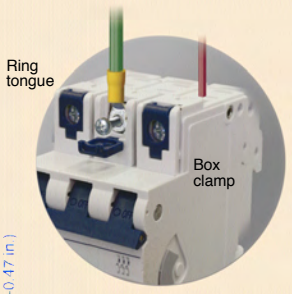
Weight:
0.775kg (1.71lb.)

Standard Dual Connection Terminal

- Box clamp terminals
  Top: 18-3 AWG;
  Bottom: 18-2 AWG
  (Line/Load reversible)
- Ring tongue terminals

Dimensions*:





** May differ by manufacturer.*

Top terminal ring tongue maximum thickness 1.6 mm.

C-Trip Characteristic

UL508 Listed
E137938

Application Examples:

Low inrush motors, lighting, wiring protection, appliances, business equipment, and control circuit applications. Relatively long thermal trip delay and medium magnetic trip point.



One Pole

Standard Pack: 12

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**1C03UM**	
0.5A	**1C05UM**	
0.75A	**1C075UM**	
0.8A	NA	
1.0A	**1C1UM**	
1.6A	**1C1.6UM**	
2.0A	**1C2UM**	
2.5A	**1C2.5UM**	
3.0A	**1C3UM**	
3.5A	**1C3.5UM**	
4.0A	**1C4UM**	
5.0A	**1C5UM**	
6.0A	**1C6UM**	
8.0A	**1C8UM**	
10A	**1C10UM**	
12A	NA	
13A	**1C13UM**	
15A	**1C15UM**	
16A	**1C16UM**	
20A	**1C20UM**	
25A	**1C25UM**	
30A	**1C30UM**	
32A	**1C32UM**	
40A	**1C40UM**	
50A	**1C50UM**	
60A	**1C60UM**	
63A	**1C63UM**	



Three Pole

Standard Pack: 4

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**3C03UM**	
0.5A	**3C05UM**	
0.75A	**3C075UM**	
0.8A	NA	
1.0A	**3C1UM**	
1.6A	**3C1.6UM**	
2.0A	**3C2UM**	
2.5A	**3C2.5UM**	
3.0A	**3C3UM**	
3.5A	**3C3.5UM**	
4.0A	**3C4UM**	
5.0A	**3C5UM**	
6.0A	**3C6UM**	
8.0A	**3C8UM**	
10A	**3C10UM**	
12A	NA	
13A	**3C13UM**	
15A	**3C15UM**	
16A	**3C16UM**	
20A	**3C20UM**	
25A	**3C25UM**	
30A	**3C30UM**	
32A	**3C32UM**	
40A	**3C40UM**	
50A	**3C50UM**	
60A	**3C60UM**	
63A	**3C63UM**	



Two Pole

Standard Pack: 6

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**2C03UM**	
0.5A	**2C05UM**	
0.75A	**2C075UM**	
0.8A	NA	
1.0A	**2C1UM**	
1.6A	**2C1.6UM**	
2.0A	**2C2UM**	
2.5A	**2C2.5UM**	
3.0A	**2C3UM**	
3.5A	**2C3.5UM**	
4.0A	**2C4UM**	
5.0A	**2C5UM**	
6.0A	**2C6UM**	
8.0A	**2C8UM**	
10A	**2C10UM**	
12A	NA	
13A	**2C13UM**	
15A	**2C15UM**	
16A	**2C16UM**	
20A	**2C20UM**	
25A	**2C25UM**	
30A	**2C30UM**	
32A	**2C32UM**	
40A	**2C40UM**	
50A	**2C50UM**	
60A	**2C60UM**	
63A	**2C63UM**	



Add-on Neutral Pole

Rating	Type/ Cat. No.	Approvals
0.3-63A/ 480Y/277V	**N63UM**	

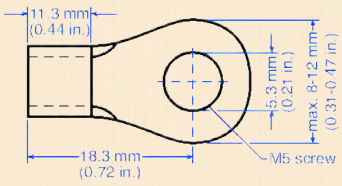
Standard Pack: 5

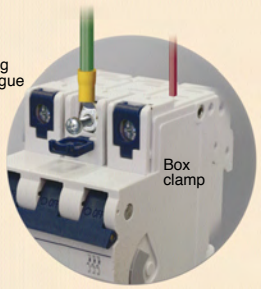
Weight:
0.775kg (1.71lb.)

Standard Dual Connection Terminal

- Box clamp terminals
  Top: 18-3 AWG;
  Bottom: 18-2 AWG
  (Line/Load reversible)
- Ring tongue terminals

Dimensions*:





** May differ by manufacturer.*

Top terminal ring tongue maximum thickness 1.6 mm.

Altech UL508

D-Trip Characteristic

Application Examples:

High inrush motors, transformers, power supplies, heaters and reactive loads. Relatively long thermal trip delay and very high magnetic trip point.

UL508 Listed
E137938



One Pole

Standard Pack: 12

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**1D03UM**	
0.5A	**1D05UM**	
0.75A	**1D075UM**	
0.8A	NA	
1.0A	**1D1UM**	
1.6A	**1D1.6UM**	
2.0A	**1D2UM**	
2.5A	**1D2.5UM**	
3.0A	**1D3UM**	
3.5A	**1D3.5UM**	
4.0A	**1D4UM**	
5.0A	**1D5UM**	
6.0A	**1D6UM**	
8.0A	**1D8UM**	
10A	**1D10UM**	
12A	NA	
13A	**1D13UM**	
15A	**1D15UM**	
16A	**1D16UM**	
20A	**1D20UM**	
25A	**1D25UM**	
30A	**1D30UM**	
32A	**1D32UM**	
40A	**1D40UM**	
50A	**1D50UM**	
60A	**1D60UM**	
63A	**1D63UM**	



Three Pole

Standard Pack: 4

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**3D03UM**	
0.5A	**3D05UM**	
0.75A	**3D075UM**	
0.8A	NA	
1.0A	**3D1UM**	
1.6A	**3D1.6UM**	
2.0A	**3D2UM**	
2.5A	**3D2.5UM**	
3.0A	**3D3UM**	
3.5A	**3D3.5UM**	
4.0A	**3D4UM**	
5.0A	**3D5UM**	
6.0A	**3D6UM**	
8.0A	**3D8UM**	
10A	**3D10UM**	
12A	NA	
13A	**3D13UM**	
15A	**3D15UM**	
16A	**3D16UM**	
20A	**3D20UM**	
25A	**3D25UM**	
30A	**3D30UM**	
32A	**3D32UM**	
40A	**3D40UM**	
50A	**3D50UM**	
60A	**3D60UM**	
63A	**3D63UM**	



Two Pole

Standard Pack: 6

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**2D03UM**	
0.5A	**2D05UM**	
0.75A	**2D075UM**	
0.8A	NA	
1.0A	**2D1UM**	
1.6A	**2D1.6UM**	
2.0A	**2D2UM**	
2.5A	**2D2.5UM**	
3.0A	**2D3UM**	
3.5A	**2D3.5UM**	
4.0A	**2D4UM**	
5.0A	**2D5UM**	
6.0A	**2D6UM**	
8.0A	**2D8UM**	
10A	**2D10UM**	
12A	NA	
13A	**2D13UM**	
15A	**2D15UM**	
16A	**2D16UM**	
20A	**2D20UM**	
25A	**2D25UM**	
30A	**2D30UM**	
32A	**2D32UM**	
40A	**2D40UM**	
50A	**2D50UM**	
60A	**2D60UM**	
63A	**2D63UM**	



Add-on Neutral Pole

Rating	Type/ Cat. No.	Approvals
0.3-63A/ 480Y/277V	**N63UM**	

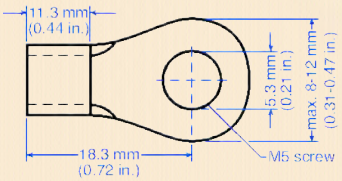
Standard Pack: 5

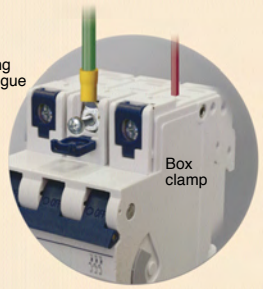
Weight:
0.775kg (1.71lb.)

Standard Dual Connection Terminal

- Box clamp terminals
  Top: 18-3 AWG;
  Bottom: 18-2 AWG
  (Line/Load reversible)
- Ring tongue terminals

Dimensions*:





** May differ by manufacturer.*

Top terminal ring tongue maximum thickness 1.6 mm.

E-Trip Characteristic

UL508 Listed
E137938

Application Examples:

High efficiency motors, which have exceedingly high inrush currents. Relatively short thermal trip delays and very high magnetic trip points.



One Pole

Standard Pack: 12

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**1E03UM**	UL SP
0.5A	**1E05UM**	UL SP
0.75A	**1E075UM**	UL SP
0.8A	NA	
1.0A	**1E1UM**	UL SP
1.6A	**1E1.6UM**	UL SP
2.0A	**1E2UM**	UL SP
2.5A	**1E2.5UM**	UL SP
3.0A	**1E3UM**	UL SP
3.5A	**1E3.5UM**	UL SP
4.0A	**1E4UM**	UL SP
5.0A	**1E5UM**	UL SP
6.0A	**1E6UM**	UL SP
8.0A	**1E8UM**	UL SP
10A	**1E10UM**	UL SP
12A	**1E12UM**	UL SP
13A	**1E13UM**	UL SP
15A	**1E15UM**	UL SP
16A	**1E16UM**	UL SP
20A	**1E20UM**	UL SP
25A	**1E25UM**	UL SP
30A	**1E30UM**	UL SP
32A	**1E32UM**	UL SP
40A	**1E40UM**	UL SP
50A	**1E50UM**	UL SP
60A	**1E60UM**	UL SP
63A	**1E63UM**	



Three Pole

Standard Pack: 4

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**3E03UM**	UL SP
0.5A	**3E05UM**	UL SP
0.75A	**3E075UM**	UL SP
0.8A	NA	
1.0A	**3E1UM**	UL SP
1.6A	**3E1.6UM**	UL SP
2.0A	**3E2UM**	UL SP
2.5A	**3E2.5UM**	UL SP
3.0A	**3E3UM**	UL SP
3.5A	**3E3.5UM**	UL SP
4.0A	**3E4UM**	UL SP
5.0A	**3E5UM**	UL SP
6.0A	**3E6UM**	UL SP
8.0A	**3E8UM**	UL SP
10A	**3E10UM**	UL SP
12A	**3E12UM**	UL SP
13A	**3E13UM**	UL SP
15A	**3E15UM**	UL SP
16A	**3E16UM**	UL SP
20A	**3E20UM**	UL SP
25A	**3E25UM**	UL SP
30A	**3E30UM**	UL SP
32A	**3E32UM**	UL SP
40A	**3E40UM**	UL SP
50A	**3E50UM**	UL SP
60A	**3E60UM**	UL SP
63A	**3E63UM**	



Two Pole

Standard Pack: 6

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**2E03UM**	UL SP
0.5A	**2E05UM**	UL SP
0.75A	**2E075UM**	UL SP
0.8A	NA	
1.0A	**2E1UM**	UL SP
1.6A	**2E1.6UM**	UL SP
2.0A	**2E2UM**	UL SP
2.5A	**2E2.5UM**	UL SP
3.0A	**2E3UM**	UL SP
3.5A	**2E3.5UM**	UL SP
4.0A	**2E4UM**	UL SP
5.0A	**2E5UM**	UL SP
6.0A	**2E6UM**	UL SP
8.0A	**2E8UM**	UL SP
10A	**2E10UM**	UL SP
12A	**2E12UM**	UL SP
13A	**2E13UM**	UL SP
15A	**2E15UM**	UL SP
16A	**2E16UM**	UL SP
20A	**2E20UM**	UL SP
25A	**2E25UM**	UL SP
30A	**2E30UM**	UL SP
32A	**2E32UM**	UL SP
40A	**2E40UM**	UL SP
50A	**2E50UM**	UL SP
60A	**2E60UM**	UL SP
63A	**2E63UM**	



Add-on Neutral Pole

Rating	Type/ Cat. No.	Approvals
0.3-63A/ 480Y/277V	**N63UM**	UL SP

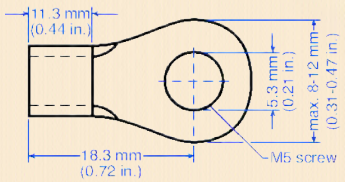
Standard Pack: 5

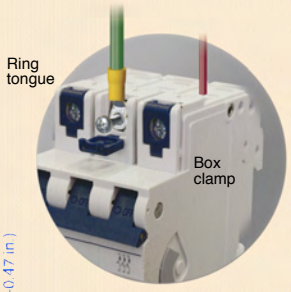
Weight:
0.775kg (1.71lb.)

Standard Dual Connection Terminal

- Box clamp terminals
  Top: 18-3 AWG;
  Bottom: 18-2 AWG
  (Line/Load reversible)
- Ring tongue terminals

Dimensions*:





** May differ by manufacturer.*

Top terminal ring tongue maximum thickness 1.6 mm.

G-Trip Characteristic

UL508 Listed
E137938

Application Examples:

General industrial, including motors, some transformers, solenoids, control circuits, lighting and wiring. Meets the US trip norms with relatively short thermal trip delay and high magnetic trip point.



One Pole

Standard Pack: 12

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**1G03UM**	
0.5A	**1G05UM**	
0.75A	NA	
0.8A	**1G08UM**	
1.0A	**1G1UM**	
1.6A	**1G1.6UM**	
2.0A	**1G2UM**	
2.5A	**1G2.5UM**	
3.0A	**1G3UM**	
3.5A	**1G3.5UM**	
4.0A	**1G4UM**	
5.0A	**1G5UM**	
6.0A	**1G6UM**	
8.0A	**1G8UM**	
10A	**1G10UM**	
12A	**1G12UM**	
13A	**1G13UM**	
15A	**1G15UM**	
16A	**1G16UM**	
20A	**1G20UM**	
25A	**1G25UM**	
30A	**1G30UM**	
32A	**1G32UM**	
40A	**1G40UM**	
50A	**1G50UM**	
60A	**1G60UM**	
63A	**1G63UM**	



Three Pole

Standard Pack: 4

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**3G03UM**	
0.5A	**3G05UM**	
0.75A	NA	
0.8A	**3G08UM**	
1.0A	**3G1UM**	
1.6A	**3G1.6UM**	
2.0A	**3G2UM**	
2.5A	**3G2.5UM**	
3.0A	**3G3UM**	
3.5A	**3G3.5UM**	
4.0A	**3G4UM**	
5.0A	**3G5UM**	
6.0A	**3G6UM**	
8.0A	**3G8UM**	
10A	**3G10UM**	
12A	**3G12UM**	
13A	**3G13UM**	
15A	**3G15UM**	
16A	**3G16UM**	
20A	**3G20UM**	
25A	**3G25UM**	
30A	**3G30UM**	
32A	**3G32UM**	
40A	**3G40UM**	
50A	**3G50UM**	
60A	**3G60UM**	
63A	**3G63UM**	



Two Pole

Standard Pack: 6

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**2G03UM**	
0.5A	**2G05UM**	
0.75A	NA	
0.8A	**2G08UM**	
1.0A	**2G1UM**	
1.6A	**2G1.6UM**	
2.0A	**2G2UM**	
2.5A	**2G2.5UM**	
3.0A	**2G3UM**	
3.5A	**2G3.5UM**	
4.0A	**2G4UM**	
5.0A	**2G5UM**	
6.0A	**2G6UM**	
8.0A	**2G8UM**	
10A	**2G10UM**	
12A	**2G12UM**	
13A	**2G13UM**	
15A	**2G15UM**	
16A	**2G16UM**	
20A	**2G20UM**	
25A	**2G25UM**	
30A	**2G30UM**	
32A	**2G32UM**	
40A	**2G40UM**	
50A	**2G50UM**	
60A	**2G60UM**	
63A	**2G63UM**	



Add-on Neutral Pole

Rating	Type/ Cat. No.	Approvals
0.3-63A/ 480Y/277V	**N63UM**	

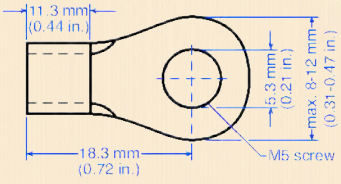
Standard Pack: 5

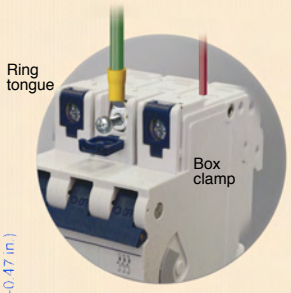
Weight:
0.775kg (1.71lb.)

Standard Dual Connection Terminal

- Box clamp terminals
  Top: 18-3 AWG;
  Bottom: 18-2 AWG
  (Line/Load reversible)
- Ring tongue terminals

Dimensions*:





** May differ by manufacturer.*

Top terminal ring tongue maximum thickness 1.6 mm.

Z-Trip Characteristic

UL508 Listed
E137938

Application Examples:

Semiconductors, components which fail-short (vs. fail-open), and components/devices with low surge-current and short circuit withstand capabilities. Relatively short thermal delay and very low magnetic trip point.



One Pole

Standard Pack: 12

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**1Z03UM**	UL SP
0.5A	**1Z05UM**	UL SP
0.75A	**1Z075UM**	UL SP
0.8A	NA	
1.0A	**1Z1UM**	UL SP
1.6A	**1Z1.6UM**	UL SP
2.0A	**1Z2UM**	UL SP
2.5A	**1Z2.5UM**	UL SP
3.0A	**1Z3UM**	UL SP
3.5A	**1Z3.5UM**	UL SP
4.0A	**1Z4UM**	UL SP
5.0A	**1Z5UM**	UL SP
6.0A	**1Z6UM**	UL SP
8.0A	**1Z8UM**	UL SP
10A	**1Z10UM**	UL SP
12A	**1Z12UM**	UL SP
13A	**1Z13UM**	UL SP
15A	**1Z15UM**	UL SP
16A	**1Z16UM**	UL SP
20A	**1Z20UM**	UL SP
25A	**1Z25UM**	UL SP
30A	**1Z30UM**	UL SP
32A	**1Z32UM**	UL SP
40A	**1Z40UM**	UL SP
50A	**1Z50UM**	UL SP



Three Pole

Standard Pack: 4

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**3Z03UM**	UL SP
0.5A	**3Z05UM**	UL SP
0.75A	**3Z075UM**	UL SP
0.8A	NA	
1.0A	**3Z1UM**	UL SP
1.6A	**3Z1.6UM**	UL SP
2.0A	**3Z2UM**	UL SP
2.5A	**3Z2.5UM**	UL SP
3.0A	**3Z3UM**	UL SP
3.5A	**3Z3.5UM**	UL SP
4.0A	**3Z4UM**	UL SP
5.0A	**3Z5UM**	UL SP
6.0A	**3Z6UM**	UL SP
8.0A	**3Z8UM**	UL SP
10A	**3Z10UM**	UL SP
12A	**3Z12UM**	UL SP
13A	**3Z13UM**	UL SP
15A	**3Z15UM**	UL SP
16A	**3Z16UM**	UL SP
20A	**3Z20UM**	UL SP
25A	**3Z25UM**	UL SP
30A	**3Z30UM**	UL SP
32A	**3Z32UM**	UL SP
40A	**3Z40UM**	UL SP
50A	**3Z50UM**	UL SP



Two Pole

Standard Pack: 6

Weight:
0.3A - 32A
1.75kg (3.86 lb.)
40A - 63A
2.07kg (4.56 lb.)

Rated Current	Type/ Cat. No.	Approvals
0.3A	**2Z03UM**	UL SP
0.5A	**2Z05UM**	UL SP
0.75A	**2Z075UM**	UL SP
0.8A	NA	
1.0A	**2Z1UM**	UL SP
1.6A	**2Z1.6UM**	UL SP
2.0A	**2Z2UM**	UL SP
2.5A	**2Z2.5UM**	UL SP
3.0A	**2Z3UM**	UL SP
3.5A	**2Z3.5UM**	UL SP
4.0A	**2Z4UM**	UL SP
5.0A	**2Z5UM**	UL SP
6.0A	**2Z6UM**	UL SP
8.0A	**2Z8UM**	UL SP
10A	**2Z10UM**	UL SP
12A	**2Z12UM**	UL SP
13A	**2Z13UM**	UL SP
15A	**2Z15UM**	UL SP
16A	**2Z16UM**	UL SP
20A	**2Z20UM**	UL SP
25A	**2Z25UM**	UL SP
30A	**2Z30UM**	UL SP
32A	**2Z32UM**	UL SP
40A	**2Z40UM**	UL SP
50A	**2Z50UM**	UL SP



Add-on Neutral Pole

Rating	Type/ Cat. No.	Approvals
0.3-63A/ 480Y/277V	**N63UM**	UL SP

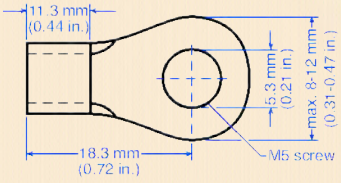
Standard Pack: 5

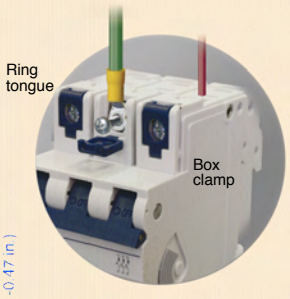
Weight:
0.775kg (1.71lb.)

Standard Dual Connection Terminal

- Box clamp terminals
  Top: 18-3 AWG;
  Bottom: 18-2 AWG
  (Line/Load reversible)
- Ring tongue terminals

Dimensions*:





** May differ by manufacturer.*

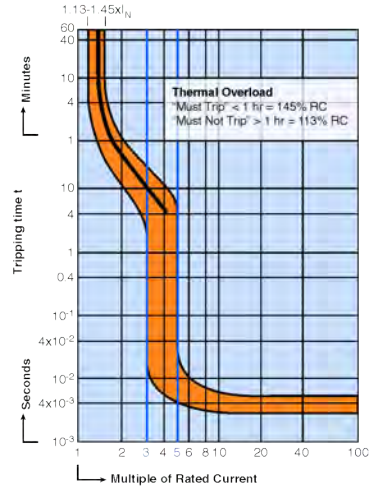
Top terminal ring tongue maximum thickness 1.6 mm.

Altech UL508

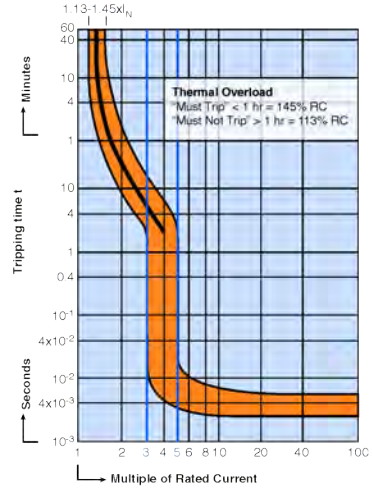
V-EA Trip Curves

B Trip Curve

V-EA-B Trip
1.0A Through 10A Rated Current



V-EA-B Trip
13A Through 63A Rated Current

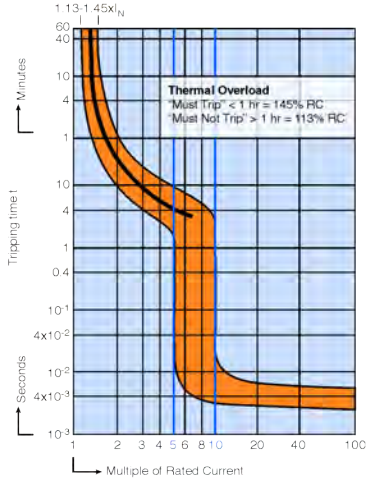


"B" Magnetic Trip Parameters
Rated current 1.0A to 63A.

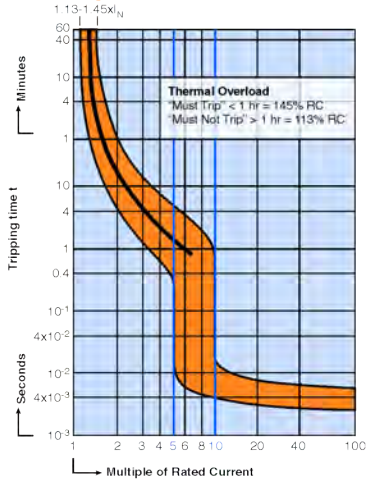
1. Hold for a minimum of 100ms at surge of 3 times rated current.
2. Trip in under 100ms at 5 times rated current.

C Trip Curve

V-EA-C Trip
0.3A Through 10A Rated Current



V-EA-C Trip
13A Through 63A Rated Current

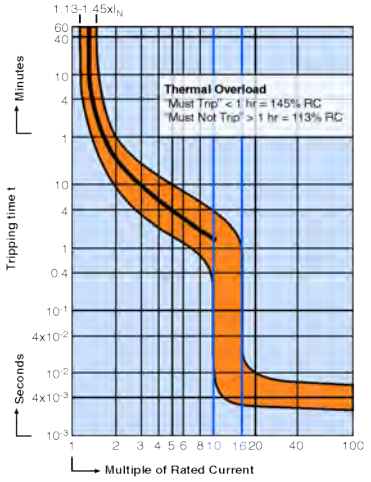


"C" Magnetic Trip Parameters
Rated current 0.3A to 63A.

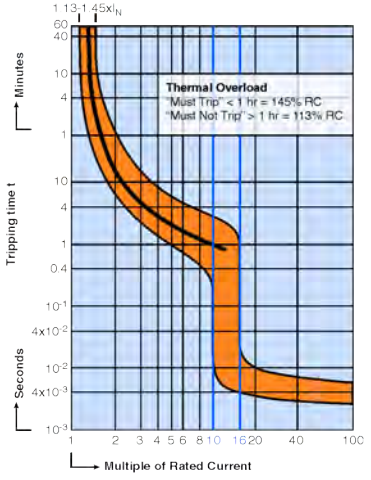
1. Hold for a minimum of 100ms at surge of 5 times rated current.
2. Trip in under 100ms at 10 times rated current.

D Trip Curve

V-EA-D Trip
0.3A Through 10A Rated Current



V-EA-D Trip
13A Through 63A Rated Current



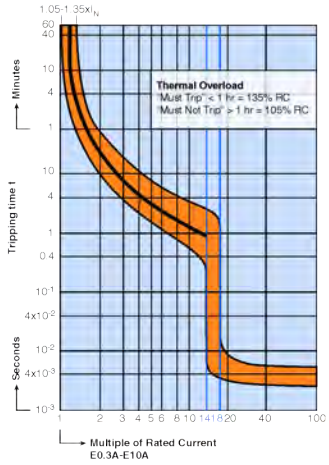
"D" Magnetic Trip Parameters
Rated current 0.3A to 63A.

1. Hold for a minimum of 100ms at surge of 10 times rated current.
2. Trip in under 100ms at 16 times rated current.

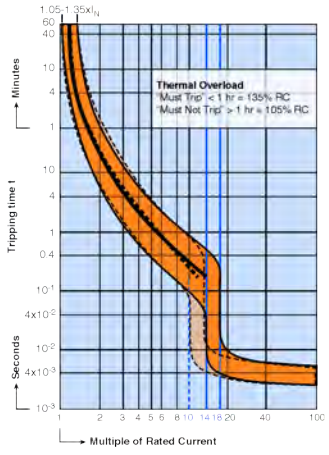
V-EA Trip Curves

E Trip Curve

V-EA-E Trip
0.3A Through 10A Rated Current



V-EA-E Trip
12A Through 60A Rated Current

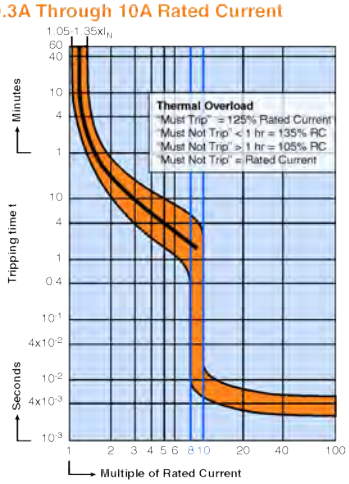


"E" Magnetic Trip Parameters
Rated Current, 0.3A to 50A, 60/63A (dotted line).

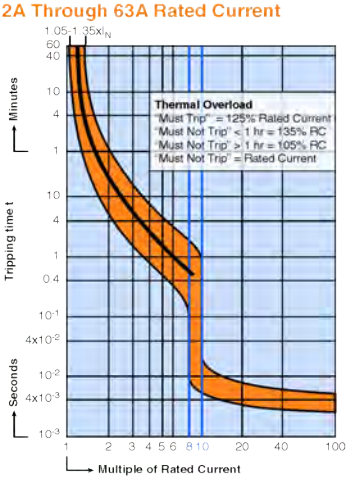
Magnetic Trip:
1. Hold for a minimum of 100ms at surge of 14 times (60A, 10 times) rated current.
2. Trip in under 100ms at 18 times (60A, 14 times) rated current.

G Trip Curve

V-EA-G Trip
0.3A Through 10A Rated Current



V-EA-G Trip
12A Through 63A Rated Current

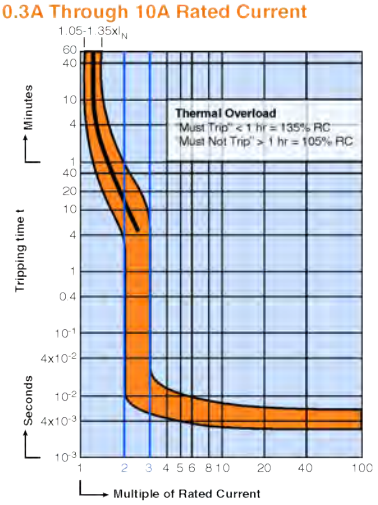


"G" Magnetic Trip Parameters
Rated Current, 0.3A to 63A.

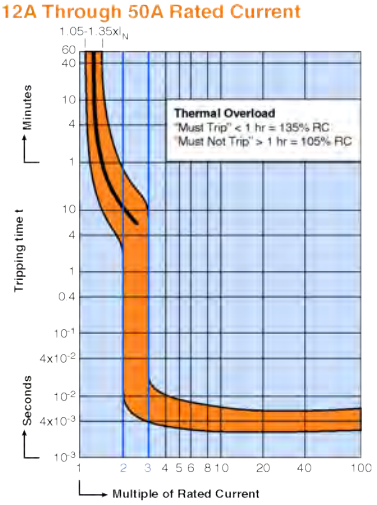
Magnetic Trip:
1. Hold for a minimum of 100ms at surge of 8 times rated current.
2. Trip in under 100ms at 10 times rated current.

Z Trip Curve

V-EA-Z Trip
0.3A Through 10A Rated Current



V-EA-Z Trip
12A Through 50A Rated Current



"Z" Trip Parameters
Rated Current, 0.3A to 50A.

Magnetic Trip:
1. Hold for a minimum of 100ms at 2 times rated current.
2. Trip in under 100ms at 3 times rated current.

Table HP 1: AMPERE RATINGS & HORSEPOWER RATING 1 PHASE

			FLA & LRC CONVERTED TO TABLE HORSEPOWER (SEE NOTE #2) USE FLA & LRC RATINGS WHERE NO HP RATING IS GIVEN					
			NOMINAL CIRCUIT VOLTAGE					
V-EA RATED	MOTOR NAMEPLATE	MOTOR NAMEPLATE	110-120 VAC	200 VAC	208 VAC	220-240 VAC	265 VAC	277 VAC
CURRENT (SEE NOTE #1)	FLA RATING	STARTING/ LRC RATING						
0.30A 0.50A 0.75A	0.30A 0.50A 0.75A	1.80A 3.00A 4.35A						
0.80A 1.0A 1.6A	0.80A 1.0A 1.6A	4.8A 6.0A 9.6A						
2.0A 2.5A 3.0A	2.0A 2.5A 3.0A	12.0A 15.0A 18.0A		1/6hp 1/6hp	1/6hp 1/6hp	1/6hp 1/6hp 1/4hp	1/6hp 1/6hp 1/4hp	1/6hp 1/4hp 1/3hp
3.5A 4.0A	3.5A 4.0A	21.0A 24.0A		1/4hp 1/4hp	1/4hp 1/3hp	1/4hp 1/3hp	1/3hp 1/3hp	1/3hp 1/3hp
5.0A 6.0A 8.0A	5.0A 6.0A 8.0A	30.0A 36.0A 48.0A	1/6hp 1/4hp 1/3hp	1/3hp 1/2hp 3/4hp	1/2hp 1/2hp 3/4hp	1/2hp 1/2hp 1hp	1/2hp 3/4hp 1hp	1/2hp 3/4hp 1hp
10.0A	10.0A	60.0A	1/2hp	1hp	1hp	1 1/2hp	1 1/2hp	2hp
12.0A 12.5A	12.0A 12.5A	72.0A 75.0A	1/2hp 1/2hp	1 1/2hp 1 1/2hp	1 1/2hp 1 1/2hp	2hp 2hp	2hp 2hp	2hp 2hp
13.0A 15.0A 16.0A	13.0A 15.0A 16.0A	78.0A 90.0A 96.0A	1/2hp 3/4hp 1hp	1 1/2hp 2hp 2hp	1 1/2hp 2hp 2hp	2hp 2hp 2hp	2hp 3hp 3hp	2hp 3hp 3hp
20.0A 25.0A	20.0A 25.0A	120.0A 150.0A	1 1/2hp 2hp	3hp 3hp	3hp 3hp	3hp 3hp	3hp 5hp	3hp 5hp
30.0A	30.0A	180.0A	2hp	3hp	3hp	5hp	5hp	5hp
32.0A	32.0A	192.0A	2hp	3hp	5hp	5hp	5hp	5hp
40.0A	40.0A	240.0A	3hp	5hp	7 1/2hp	7 1/2hp	7 1/2hp	7 1/2hp
50.0A 60.0A	50.0A 60.0A	300.0A 360.0A	3hp 5hp	7 1/2hp 10hp	10hp 10hp	10hp 10hp	10hp 10hp	10hp 15hp

NOTE #1: For AC motor circuit nameplate full load current, AC general-use loads, AC resistance loads, AC incandescent lamp (tungsten) loads, AC electric discharge lamp (ballast) loads.
NOTE #2: Conversions per UL508® Table 45.2 and NFPA-70: National Electrical Code® 2008 Tables 430-248 and 430-251(A).

Table HP 2: AMPERE RATING & HORSEPOWER RATING 3 PHASE & 2 PHASE - 4 WIRE

			FLA & LRC RATINGS CONVERTED TO TABLE HORSEPOWER (SEE NOTE #2) USE FLA & LRC RATINGS WHERE NO HP IS LISTED									
V-EA RATED CURRENT (SEE NOTE #1)	MOTOR NAMEPLATE FLA RATING	MOTOR NAMEPLATE STARTING/ LRC RATING	110-120 VAC Motor Design		200 VAC Motor Design		208 VAC Motor Design		220-240 VAC (SEE NOTE #3) Motor Design		440-480 VAC Motor Design	
			B, C, D	E	B, C, D	E	B, C, D	E	B, C, D	E	B, C, D	E
0.30A 0.50A 0.75A	0.30A 0.50A 0.75A	3.0A 5.0A 7.5A										
0.80A 1.0A 1.6A	0.80A 1.0A 1.6A	8.0A 10.0A 16.0A									1/2hp	1/2hp
2.0A 2.5A 3.0A	2.0A 2.5A 3.0A	20.0A 25.0A 30.0A			1/2hp 1/2hp	1/2hp 1/2hp	1/2hp 1/2hp	1/2hp 1/2hp	1/2hp 1/2hp 1/2hp	1/2hp 1/2hp 1/2hp	3/4hp 1hp 1 1/2hp	3/4hp 1hp 1 1/2hp
3.5A 4.0A	3.5A 4.0A	35.0A 40.0A			1/2hp 3/4hp	1/2hp 3/4hp	3/4hp 3/4hp	3/4hp 3/4hp	3/4hp 3/4hp	3/4hp 3/4hp	2hp 2hp	2hp 2hp
5.0A 6.0A 8.0A	5.0A 6.0A 8.0A	42.0A 50.4A 67.2A	1/2hp 1/2hp 3/4hp	1/2hp 1/2hp 3/4hp	1hp 1hp 2hp	1hp 1hp 2hp	1hp 1hp 2hp	1hp 1hp 2hp	1hp 1 1/2hp 2hp	1hp 1 1/2hp 2hp	3hp 3hp 5hp	3hp 3hp 5hp
10.0A 12.0A 12.5A	10.0A 12.0A 12.5A	84.0A 100.8A 105.0A	1hp 1 1/2hp 1 1/2hp	1hp 1 1/2hp 1 1/2hp	2hp 3hp 3hp	2hp 3hp 3hp	2hp 3hp 3hp	2hp 3hp 3hp	3hp 3hp 3hp	3hp 3hp 3hp	5hp 7 1/2hp 7 1/2hp	5hp 7 1/2hp 7 1/2hp
13.0A 15.0A 16.0A	13.0A 15.0A 16.0A	109.2A 126.0A 134.4A	1 1/2hp 2hp 2hp	1 1/2hp 2hp 2hp	3hp 3hp 3hp	3hp 3hp 3hp	3hp 3hp 3hp	3hp 3hp 3hp	3hp 3hp 5hp	3hp 3hp 5hp	7 1/2hp 10hp 10hp	7 1/2hp 10hp 10hp
20.0A 25.0A	20.0A 25.0A	168.0A 210.0A	3hp 3hp	3hp 3hp	5hp 5hp	5hp 5hp	5hp 7 1/2hp	5hp 7 1/2hp	5hp 7 1/2hp	5hp 7 1/2hp	10hp 15hp	10hp 15hp
30.0A	30.0A	252.0A	5hp	5hp	5hp	5hp	7 1/2hp	7 1/2hp	10hp	10hp	20hp	20hp
32.0A	32.0A	268.8A	5hp	5hp	5hp	5hp	10hp	10hp	10hp	10hp	20hp	20hp
40.0A	40.0A	226.0A	5hp	5hp	10hp	7 1/2hp	10hp	7 1/2hp	10hp	10hp	30hp	20hp
50.0A 60.0A	50.0A 60.0A	282.5A 339.0A	7 1/2hp 10hp	7 1/2hp 10hp	15hp 15hp	10hp 10hp	15hp 20hp	10hp 10hp	15hp 20hp	10hp 15hp	30hp 40hp	25hp 30hp

NOTE #1: For AC motor circuit nameplate full load current, AC general-use loads, AC resistance loads, AC incandescent lamp (tungsten) loads, AC electric discharge lamp (ballast) loads.
NOTE #2: Conversions per UL508® proposed Tables 45.2 and 45.4 and NFPA-70: National Electrical Code® 2008 Tables 430-249, 430-250 and 430-251B).

V-EA INTERNAL RESISTANCE

Rated Current (Amp)	Trip Characteristic					
	B (Ohms)	C (Ohms)	D (Ohms)	E (Ohms)	G (Ohms)	Z (Ohms)
0.3	—	16.8620	16.8620	14.52000	16.8620	31.5060
0.5	—	6.8540	6.0009	5.92000	6.8540	10.2460
0.75/0.8	—	3.0540	3.0540	2.70000	3.0540	5.3920
1.0	—	1.7000	1.7560	1.48000	1.7560	2.6910
1.6	—	0.5870	0.5870	0.57400	0.5870	0.9440
2.0	—	0.4190	0.4190	0.40500	0.4190	0.8900
2.5	—	0.2950	0.2950	0.26900	0.2950	0.4290
3.0	—	0.2020	0.2020	0.18600	0.2020	0.3460
3.5	—	0.1390	0.1390	0.13900	0.1390	0.1790
4.0	—	0.1090	0.1090	0.10600	0.1090	0.1620
5.0	—	0.0654	0.0654	0.05900	0.0654	0.1050
6.0	0.0528	0.0528	0.0491	0.04600	0.0491	0.0823
8.0	—	0.0278	0.0240	0.03040	0.0333	0.0371
10	0.0216	0.0216	0.0187	0.02020	0.0211	0.0278
12/12.5	—	—	—	0.00724	0.0084	0.0151
13	0.0113	0.0084	0.0085	0.00724	0.0084	0.0151
15/16	0.0085	0.0085	0.0076	0.00731	0.0076	0.0114
20	0.0067	0.0067	0.0064	0.00582	0.0064	0.0075
25	0.0050	0.0050	0.0041	0.00411	0.0046	0.0050
30/32	0.0032	0.0032	0.0027	0.00272	0.0030	0.0032
40	0.0025	0.0025	0.0022	0.00212	0.0022	0.0022
50	0.0019	0.0019	0.0018	0.00184	0.0019	0.00195
60/63	0.0018	0.0018	0.0017	0.00172	0.00179	—

Resistances listed are “hot” values, as opposed to cold start values. Operating voltage drop across the V-EA and power loss per pole can be approximated with basic formulas:

$V_{DROP} = I_{OPERATING} \times R_{TABLE}$

$P_{LOSS\ P/P} = I^2_{OPERATING} \times R_{TABLE}$

Voltage drops should be reviewed when V-EAs with high internal resistance are used (e.g., load voltage minimums). Power loss should be reviewed when V-EAs with high rated currents are used (e.g., enclosure heating).

The listed V-EA internal resistance values should not be used in calculations of available short-circuit current downstream of the V-EA. The dynamic impedance of the V-EA under short-circuit conditions can vary significantly from internal resistance values in normal operation.

LINE CURRENT FREQUENCY EFFECTS ON TRIP CURVES

Frequency Effects on Magnetic Trip Curves					
Trip Curve	Trip Zone At 16 2/3 - 60Hz (x RC)	Trip Zone At 100 Hz (x RC)	Trip Zone At 200 Hz (x RC)	Trip Zone At 400 Hz (x RC)	Trip Zone At DC (x RC)
Z	2 - 3	2.2 - 3.3	2.4 - 3.6	2.8 - 4.2	3.0 - 4.5
B	3 - 5	3.3 - 5.5	3.6 - 6.0	4.2 - 7.0	4.5 - 7.5
C	5 - 10	5.5 - 11.0	6.0 - 12	7.0 - 14.0	7.5 - 15.0
G	8 - 10	8.8 - 11.0	9.6 - 12.0	11.2 - 14.0	12.0 - 15.0
D	10 - 16	11.0 - 17.6	12.0 - 19.2	14.0 - 22.4	15.0 - 24.0
E	14 - 18	15.4 - 19.8	16.8 - 21.6	19.6 - 25.2	21.0 - 27.0

The thermal trip is not affected by the frequency of the line current. The magnetic trip is within the trip zone of the characteristic curve for frequencies from 16 2/3 to 60Hz. At lower and higher frequencies, the magnetic trip will be delayed longer than indicated by the characteristic curve, roughly as follows:

At 100Hz: Mag. Trip Current = 1.1 x curve current
At 200Hz: Mag. Trip Current = 1.2 x curve current
At 400Hz: Mag. Trip Current = 1.4 x curve current
At DC: Mag. Trip Current = 1.5 x curve current

For example, at 16 2/3 - 60 Hz the magnetic trip zone for the “G” characteristic is 8 to 10 times the rated current of the specific V-EA (i.e., hold for at least 100ms at 8 x RC, trip in less than 100ms at 10 x RC). With a 400Hz current, a magnetic trip at 10 x RC would be greatly delayed (thermal would likely trip first), as the magnetic trip zone is now 11.2 to 14 x RC. If a quicker magnetic trip is required with 400Hz, the “B” or “C” characteristic should be considered.

MECHANICAL ENDURANCE RATINGS (ON/OFF OPERATIONS)

Application	2 x (1.15 x RC)	2 x RC	RC	No Load	Total
AC General Use	—	6000	—	4000	10000
AC Motor Starting Across the Line	1000	—	5000	4000	10000
AC Incandescent Lamps (Tungsten)	—	—	6000	4000	10000
AC Electrical Discharge Lamps (Ballast)	—	6000	—	4000	10000
AC Resistance	—	6000	—	4000	10000

Manufacturers self certification	20000 ON/OFF operations with no load

Altech UL1077/508 Busbar System

UL508 listed
E205412

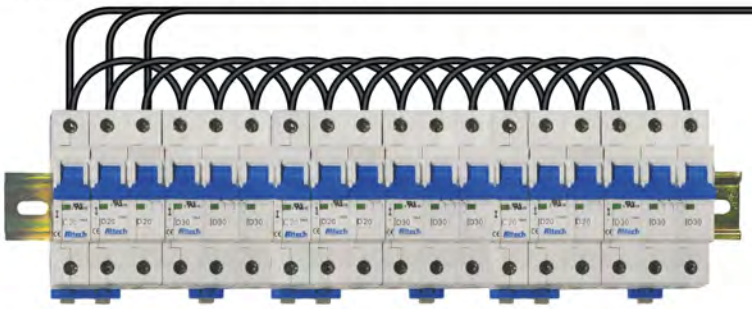
UL508 Listed Busbars

The Altech Busbar System is an innovative way to jumper up to 57 poles of Manual Motor Controllers (MMC) and Supplementary Protectors (SP).

The advantages of this busbar system are:

- 30% Installation time savings
- Panel space savings
- Reduced maintenance
- High electrical ratings

Without Altech Busbar System



With Altech Busbar System



Universal UL1077/508 Busbar fits most Supplementary Protectors and Manual Motor Controllers in the market!

Please contact Altech for details and further information.

UL1077/508 Busbar System

- 1-57 different pin configurations
- 1/2 pole spacing (auxiliary switch) available
- Power Feeding:
  Power Feed Lugs (115A), Direct Power Feed (115A), Power Feed Block (200A)
- UL recognized and listed for Altech's R-Series, V-EA Series and MA Series of Manual Motor Controllers and Supplementary Protectors
- UL recognized and listed for use with most popular UL1077 supplementary protectors and UL508 Manual Motor Controllers in the market.
- Customers can cut the Busbar without losing the UL approval
- Line/Load reversible

Technical Specifications	Busbars UL1077/ 508
Material of Busbar	Copper
Material of Insulation (Housing)	Polyamid
Electrical Ratings	18mm²: 80A/480VAC 25mm²: 100A/480VAC
Short Circuit Withstand Rating	10kA
Applying Standards	UL508, VDE0660 Part 100 and 502, VDE 0606, VDE 0659

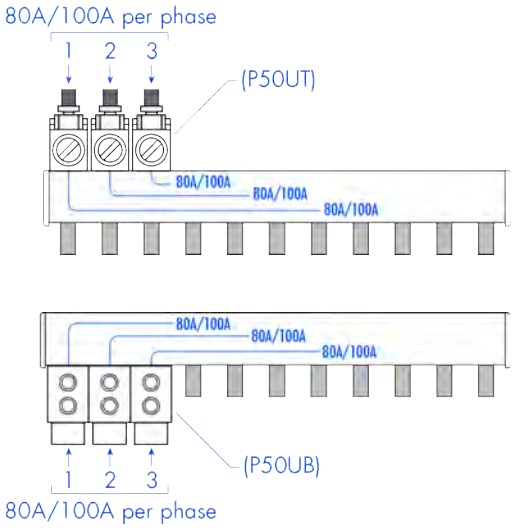
Altech UL1077/508 Busbar System

Power Feed Methods

1) Start/ End Feed Method

P50UT* / P50UB*

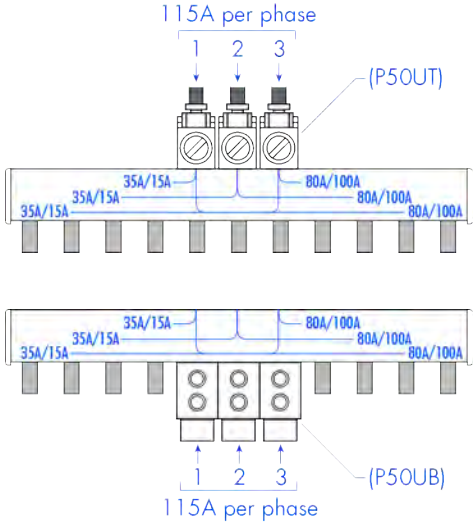
With the **P50UT** Power Feed Lug or the **P50UB** Modular Direct Power Feed as a Start/End Feeding Device a maximum input current of **80A/100A per Phase** can be achieved. 80A with 18mm² Busbar and 100A with 25mm² Busbar.



2) Center/ Middle Feed Method

P50UT* / P50UB*

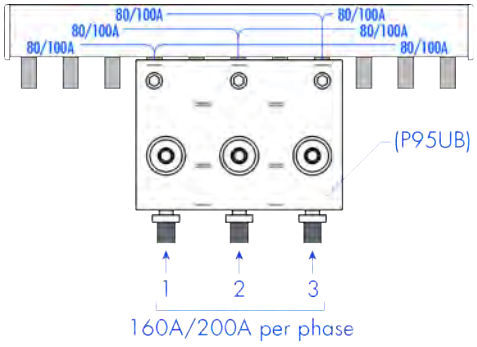
With the **P50UT** Power Feed Lug or the **P50UB** Modular Direct Power Feed as a Center/Middle Feeding Device a maximum input current of **115A per Phase** can be achieved. (18mm²: 80A + 35A; 25mm²: 100A + 15A)



P95UB*

With the **P95UB** Power Feed Block as a Center/Middle Feeding Device a maximum input current of **160A/200A per Phase** can be achieved (160A with 18mm² Busbar and 200A with 25mm² Busbar).

Note: The Power Feed Block can only be used with a standard spacing 3 Phase UL1077/508 Busbar. It also uses 5 pins because of its size. (see page 43 for more information)

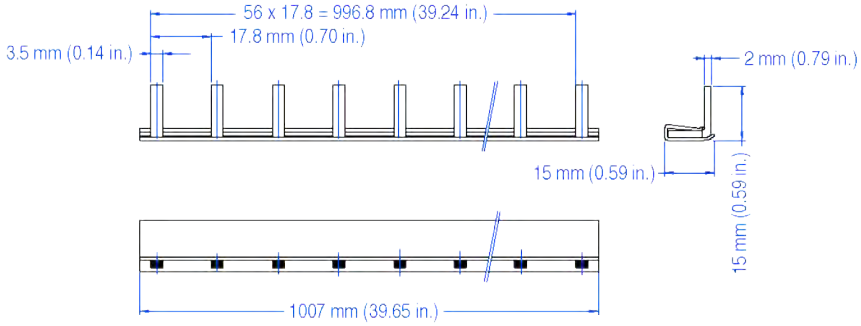


1 PHASE BUSBAR - standard spacing

18mm² for 80A

UL508 listed
E205412





18mm² for 80A			
Type/ Cat. No.	**No. of Pins**	**No. of MMC to Jumper**	**Length [mm]**
1P18U1/2	2	2x1 pole	32.5
1P18U1/3	3	3x1 pole	50.3
1P18U1/4	4	4x1 pole	68.0
1P18U1/5	5	5x1 pole	85.8
1P18U1/6	6	6x1 pole	103.5
1P18U1/7	7	7x1 pole	121.3
1P18U1/8	8	8x1 pole	139.0
1P18U1/9	9	9x1 pole	156.8
1P18U1/10	10	10x1 pole	174.5
1P18U1/11	11	11x1 pole	192.3
1P18U1/12	12	12x1 pole	210.0
1P18U1/13	13	13x1 pole	227.8
1P18U1/14	14	14x1 pole	245.5
1P18U1/15	15	15x1 pole	263.3
1P18U1/16	16	16x1 pole	281.0
1P18U1/17	17	17x1 pole	298.8
1P18U1/18	18	18x1 pole	316.5
1P18U1/19	19	19x1 pole	334.3
1P18U1/20	20	20x1 pole	352.0
1P18U1/21	21	21x1 pole	369.8
1P18U1/22	22	22x1 pole	387.5
1P18U1/23	23	23x1 pole	405.3
1P18U1/24	24	24x1 pole	423.0
1P18U1/25	25	25x1 pole	440.8
1P18U1/26	26	26x1 pole	458.5
1P18U1/27	27	27x1 pole	476.3
1P18U1/28	28	28x1 pole	494.0
1P18U1/29	29	29x1 pole	511.8

18mm² for 80A			
Type/ Cat. No.	**No. of Pins**	**No. of MMC to Jumper**	**Length [mm]**
1P18U1/30	30	30x1 pole	529.5
1P18U1/31	31	31x1 pole	547.3
1P18U1/32	32	32x1 pole	565.0
1P18U1/33	33	33x1 pole	582.8
1P18U1/34	34	34x1 pole	600.5
1P18U1/35	35	35x1 pole	618.3
1P18U1/36	36	36x1 pole	636.0
1P18U1/37	37	37x1 pole	653.8
1P18U1/38	38	38x1 pole	671.5
1P18U1/39	39	39x1 pole	689.3
1P18U1/40	40	40x1 pole	707.0
1P18U1/41	41	41x1 pole	724.8
1P18U1/42	42	42x1 pole	742.5
1P18U1/43	43	43x1 pole	760.3
1P18U1/44	44	44x1 pole	778.0
1P18U1/45	45	45x1 pole	795.8
1P18U1/46	46	46x1 pole	813.5
1P18U1/47	47	47x1 pole	831.3
1P18U1/48	48	48x1 pole	849.0
1P18U1/49	49	49x1 pole	866.8
1P18U1/50	50	50x1 pole	884.5
1P18U1/51	51	51x1 pole	902.3
1P18U1/52	52	52x1 pole	920.0
1P18U1/53	53	53x1 pole	937.8
1P18U1/54	54	54x1 pole	955.5
1P18U1/55	55	55x1 pole	973.3
1P18U1/56	56	56x1 pole	991.0
1P18U1/57	57	57x1 pole	1008.8

ACCESSORIES





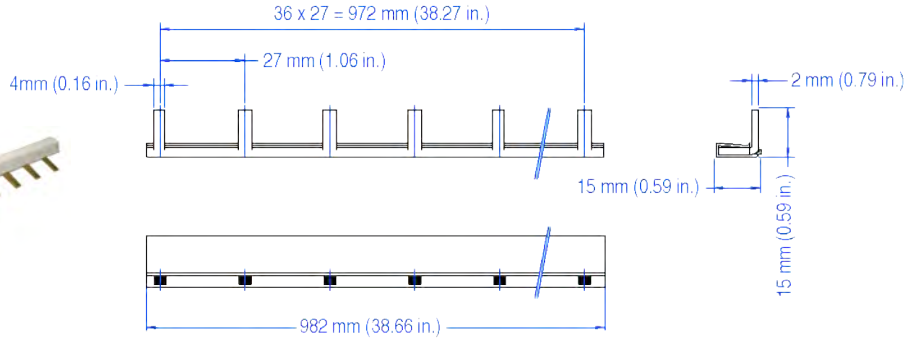


Type/Cat. No:	**P50UT**	**P50UB**	**BRS5**
Description:	Power Feed Lug	Modular Direct Power Feed	Insulation Cap

1 PHASE BUSBAR - 1/2 pole spacing

18mm² for 80A





UL508 listed
E205412

18mm² for 80A			
Type/ Cat. No.	**No. of Pins**	**No. of MMC to Jumper**	**Length [mm]**
1P18U1H/2	2	2x1 pole	39.0
1P18U1H/3	3	3x1 pole	66.0
1P18U1H/4	4	4x1 pole	93.0
1P18U1H/5	5	5x1 pole	120.0
1P18U1H/6	6	6x1 pole	147.0
1P18U1H/7	7	7x1 pole	174.0
1P18U1H/8	8	8x1 pole	201.0
1P18U1H/9	9	9x1 pole	228.0
1P18U1H/10	10	10x1 pole	255.0
1P18U1H/11	11	11x1 pole	282.0
1P18U1H/12	12	12x1 pole	309.0
1P18U1H/13	13	13x1 pole	336.0
1P18U1H/14	14	14x1 pole	363.0
1P18U1H/15	15	15x1 pole	390.0
1P18U1H/16	16	16x1 pole	417.0
1P18U1H/17	17	17x1 pole	444.0
1P18U1H/18	18	18x1 pole	471.0
1P18U1H/19	19	19x1 pole	498.0

18mm² for 80A			
Type/ Cat. No.	**No. of Pins**	**No. of MMC to Jumper**	**Length [mm]**
1P18U1H/20	20	20x1 pole	525.0
1P18U1H/21	21	21x1 pole	552.0
1P18U1H/22	22	22x1 pole	579.0
1P18U1H/23	23	23x1 pole	606.0
1P18U1H/24	24	24x1 pole	633.0
1P18U1H/25	25	25x1 pole	660.0
1P18U1H/26	26	26x1 pole	687.0
1P18U1H/27	27	27x1 pole	714.0
1P18U1H/28	28	28x1 pole	741.0
1P18U1H/29	29	29x1 pole	768.0
1P18U1H/30	30	30x1 pole	795.0
1P18U1H/31	31	31x1 pole	822.0
1P18U1H/32	32	32x1 pole	849.0
1P18U1H/33	33	33x1 pole	876.0
1P18U1H/34	34	34x1 pole	903.0
1P18U1H/35	35	35x1 pole	930.0
1P18U1H/36	36	36x1 pole	957.0

ACCESSORIES





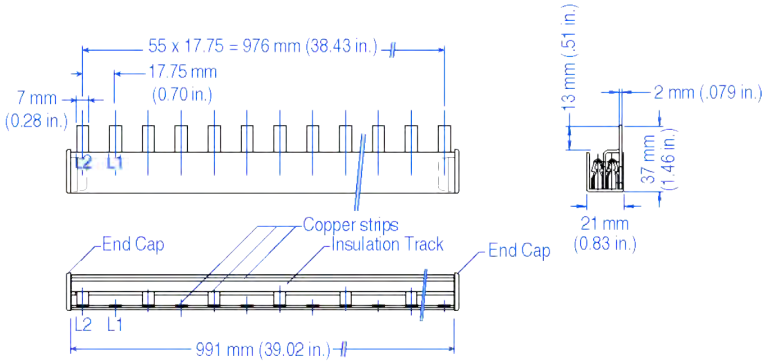


Type/Cat. No:	**P50UT**	**P50UB**	**BRS5**
Description:	Power Feed Lug	Modular Direct Power Feed	Insulation Cap

2 PHASE BUSBAR - standard spacing

18mm² for 80A / 25mm² for 100A





18mm² for 80A

Type/ Cat. No.	No. of Pins	No. of MMC to Jumper	Length [mm]
2P18U3/4	4	2x2 pole	66.3
2P18U3/6	6	3x2 pole	101.8
2P18U3/8	8	4x2 pole	137.3
2P18U3/10	10	5x2 pole	172.8
2P18U3/12	12	6x2 pole	208.3
2P18U3/14	14	7x2 pole	243.8
2P18U3/16	16	8x2 pole	279.3
2P18U3/18	18	9x2 pole	314.8
2P18U3/20	20	10x2 pole	350.3
2P18U3/22	22	11x2 pole	385.8
2P18U3/24	24	12x2 pole	421.3
2P18U3/26	26	13x2 pole	456.8
2P18U3/28	28	14x2 pole	492.3
2P18U3/30	30	15x2 pole	527.8
2P18U3/32	32	16x2 pole	563.3
2P18U3/34	34	17x2 pole	598.8
2P18U3/36	36	18x2 pole	634.3
2P18U3/38	38	19x2 pole	669.8
2P18U3/40	40	20x2 pole	705.3
2P18U3/42	42	21x2 pole	740.8
2P18U3/44	44	22x2 pole	776.3
2P18U3/46	46	23x2 pole	811.8
2P18U3/48	48	24x2 pole	847.3
2P18U3/50	50	25x2 pole	882.8
2P18U3/52	52	26x2 pole	918.3
2P18U3/54	54	27x2 pole	953.8
2P18U3/56	56	28x2 pole	989.3

25mm² for 100A

Type/ Cat. No.	No. of Pins	No. of MMC to Jumper	Length [mm]
2P25U3/4	4	2x2 pole	66.3
2P25U3/6	6	3x2 pole	101.8
2P25U3/8	8	4x2 pole	137.3
2P25U3/10	10	5x2 pole	172.8
2P25U3/12	12	6x2 pole	208.3
2P25U3/14	14	7x2 pole	243.8
2P25U3/16	16	8x2 pole	279.3
2P25U3/18	18	9x2 pole	314.8
2P25U3/20	20	10x2 pole	350.3
2P25U3/22	22	11x2 pole	385.8
2P25U3/24	24	12x2 pole	421.3
2P25U3/26	26	13x2 pole	456.8
2P25U3/28	28	14x2 pole	492.3
2P25U3/30	30	15x2 pole	527.8
2P25U3/32	32	16x2 pole	563.3
2P25U3/34	34	17x2 pole	598.8
2P25U3/36	36	18x2 pole	634.3
2P25U3/38	38	19x2 pole	669.8
2P25U3/40	40	20x2 pole	705.3
2P25U3/42	42	21x2 pole	740.8
2P25U3/44	44	22x2 pole	776.3
2P25U3/46	46	23x2 pole	811.8
2P25U3/48	48	24x2 pole	847.3
2P25U3/50	50	25x2 pole	882.8
2P25U3/52	52	26x2 pole	918.3
2P25U3/54	54	27x2 pole	953.8
2P25U3/56	56	28x2 pole	989.3

ACCESSORIES

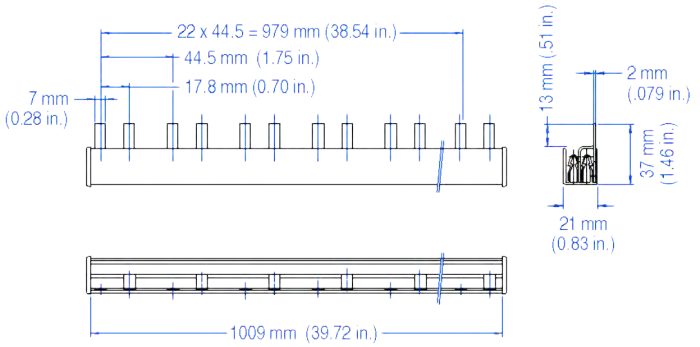


Type/Cat. No:	P50UT	P50UB	BRS5	18/25CAP3P
Description:	Power Feed Lug	Modular Direct Power Feed	Insulation Cap	End Cap

2 PHASE BUSBAR - 1/2 pole spacing

18mm² for 80A / 25mm² for 100A





18mm² for 80A

Type/ Cat. No.	No. of Pins	No. of MMC to Jumper	Length [mm]
2P18U3H/4	4	2x2 pole	75.3
2P18U3H/6	6	3x2 pole	119.8
2P18U3H/8	8	4x2 pole	164.3
2P18U3H/10	10	5x2 poles	208.8
2P18U3H/12	12	6x2 pole	253.3
2P18U3H/14	14	7x2 pole	297.8
2P18U3H/16	16	8x2 pole	342.3
2P18U3H/18	18	9x2 pole	386.8
2P18U3H/20	20	10x2 pole	431.3
2P18U3H/22	22	11x2 pole	475.8
2P18U3H/24	24	12x2 pole	520.3
2P18U3H/26	26	13x2 pole	564.8
2P18U3H/28	28	14x2 pole	609.3
2P18U3H/30	30	15x2 pole	653.8
2P18U3H/32	32	16x2 pole	698.3
2P18U3H/34	34	17x2 pole	742.8
2P18U3H/36	36	18x2 pole	787.3
2P18U3H/38	38	19x2 pole	831.8
2P18U3H/40	40	20x2 pole	876.3
2P18U3H/42	42	21x2 pole	920.8
2P18U3H/44	44	22x2 pole	965.3
2P18U3H/46	46	23x2 pole	1009.8
2P18U3H/48	48	24x2 pole	1054.3
2P18U3H/50	50	25x2 pole	1098.8
2P18U3H/52	52	26x2 pole	1143.3
2P18U3H/54	54	27x2 pole	1187.8
2P18U3H/56	56	28x1 pole	1232.3

25mm² for 100A

Type/ Cat. No.	No. of Pins	No. of MMC to Jumper	Length [mm]
2P25U3H/4	4	2x2 pole	75.3
2P25U3H/6	6	3x2 pole	119.8
2P25U3H/8	8	4x2 pole	164.3
2P25U3H/10	10	5x2 pole	208.8
2P25U3H/12	12	6x2 pole	253.3
2P25U3H/14	14	7x2 pole	297.8
2P25U3H/16	16	8x2 pole	342.3
2P25U3H/18	18	9x2 pole	386.8
2P25U3H/20	20	10x2 pole	431.3
2P25U3H/22	22	11x2 pole	475.8
2P25U3H/24	24	12x2 pole	520.3
2P25U3H/26	26	13x2 pole	564.8
2P25U3H/28	28	14x2 pole	609.3
2P25U3H/30	30	15x2 pole	653.8
2P25U3H/32	32	16x2 pole	698.3
2P25U3H/34	34	17x2 pole	742.8
2P25U3H/36	36	18x2 pole	787.3
2P25U3H/38	38	19x2 pole	831.8
2P25U3H/40	40	20x2 pole	876.3
2P25U3H/42	42	21x2 pole	920.8
2P25U3H/44	44	22x2 pole	965.3
2P25U3H/46	46	23x2 pole	1009.8
2P25U3H/48	48	24x2 pole	1054.3
2P25U3H/50	50	25x2 pole	1098.8
2P25U3H/52	52	26x2 pole	1143.3
2P25U3H/54	54	27x2 pole	1187.8
2P25U3H/56	56	28x2 pole	1232.3

ACCESSORIES



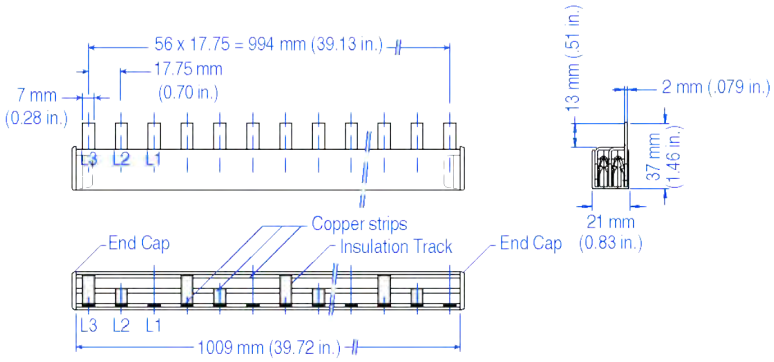
Type/Cat. No:	P50UT	P50UB	BRS5	18/25CAP3P
Description:	Power Feed Lug	Modular Direct Power Feed	Insulation Cap	End Cap

3 PHASE BUSBAR - standard spacing

18mm² for 80A / 25mm² for 100A

UL508 listed
E205412





18mm² for 80A

Type/ Cat. No.	No. of Pins	No. of MMC to Jumper	Length [mm]
3P18U3/6	6	2x3 pole	101.8
3P18U3/9	9	3x3 pole	155.0
3P18U3/12	12	4x3 pole	208.3
3P18U3/15	15	5x3 pole	261.5
3P18U3/18	18	6x3 pole	314.8
3P18U3/21	21	7x3 pole	368.0
3P18U3/24	24	8x3 pole	421.3
3P18U3/27	27	9x3 pole	474.5
3P18U3/30	30	10x3 pole	527.8
3P18U3/33	33	11x3 pole	581.0
3P18U3/36	36	12x3 pole	634.3
3P18U3/39	39	13x3 pole	687.5
3P18U3/42	42	14x3 pole	740.8
3P18U3/45	45	15x3 pole	794.0
3P18U3/48	48	16x3 pole	847.3
3P18U3/51	51	17x3 pole	900.5
3P18U3/54	54	18x3 pole	953.8
3P18U3/57	57	19x3 pole	1007.0

25mm² for 100A

Type/ Cat. No.	No. of Pins	No. of MMC to Jumper	Length [mm]
3P25U3/6	6	2x3 pole	101.8
3P25U3/9	9	3x3 pole	155.0
3P25U3/12	12	4x3 pole	208.3
3P25U3/15	15	5x3 pole	261.5
3P25U3/18	18	6x3 pole	314.8
3P25U3/21	21	7x3 pole	368.0
3P25U3/24	24	8x3 pole	421.3
3P25U3/27	27	9x3 pole	474.5
3P25U3/30	30	10x3 pole	527.8
3P25U3/33	33	11x3 pole	581.0
3P25U3/36	36	12x3 pole	634.3
3P25U3/39	39	13x3 pole	687.5
3P25U3/42	42	14x3 pole	740.8
3P25U3/45	45	15x3 pole	794.0
3P25U3/48	48	16x3 pole	847.3
3P25U3/51	51	17x3 pole	900.5
3P25U3/54	54	18x3 pole	953.8
3P25U3/57	57	19x3 pole	1007.0

ACCESSORIES







Type/Cat. No:	P50UT	P50UB	P95UB
Description:	Power Feed Lug	Modular Direct Power Feed	Power Feed Block





Type/Cat. No:	BRS5	18/25CAP3P
Description:	Insulation Cap	End Cap

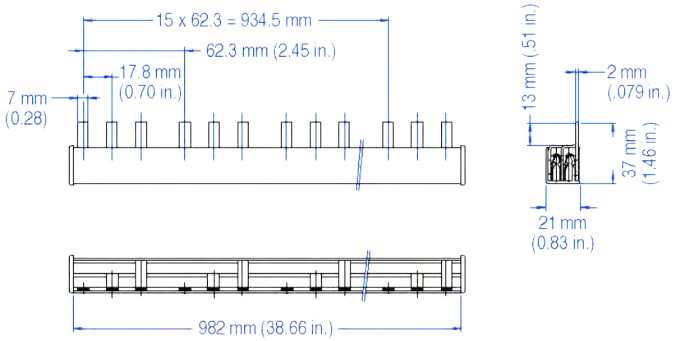
3 PHASE BUSBAR - 1/2 pole spacing

18mm² for 80A / 25mm² for 100A

Altech Corp.®

UL508 listed
E205412





18mm² for 80A

Type/ Cat. No.	No. of Pins	No. of MMC to Jumper	Length [mm]
3P18U3H/6	6	2x3 pole	110.8
3P18U3H/9	9	3x3 pole	173.1
3P18U3H/12	12	4x3 pole	235.4
3P18U3H/15	15	5x3 pole	297.7
3P18U3H/18	18	6x3 pole	360.0
3P18U3H/21	21	7x3 pole	422.3
3P18U3H/24	24	8x3 pole	484.6
3P18U3H/27	27	9x3 pole	546.9
3P18U3H/30	30	10x3 pole	609.2
3P18U3H/33	33	11x3 pole	671.5
3P18U3H/36	36	12x3 pole	733.8
3P18U3H/39	39	13x3 pole	796.1
3P18U3H/42	42	14x3 pole	858.4
3P18U3H/45	45	15x3 pole	920.7
3P18U3H/48	48	16x3 pole	983.0
3P18U3H/51	51	17x3 pole	1045.3
3P18U3H/54	54	18x3 pole	1107.6
3P18U3H/57	57	19x3 pole	1169.9

25mm² for 100A

Type/ Cat. No.	No. of Pins	No. of MMC to Jumper	Length [mm]
3P25U3H/6	6	2x3 pole	110.8
3P25U3H/9	9	3x3 pole	173.1
3P25U3H/12	12	4x3 pole	235.4
3P25U3H/15	15	5x3 pole	297.7
3P25U3H/18	18	6x3 pole	360.0
3P25U3H/21	21	7x3 pole	422.3
3P25U3H/24	24	8x3 pole	484.6
3P25U3H/27	27	9x3 pole	546.9
3P25U3H/30	30	10x3 pole	609.2
3P25U3H/33	33	11x3 pole	671.5
3P25U3H/36	36	12x3 pole	733.8
3P25U3H/39	39	13x3 pole	796.1
3P25U3H/42	42	14x3 pole	858.4
3P25U3H/45	45	15x3 pole	920.7
3P25U3H/48	48	16x3 pole	983.0
3P25U3H/51	51	17x3 pole	1045.3
3P25U3H/54	54	18x3 pole	1107.6
3P25U3H/57	57	19x3 pole	1169.9

ACCESSORIES





Type/Cat. No:	P50UT	P50UB
Description:	Power Feed Lug	Modular Direct Power Feed





Type/Cat. No:	BRS5	18/25CAP3P
Description:	Insulation Cap	End Cap

Power Feed Devices

Easy connection of power supply wires to the busbar/MCB. Power Feed Devices ensure permanent connection.

Power Feed Lug

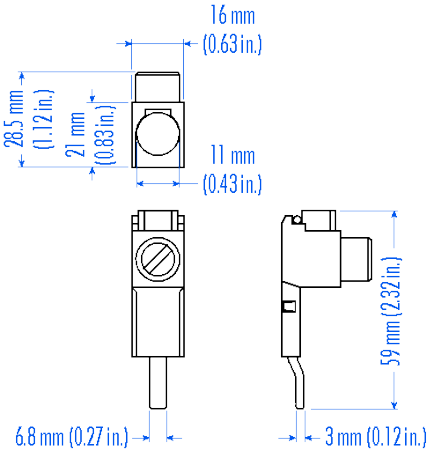


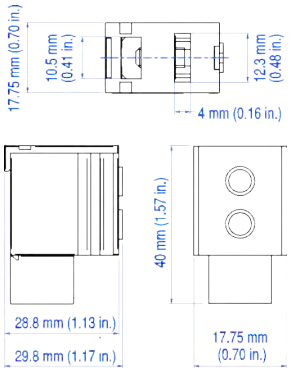
Modular Direct Power Feed



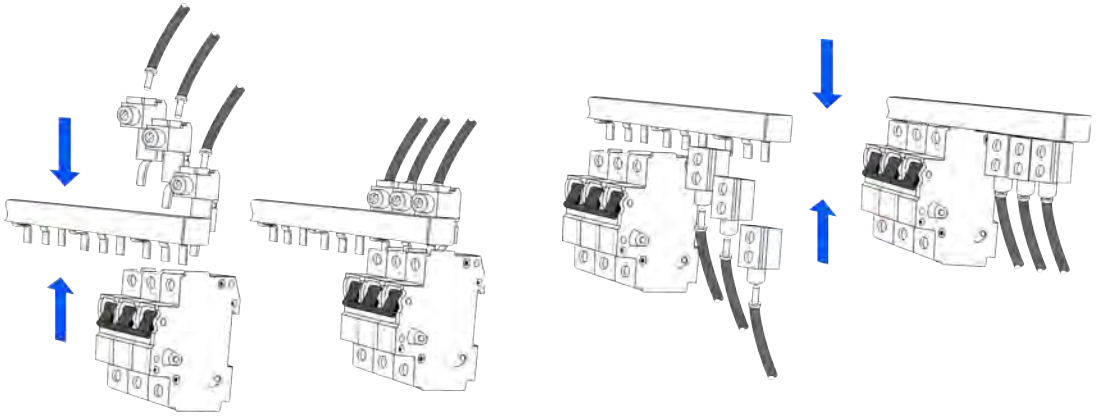
Type/Cat. No.	P50UT	P50UB
Electrical Ratings	115A/480VAC	115A/480VAC
Terminal Site Acceptability	10-1/0 AWG (1.5-50mm²)	14-1 AWG (1.5-50mm²)
Recommended/ Required Torque	5.6Nm (50lb. in.)	4Nm (35.4 lb. in.)
Material of Lug/ Terminal	Brass	Brass
Insulation Material	Polyamid	Polyamid
For use with	UL1077/508 18 and 25mm² 1-3 phase busbars	UL1077/508 18 and 25mm² 1-3 phase busbars

Dimensions





Assembly Instructions



The power feed lugs (Cat. # P50UT) fit together with the lugs of the busbar in the terminals of the MCB/MA.

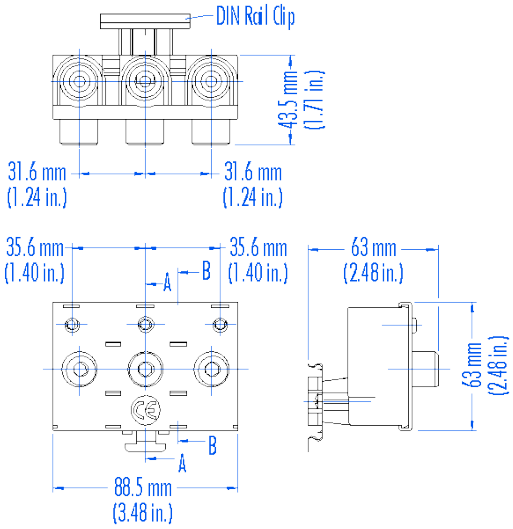
Power Feed Block



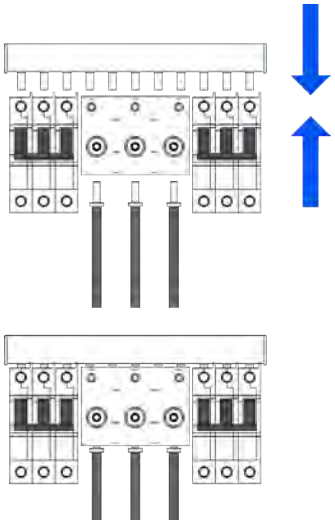
UL508 listed
E205412

Type/Cat. No.	P95UB
Electrical Ratings	200A/ 480VAC
Terminal Site Acceptability	1-4/0 AWG (50-120mm²)
Recommended/ Required Torque	19.5Nm (175lb. in.)
Material of Lug/ Terminal	Brass
Insulation Material	Polyamid
For use with	UL1077/508 18 and 25mm² 3 phase busbars (standard spacing only)

Dimensions



Assembly Instructions



Miscellaneous Accessories

End Caps



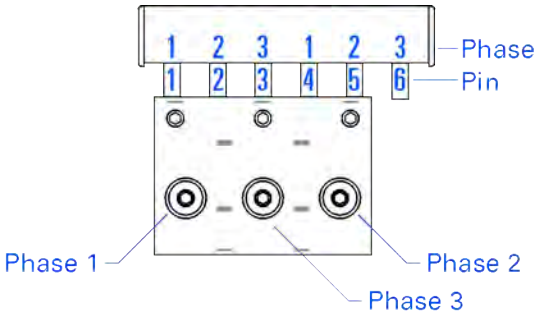
Type/Cat. No:	18/25CAP3P
For use with:	18/25mm² 2&3 phase Busbar

Insulation Caps



Type/Cat. No:	BRS5 *(5 per strip)*
For use with:	18/25mm² 1-3 phase Busbar

NOTE: The Power Feed Block uses the space of 5 Pins of the standard spacing Busbar (see drawing below). Phase 1 connects to Pin 1, Phase 2 to Pin 3 and Phase 3 to Pin 5. Pin 2 and 4 are not in use. Pin 6 should be covered with an insulation cap if phase sequence stays the same. Therefore, the Power Feed Block covers 6 pins to connect to the three phases.



MA- Series

Three Phase Adjustable Trip Miniature Circuit Breakers/ Manual Motor Controllers



UL508 listed
E137938

CAN/CSA-C22.2 No.14 certified

The MA was designed to handle the high inrush loads of 3 phase transformers, power supplies, motors, etc. The MA protects wiring and equipment from damage caused by the three major classes of over-current, yet greatly reduces the number of nuisance trips in high starting and inrush current circuits.

An IEC device with excellent ratings under a UL listing at 480Y/277V (including group ratings) and at 500V under international standards, the Altech/ABL Sursum MA provides short and long term cost effective circuit protection for USA and/or export applications. The short term advantages include: (1) adjustable thermal trip allows finalization of initial designs before procurement of the load equipment is complete; (2) snap-on mounting for readily available, internationally standardized DIN Rail saves panel layout design time as well as installation and change labor; (3) large cage-clamp terminals with screws suitable to power screwdrivers, simplifies and speeds wiring; (4) convenient switched disconnect during factory testing and/or initial start-up saves time and aggravation. The key long term advantage is customer satisfaction and proven over-current protection of wiring and equipment (and the lack of rework/repair costs).

Type Designation

MA	16	U	M
(a)	**(b)**	**(c)**	**(d)**

(a) = MA - Manual Motor Controller
(b) = Rated Current
(c) = U - US Housing
= R - US Housing + Ring Tongue
(d) = M - Part No. Designation

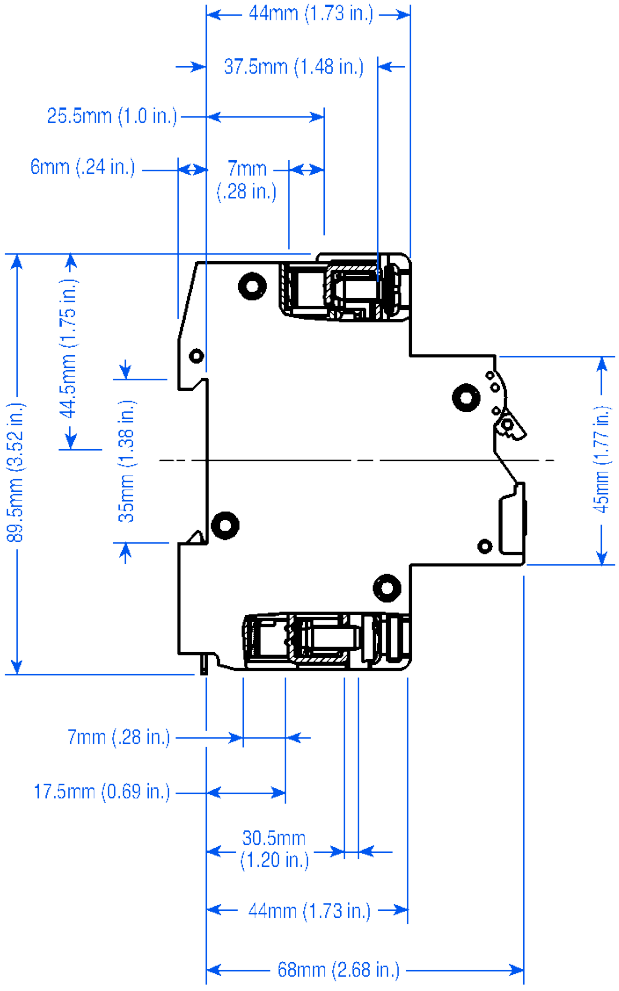
Voltage Rating	480Y/277VAC
AIC (Interrupt Capacity)	0.16A-2.5A: 42kA; 4.0A-16A: 14kA; 20A-40A: 10kA
Standard Short Circuit Withstand Rating (UL/CSA Ratings)	0.16A-2.5A: 42kA; 4.0A-16A: 14kA
Group Short Circuit Ratings (UL/CSA Ratings)	see above
Typical Life	6000 on/off operations with 2xRC
Calibration Temperature	25°C, +0°, -5° (77°F, +0° -9°)
Standard Pack and Weight	1/450g (1.0 lb.)
Terminal Size Acceptability	Top/Bottom: 18-3 AWG

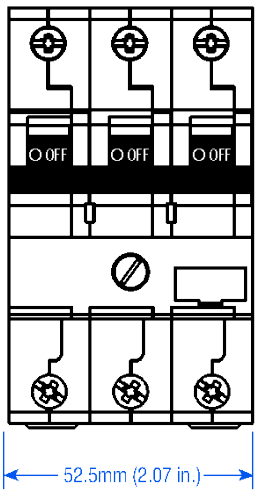
Cat. No.	Rated Current	FLA Dial Adjustment Markings	GROUP SHORT CIRCUIT RATING AT 480VAC[a] (and BCP size)	3Ø HORSEPOWER RATINGS AT NOMINAL LINE VOLTAGE (See Note for HEA Definition)				
				110-120V HP (HEA)	200V HP (HEA)	208V HP (HEA)	220-240V HP (HEA)	460-480V HP (HEA)
MA016UM	0.16A	0.1/ 0.12/0.14/0.16	42kA$_{RMS}$ symmetrical (max. 1200A MCCB or RK5)	Through MA2.5U, ampere rated for motor circuits having a full-load-amperage (FLA) not exceeding the MA's general purpose rated current (RC, equals maximum dial setting) and a locked rotor current not exceeding 6 times the MA's RC.				
MA025UM	0.25A	0.16/0.19/0.22/0.25						
MA040UM	0.40A	0.25/0.30/0.35/0.40						
MA063UM	0.63A	0.40/0.48/0.56/0.63						
MA1.0UM	1.0A	0.63/0.75/0.87/1.0						
MA1.6UM	1.6A	1.0/1.2/1.4/1.6						
MA2.5UM	2.5A	1.6/1.9/2.2/2.5						
MA4.0UM	4.0A	2.5/3.0/3.5/4.0	14kA$_{RMS}$ symmetrical (max. 350A MCCB or RK5)	1/2 (4.0)	3/4 (3.2)	3/4 (3.1)	1 (3.6)	2 (3.42)
MA6.3UM	6.3A	4.0/4.8/5.6/6.3		3/4 (5.6)	1 1/2 (6.0)	1 1/2 (5.7)	1 1/2 (5.2)	3 (4.8)
MA10UM	10A	6.3/7.5/8.7/10		1 (7.2)	2 (7.8)	2 (7.5)	3 (9.6)	5 (7.6)
MA16UM	16A	10/12/14/16		2 (13.6)	3 (11.0)	3 (10.6)	5 (15.2)	10 (14.0)
MA20UM	20A	16/17/18.5/20	10kA$_{RMS}$ symmetrical (max. 350A MCCB or RK5)	3 (19.2)	5 (17.5)	5 (16.7)	5 (15.2)	10 (14.0)
MA25UM	25A	20/21.5/23/25		3 (19.2)	5 (17.5)	7 1/2 (24.2)	7 1/2 (22.0)	15 (21.0)
MA32UM	32A	25/27/30/32		5 (30.4)	7 1/2 (25.0)	7 1/2 (24.2)	10 (28.0)	20 (27.0)
MA40UM	40A	32/34/37/40		5 (30.4)	10 (32.0)	10 (31.0)	10 (28.0)	25 (34.0)

Note: **HEA - Horsepower Equivalent Amperes**, the nominal amperage assigned to standard motor horsepower ratings in design guide tables such as NFPA-70 Tables 430-248, 430-249, 430-250; UL1077 Table 16.2; CSA - C22.2 No. 235-M89 Tables 44 and 45; CSA-C22.2 No. 14-M91 Table 19, etc. Multiply HEA values (in parenthesis) by 1.1 if power factor is 90%, and by 1.2 if power factor is 80%.

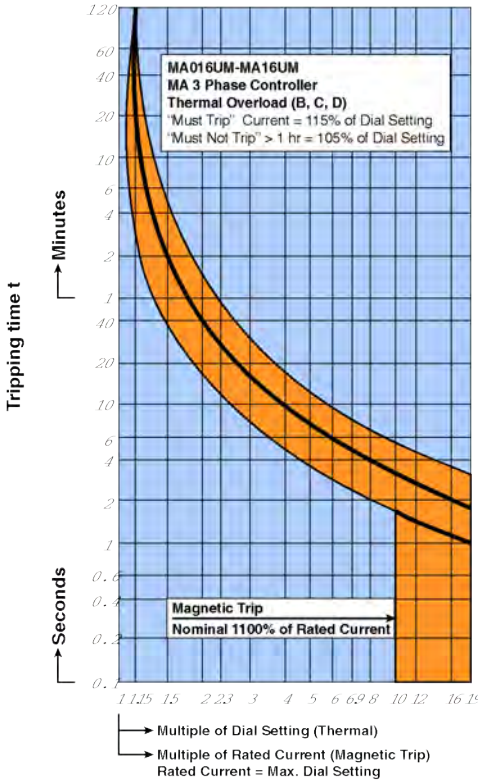
[a] The standard-circuit short-circuit rating is 14kA for all types. Group ratings can be used in a standard circuit (e.g., MA1.0U at 42kA), but a higher standard rating cannot be used in a group circuit (e.g., MA40U at 14kA only in standard circuit.)

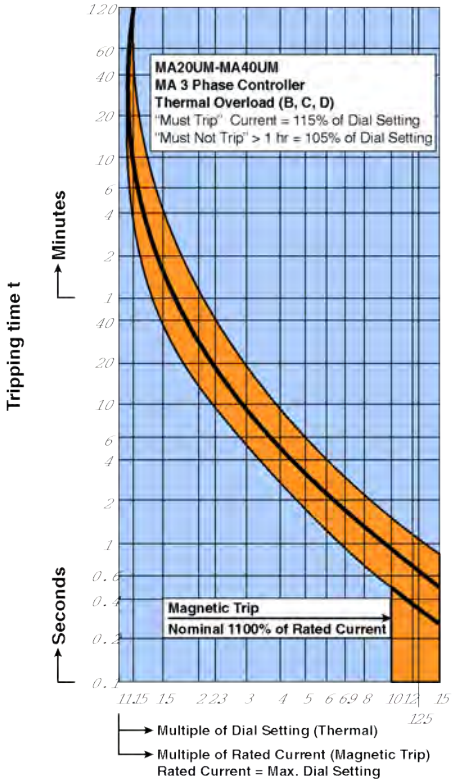
DIMENSIONS





MA/USA Manual Motor Controller





V-EA and MA Manual Motor Controllers Accessories

UL508 Listed
E137938

Accessories can be factory or field mounted on V-EA and MA manual motor controllers for enhanced control and monitoring capabilities. Field mounting kits include all necessary parts and instructions. Accessories can be gang mounted on a single controller (the Auxiliary Switch in the outside position). The mounting arrangement links the internal latch-pins for the tripping mechanisms, ensuring simultaneous trips. Handles are linked to simplify manual resetting.

* Reset-Hold Voltage = 0.85 x V_E; Drop-Out Voltage = 0.2 x V_E

FA - Shunt Trip



Type/ Cat. No.	Trip/Coil Voltage AC or DC	Max. Coil Current	Approvals
FA12UM	12V	1.3A	
FA24UM	24V	0.6A	
FA48UM	48-72V	0.2A	
FA110UM	110V/220V	0.25A/0.5A	

Standard Pack: 5
Weight: 525 grams (1.16 lb.)
Width: 17.5mm (.689in.)

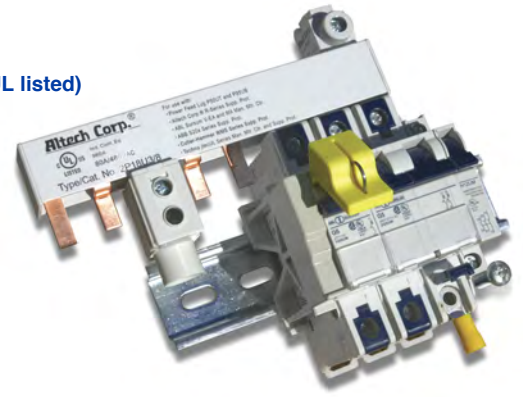
UA - Undervoltage Trip (not UL listed)



Type/ Cat. No.	Line Voltage 60Hz*
UA120UM	120VAC
UA220UM	220VAC

Reset-Hold Voltage = 0.85 x V_E
Drop-Out Voltage = 0.35 - 0.7 x V_E

Standard Pack: 5
Weight: 750 grams (1.65 lb.)
Width: 17.5mm (.689in.)



For further Busbar information please see our comprehensive Altech Universal Power Distribution catalog.

H - Auxiliary Switch



Type/ Cat. No.	No. of Contacts	Contact Type	Contact Rating	Wire Size	For Use with:	Approvals
H10UM	1	1NO	10A / 220V AC 3A / 110V DC or pulsed 1A / 220V DC or pulsed	$4mm^2$ (12 AWG)	V-EA, MA	
H11UM	2	1NO + 1NC				
H12UM	3	1NO + 2NC				
H21UM	3	2NO + 1NC				

Standard Pack: 10
Weight: 450 grams (0.99 lb.)
Width: 9mm (.354in.)

Add-on Neutral Pole



Type/ Cat. No.	Rating	Approvals
N63UM	0.3-63A/ 480Y/277V	

Standard Pack: 5
Weight: 0.775kg (1.71lb.)
Width: 17.5mm (.689in.)

* Please consult Altech for other voltages and your 50Hz application needs.



Lock-out * Cat. No. EASS

Prevent inadvertent resetting of the V-EA or MA during maintenance. Fits 1/4" pad lock.

Touch Protector Cat. No. BS.UL



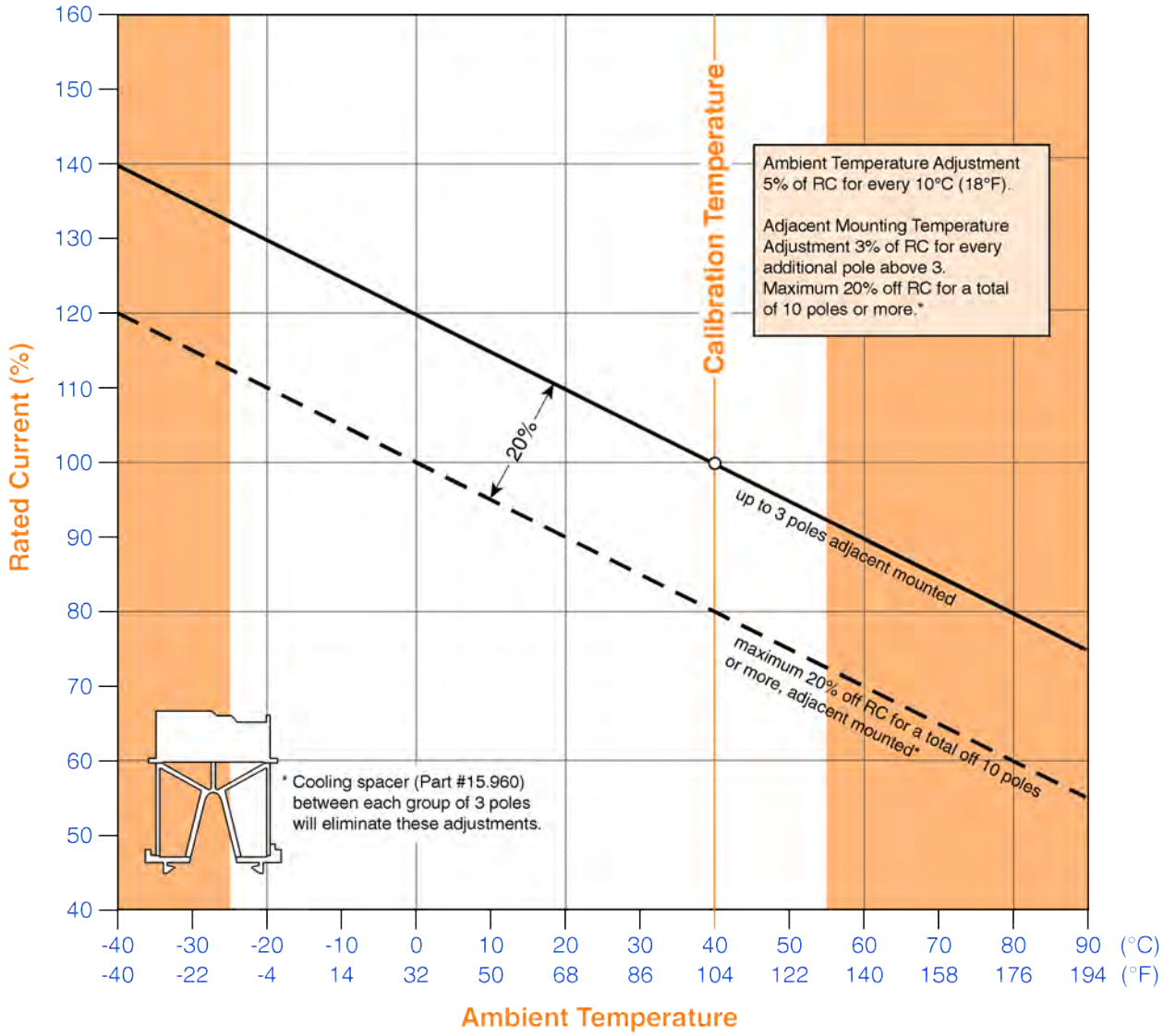


Cooling Spacer Cat. No. 15.960

TEMPERATURE CORRECTION CURVE

Ambient Temperature and Adjacent Mounting/Loading Adjustment

(V-EA/MA Ambient Temperature - 25°C to 55°C, Storage Temperature -40°C to 70°C)



* V-EA and MA can also be locked in the on and off position by simply using a common lead or meter seal, which gets fed through the hole in the handle and a corresponding hole in the housing.

MS-Series
Three Phase Adjustable Trip Economy Manual Motor Controllers
with overload and short circuit protection, phase failure sensitivity according to IEC 947-4-1, DIN VDE 0660 Part 102

With its high breaking capacity and current limitation the MS Manual Motor Controllers provide optimum protection for electrical motors as well as for other consumer units up to 25 amps. They are equipped with phase failure sensitivity, isolating and main switch functions. 13 ranges cover nominal rated currents from 0.1 up to 25 amps. The MS's are temperature compensated; the trip current of the magnetic part is 12 x I_n. The Manual Motor Controllers are built in accordance with IEC 947.



E137938

Type Designation

MS 016
(a) (b)

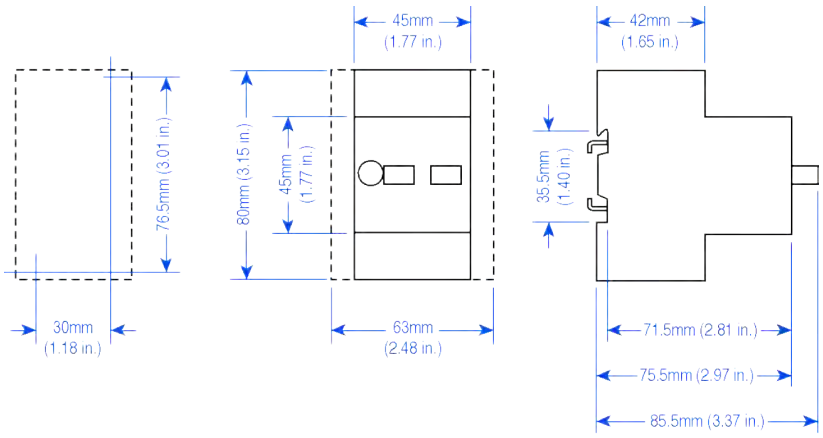
(a) = MS - Manual Motor Controller

(b) = Rated Current

Type/ Cat. No.	Rated Current	Overload release adjustment/FLA (A)	Instantaneous setting (A)	3Ø Horsepower Rating 115V	200V	230V	480V	600V
MS016	0.16	0.1 - 0.16	1.92	Ampere rated for motor circuits having a full-load-amperage (FLA) not exceeding the MS's general purpose rated current and a locked rotor current not exceeding 6 times the MS's rated current.				
MS025	0.25	0.16 - 0.25	3					
MS04	0.4	0.25 - 0.4	4.8					
MS063	0.63	0.4 - 0.63	7.6					
MS1	1.0	0.63 - 1	12				1/2hp	1/2hp
MS1.6	1.6	1 - 16	19.2				3/4hp	1hp
MS2.5	2.5	1.6 - 2.5	30		1/2hp	1/2hp	1hp	1 1/2hp
MS4	4.0	2.5 - 4	48	1/2hp	3/4hp	1hp	2hp	3hp
MS6.3	6.3	4 - 6.3	75.6	3/4hp	1 1/2hp	1 1/2hp	3hp	5hp
MS10	10.0	6.3 - 10	120	1hp	2hp	3hp	5hp	7 1/2hp
MS16	16.0	10 - 16	192	2hp	3hp	5hp	10hp	10hp
MS20	20.0	16 - 20	240	3hp	5hp	7 1/2hp	15hp	–
MS25	25.0	20 - 25	300	3hp	5hp	7 1/2hp	15hp	–

Maximum Voltage	600V AC (MS20 and MS25, 480V AC)
Short Circuit Withstanding Rating (UL/CSA Rating)	5kA
Group Short Circuit Withstanding Rating (UL/CSA Rating)	5kA
Interrupting Capacity (VDE - Ratings)	0.16-6.3A: Self protected 10-25A: 6kA
Mechanical Endurance	10000 on/off operations
Standard Pack and Weight	1/250g (0.55lb)
Terminal Size Acceptability	14-10 AWG
Terminal Torque	1.8Nm (16lb. in.)

Dimensions



Accessories

MS Three Phase Adjustable Trip Economy Manual Motor Controllers



Auxiliary contact blocks for side mounting (3.5A/230VAC; 2A/400V AC)

Width mm	Contacts	Type/ Cat. No.	Weight g/pc.	Std. Pk.
9	2NO	**HMS20**	40	10
9	1NO + 1NC	**HMS11**	40	10
9	1NO	**HMS10**	35	10
9	2NC	**HMS02**	40	10
9	1NC	**HMS01**	35	10



Insulated Enclosure IP55

with integrated PE(N) terminal;
top and bottom each have 2 metric knock-outs

Type/ Cat. No.	Weight g/pc.	Std. Pk.
MS.G55	240	1





Emergency-Stop

twist or key to release,
red on yellow background

Release Type	Type/ Cat. No.	Weight g/pc.	Std. Pk.
Twist	**MS.PV**	60	5
Key	**MS.PS2**	65	5



Flush Mounting Enclosure IP55

with integrated PE(N) terminal

Type/ Cat. No.	Weight g/pc.	Std. Pk.
MS.F55	170	1



Indicator Light

with neon bulb, nominal rated voltage:
220 - 240V or 380 - 440V

Color	Type/ Cat. No. 220-240V	380-440V	Weight g/pc.	Std. Pk.
trans	**MS.SLW2**	**MS.SLW3**	10	5
green	**MS.SLG2**	**MS.SLG3**	10	5
red	**MS.SLR2**	**MS.SLR3**	10	5
yellow	**MS.SLJ2**	**MS.SLJ3**	10	5

Busbar



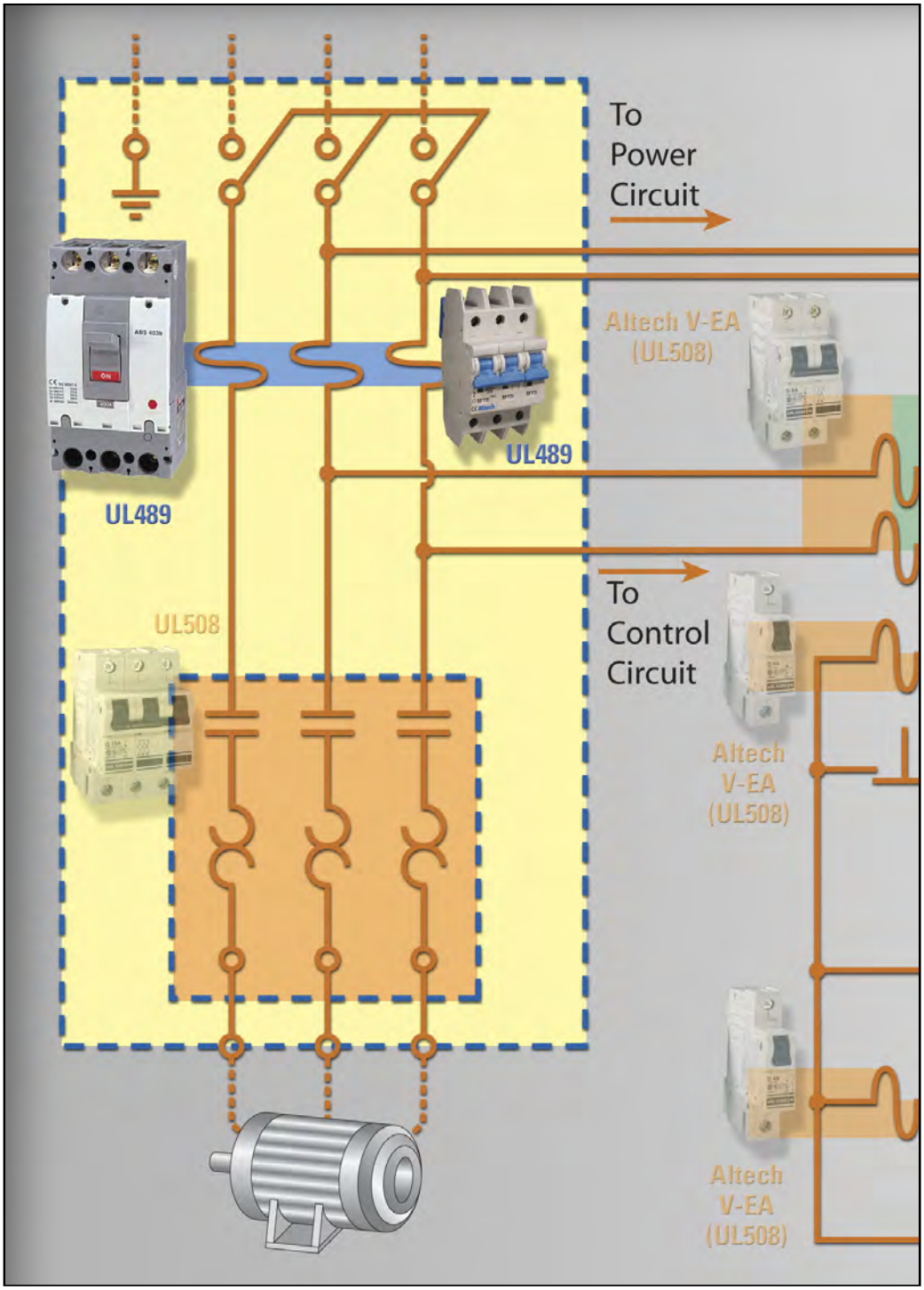
Busbar 63A	Type/Cat. No. for 2 MS	for 3 MS	for 4 MS	for 5 MS
no spacing	**G45-14-2**	**G45-14-3**	**G45-14-4**	**G45-14-5**
with auxiliary switch (1/2 pole) spacing	**G54-14-2**	**G54-14-3**	**G54-14-4**	**G54-14-5**



Power Feed Block

Type/ Cat. No.	Rating (A)	Std. Pk.
GE2-14	63A	1

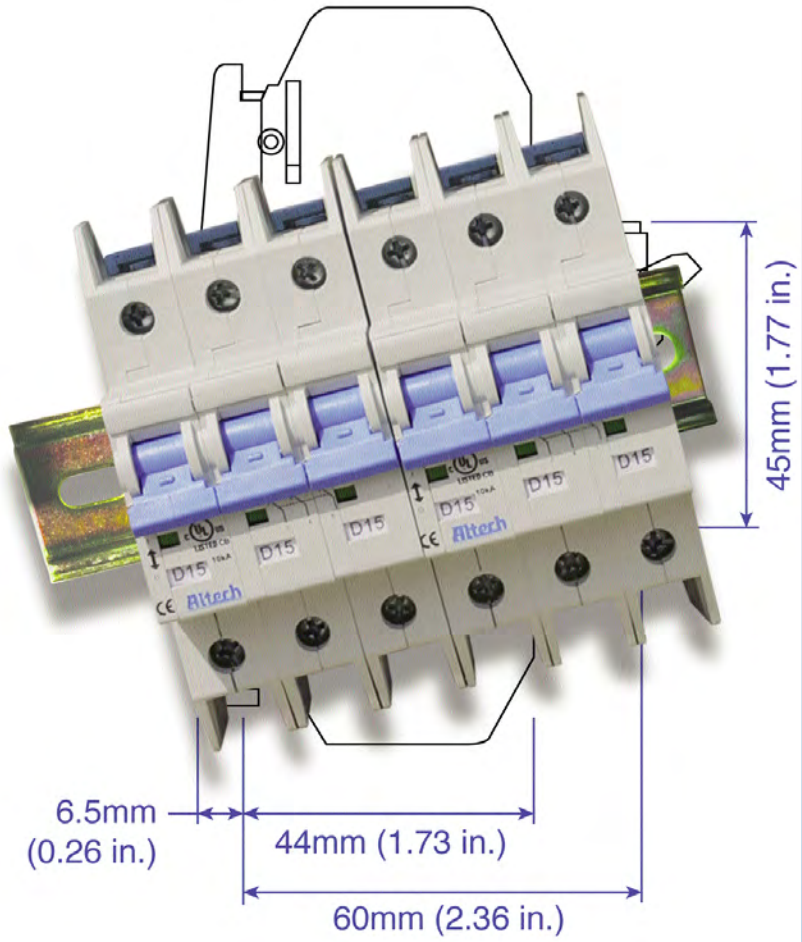
Typical UL489 Application
Power Circuit of a UL508A Panel



Disclaimer: This is an application example. Installation should be done by a qualified electrician under the guidance of UL specifications..

L-Series
AC or DC
Miniature Molded Case Circuit Breakers

LISTED
E305318



UL489 Listed Circuit Breakers

- Available in AC and DC models
- DIN Rail Mounted
- 17.5mm width
- Thermal Magnetic
- 240V, 480Y/277V AC, 50/60Hz
- 125VDC (1 pole); 250VDC (2pole)
- 10kA Short Circuit Interrupting Capacity
- Positive Trip indicator (Green - off/tripped, Red - on)
- HACR Type 40°C
- Line/Load reversible

AC Version Current/ Voltage Rating	**0.2-63A/240VAC, 0.2-32A/480Y/277VAC***
DC Version Current/ Voltage Rating	**0.2-63A/125/250VDC**
Calibration Temperature	40°C (104°F)
Operating Temperature	-25° to 60°C (-13° to 140°F)
Storage Temperature	-25° to 75°C (-13° to 167°F)
Terminal Size Acceptability:	
Solid Wire	18 AWG -10 AWG
Stranded Wire	18 AWG -6 AWG
Terminal Torque	2.8 Nm (25 lb-in.)
Terminal Protection Degree	IP20
Electrical Life	6000 cycles on/off
Mechanical Life	100000 cycles on/off
Wire Connection	copper wire only 60/75°C

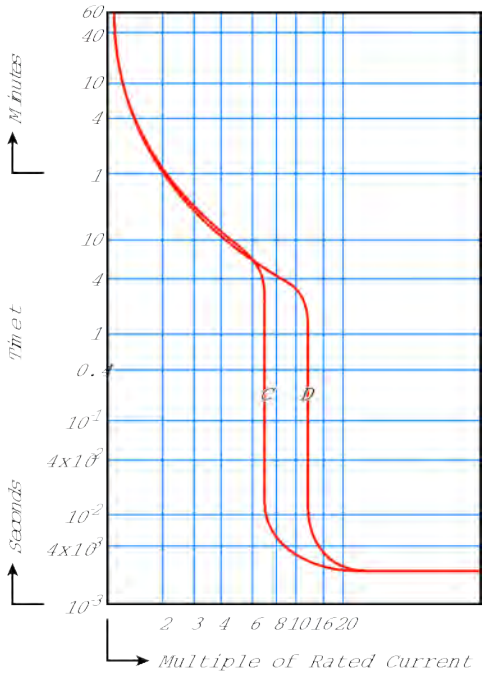
**One device dual voltage ratings.*

AC - SHORT CIRCUIT INTERRUPTING RATING

No. Poles	Type	0.2-32A	33-63A
1	AC	10kA@120, 240, 277V	10kA@120, 240V
2-4	AC	10kA@120, 240V, 480Y/277V	10kA@120, 240V

DC - SHORT CIRCUIT INTERRUPTING RATING

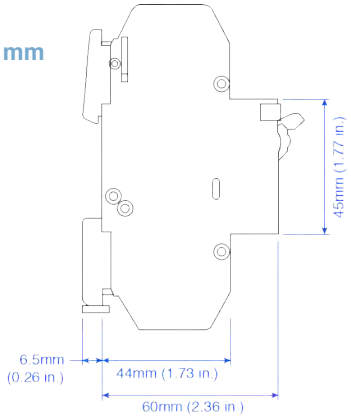
No. Poles	Type	0.2-32A	33-63A
1	DC	10kA@125V	10kA@125V
2	DC	10kA@250V	10kA@250V

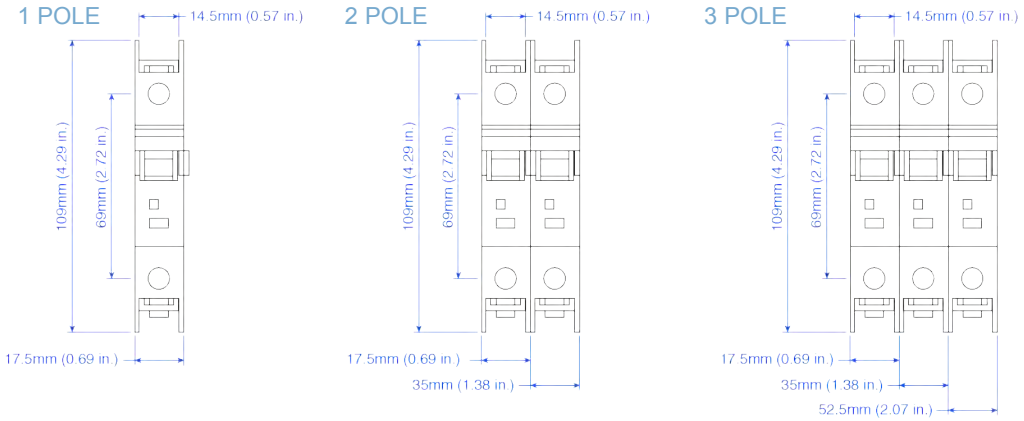


Time versus Current Trip Curve

For the exact trip curve, please refer to page 56.

Dimensions in mm
side view





Trip-Characteristics*				Type	Applications						
Characteristic Trip Boundaries					Lighting Wiring Protection Control Circuits	Business Equipment Appliances	Transformers	Power Supplies Heaters	Motors		Reactive Load
Thermal Trip		Magnetic Trip							Low Inrush	High Inrush	
Must not Trip>100ms	Must Trip <1hr	Must not Trip>100ms	Must Trip at 100ms								
C-Characteristics											
1.05xRC	1.3xRC	5xRC	10xRC	AC							
1.05xRC	1.3xRC	5xRC	10xRC	DC							
D-Characteristics											
1.05xRC	1.3xRC	10xRC	16xRC	AC							
1.05xRC	1.3xRC	10xRC	16xRC	DC							

**The value of each characteristic is shown vertically beneath its corresponding heading.*

Warning!
This information should only be used as a selection guide. The use of a Miniature Circuit Breaker in an application with a certain Trip-Characteristic always requires prototype testing! It is the responsibility of the circuit design engineer to select the appropriate Miniature Circuit Breaker for his specific application.

AC C-Trip Characteristics

Application Examples:
Low inrush motors, resistive loads, wiring protection, receptacles, lighting, and control circuit applications. Relatively short thermal trip delay and medium magnetic trip point.

C UL US

LISTED
E305318

CE



One Pole

Rated Current	Type/ Cat. No.
0.2A	1CU02L
0.5A	1CU05L
1.0A	1CU1L
1.6A	1CU1.6L
2.0A	1CU2L
3.0A	1CU3L
4.0A	1CU4L
5.0A	1CU5L
6.0A	1CU6L
8.0A	1CU8L
10A	1CU10L
12A	1CU12L
13A	1CU13L
15A	1CU15L
16A	1CU16L
20A	1CU20L
25A	1CU25L
30A	1CU30L
32A	1CU32L
40A	1CU40L
50A	1CU50L
60A	1CU60L
63A	1CU63L

Standard Pack: 12

Weight: 1.7kg (3.74 lb.)



Two Pole

Rated Current	Type/ Cat. No.
0.2A	2CU02L
0.5A	2CU05L
1.0A	2CU1L
1.6A	2CU1.6L
2.0A	2CU2L
3.0A	2CU3L
4.0A	2CU4L
5.0A	2CU5L
6.0A	2CU6L
8.0A	2CU8L
10A	2CU10L
12A	2CU12L
13A	2CU13L
15A	2CU15L
16A	2CU16L
20A	2CU20L
25A	2CU25L
30A	2CU30L
32A	2CU32L
40A	2CU40L
50A	2CU50L
60A	2CU60L
63A	2CU63L

Standard Pack: 6

Weight: 1.7kg (3.74 lb.)



Three Pole

Rated Current	Type/ Cat. No.
0.2A	3CU02L
0.5A	3CU05L
1.0A	3CU1L
1.6A	3CU1.6L
2.0A	3CU2L
3.0A	3CU3L
4.0A	3CU4L
5.0A	3CU5L
6.0A	3CU6L
8.0A	3CU8L
10A	3CU10L
12A	3CU12L
13A	3CU13L
15A	3CU15L
16A	3CU16L
20A	3CU20L
25A	3CU25L
30A	3CU30L
32A	3CU32L
40A	3CU40L
50A	3CU50L
60A	3CU60L
63A	3CU63L

Standard Pack: 4

Weight: 1.7kg (3.74 lb.)



Four Pole
Please contact Altech.



For ring tongue terminal version, replace "U" with "**R**" in part number. For example **1CR20L** instead of *1CU20L*.

AC D-Trip Characteristics

Application Examples:
High inrush motors, transformers, power supplies, heaters and reactive loads. Relatively long thermal trip delay and very high magnetic trip point.

C UL US

LISTED
E305318



One Pole

Rated Current	Type/ Cat. No.
0.2A	1DU02L
0.5A	1DU05L
1.0A	1DU1L
1.6A	1DU1.6L
2.0A	1DU2L
3.0A	1DU3L
4.0A	1DU4L
5.0A	1DU5L
6.0A	1DU6L
8.0A	1DU8L
10A	1DU10L
12A	1DU12L
13A	1DU13L
15A	1DU15L
16A	1DU16L
20A	1DU20L
25A	1DU25L
30A	1DU30L
32A	1DU32L
40A	1DU40L
50A	1DU50L
60A	1DU60L
63A	1DU63L

Standard Pack: 12

Weight: 1.7kg (3.74 lb.)



Two Pole

Rated Current	Type/ Cat. No.
0.2A	2DU02L
0.5A	2DU05L
1.0A	2DU1L
1.6A	2DU1.6L
2.0A	2DU2L
3.0A	2DU3L
4.0A	2DU4L
5.0A	2DU5L
6.0A	2DU6L
8.0A	2DU8L
10A	2DU10L
12A	2DU12L
13A	2DU13L
15A	2DU15L
16A	2DU16L
20A	2DU20L
25A	2DU25L
30A	2DU30L
32A	2DU32L
40A	2DU40L
50A	2DU50L
60A	2DU60L
63A	2DU63L

Standard Pack: 6

Weight: 1.7kg (3.74 lb.)



Three Pole

Rated Current	Type/ Cat. No.
0.2A	3DU02L
0.5A	3DU05L
1.0A	3DU1L
1.6A	3DU1.6L
2.0A	3DU2L
3.0A	3DU3L
4.0A	3DU4L
5.0A	3DU5L
6.0A	3DU6L
8.0A	3DU8L
10A	3DU10L
12A	3DU12L
13A	3DU13L
15A	3DU15L
16A	3DU16L
20A	3DU20L
25A	3DU25L
30A	3DU30L
32A	3DU32L
40A	3DU40L
50A	3DU50L
60A	3DU60L
63A	3DU63L

Standard Pack: 4

Weight: 1.7kg (3.74 lb.)



Four Pole
Please contact Altech.



For ring tongue terminal version, replace "U" with "**R**" in part number. For example **1CR20L** instead of *1CU20L*.

DC C- & D-Trip Characteristics

Application Examples:
Telecommunication equipment, computer equipment, uniterruptable power supplies.

Altech Corp.®

c UL us

LISTED
E305318

C-Trip



One Pole

Rated Current	Type/ Cat. No.
0.2A	DC1CU02L
0.5A	DC1CU05L
1.0A	DC1CU1L
1.6A	DC1CU1.6L
2.0A	DC1CU2L
3.0A	DC1CU3L
4.0A	DC1CU4L
5.0A	DC1CU5L
6.0A	DC1CU6L
8.0A	DC1CU8L
10A	DC1CU10L
12A	DC1CU12L
13A	DC1CU13L
15A	DC1CU15L
16A	DC1CU16L
20A	DC1CU20L
25A	DC1CU25L
30A	DC1CU30L
32A	DC1CU32L
40A	DC1CU40L
50A	DC1CU50L
60A	DC1CU60L
63A	DC1CU63L

Standard Pack: 12

Weight: 1.7kg (3.74 lb.)



Two Pole

Rated Current	Type/ Cat. No.
0.2A	DC2CU02L
0.5A	DC2CU05L
1.0A	DC2CU1L
1.6A	DC2CU1.6L
2.0A	DC2CU2L
3.0A	DC2CU3L
4.0A	DC2CU4L
5.0A	DC2CU5L
6.0A	DC2CU6L
8.0A	DC2CU8L
10A	DC2CU10L
12A	DC2CU12L
13A	DC2CU13L
15A	DC2CU15L
16A	DC2CU16L
20A	DC2CU20L
25A	DC2CU25L
30A	DC2CU30L
32A	DC2CU32L
40A	DC2CU40L
50A	DC2CU50L
60A	DC2CU60L
63A	DC2CU63L

Standard Pack: 6

Weight: 1.7kg (3.74 lb.)

D-Trip



One Pole

Rated Current	Type/ Cat. No.
0.2A	DC1DU02L
0.5A	DC1DU05L
1.0A	DC1DU1L
1.6A	DC1DU1.6L
2.0A	DC1DU2L
3.0A	DC1DU3L
4.0A	DC1DU4L
5.0A	DC1DU5L
6.0A	DC1DU6L
8.0A	DC1DU8L
10A	DC1DU10L
12A	DC1DU12L
13A	DC1DU13L
15A	DC1DU15L
16A	DC1DU16L
20A	DC1DU20L
25A	DC1DU25L
30A	DC1DU30L
32A	DC1DU32L
40A	DC1DU40L
50A	DC1DU50L
60A	DC1DU60L
63A	DC1DU63L

Standard Pack: 12

Weight: 1.7kg (3.74 lb.)



Two Pole

Rated Current	Type/ Cat. No.
0.2A	DC2DU02L
0.5A	DC2DU05L
1.0A	DC2DU1L
1.6A	DC2DU1.6L
2.0A	DC2DU2L
3.0A	DC2DU3L
4.0A	DC2DU4L
5.0A	DC2DU5L
6.0A	DC2DU6L
8.0A	DC2DU8L
10A	DC2DU10L
12A	DC2DU12L
13A	DC2DU13L
15A	DC2DU15L
16A	DC2DU16L
20A	DC2DU20L
25A	DC2DU25L
30A	DC2DU30L
32A	DC2DU32L
40A	DC2DU40L
50A	DC2DU50L
60A	DC2DU60L
63A	DC2DU63L

Standard Pack: 6

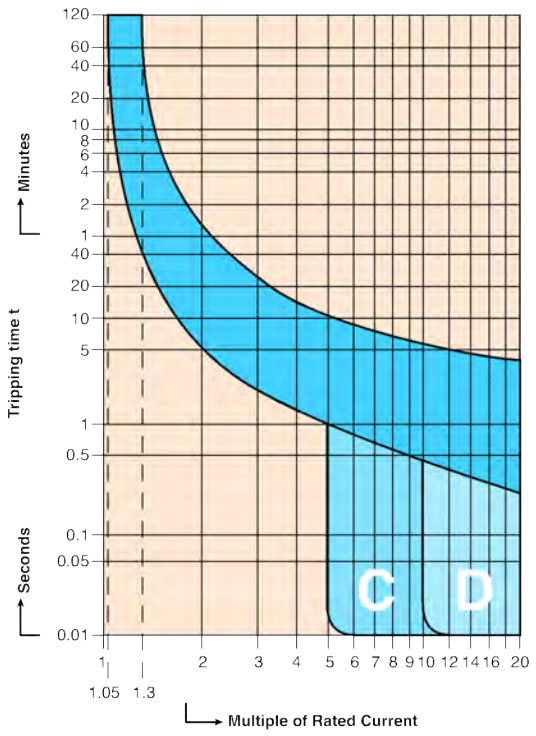
Weight: 1.7kg (3.74 lb.)



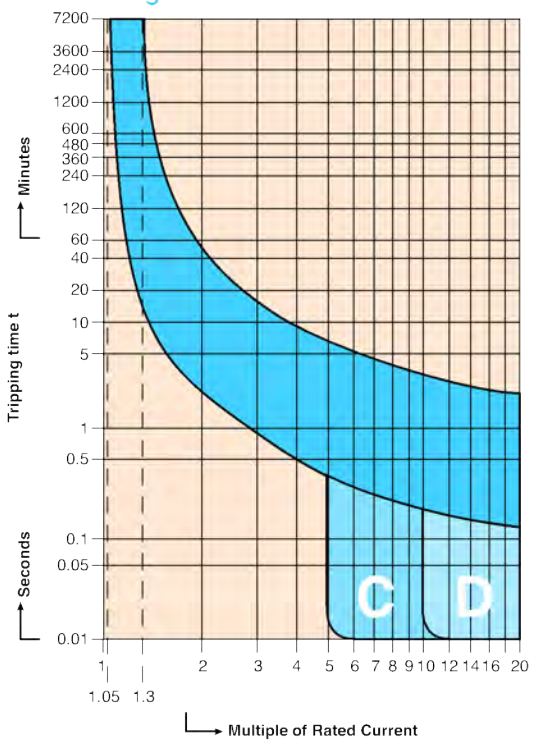
For ring tongue terminal version, replace "U" with "**R**" in part number. For example **1CR20L** instead of *1CU20L*.

L-Series Trip Curves

C and D Trip
Less than 10A



C and D Trip
10A and higher



Temperature and Power Loss Specifications

Rated current In (A)	Effective rated current allowing for ambient temperature I cor (A)									Internal impedance Z (m Ω) char. B, C, D, K	Power Loss B, C, D, K P (W)
	-20	-10	0	10	20	30	40	50	60		
0.2	0.24	0.24	0.23	0.22	0.21	0.2	0.19	0.18	0.17	45100.0	1.80
0.5	0.61	0.59	0.57	0.55	0.53	0.5	0.47	0.44	0.42	8000.0	2.00
1	1.21	1.18	1.14	1.1	1.05	1.0	0.93	0.88	0.83	2000.0	2.00
2	2.42	2.36	2.28	2.2	2.1	2.0	1.86	1.76	1.67	490.0	1.96
3	3.63	3.54	3.42	3.3	3.15	3.0	2.79	2.64	2.5	230.0	2.07
4	4.84	4.72	4.56	4.4	4.2	4.0	3.72	3.52	3.33	150.0	2.40
5	6.1	5.9	5.7	5.5	5.3	5.0	4.7	4.4	4.2	95.0	2.38
6	7.3	7.1	6.8	6.6	6.3	6.0	5.6	5.3	5.0	69.0	2.48
7	8.5	8.2	8.0	7.7	7.4	7.0	6.5	6.2	5.8	52.0	2.55
8	9.7	9.4	9.1	8.8	8.4	8.0	7.4	7.0	6.7	35.0	2.24
10	12.1	11.8	11.4	11.0	10.5	10.0	9.3	8.8	8.3	23.5	2.35
12	14.5	14.2	13.7	13.2	12.6	12.0	11.2	10.6	10.0	18.7	2.69
13	15.7	15.3	14.8	14.3	13.7	13.0	12.1	11.5	10.8	14.3	2.42
14	16.9	16.5	16.0	15.4	14.7	14.0	13.0	12.3	11.7	12.4	2.43
15	18.2	17.7	17.1	16.5	15.8	15.0	14.0	13.2	12.5	10.1	2.27
16	19.4	18.9	18.2	17.6	16.8	16.0	14.9	14.1	13.3	7.5	1.92
20	24.2	23.6	22.8	22.0	21.0	20.0	18.6	17.6	16.7	6.3	2.52
25	30.3	29.5	28.5	27.5	26.3	25.0	23.3	22.0	20.8	4.6	2.88
30	36.3	35.4	34.2	33.0	31.5	30.0	27.9	26.5	25.0	3.6	3.24
32	38.7	37.8	36.5	35.2	33.6	32.0	29.8	28.2	26.7	3.6	3.69
35	42.3	41.3	39.9	38.5	36.8	35.0	32.6	30.8	29.2	3.6	4.41
40	48.4	47.2	45.6	44.0	42.0	40.0	37.2	35.2	33.3	3.0	4.80
50	60.5	59.0	57.0	55.0	52.5	50.0	46.5	44.1	41.7	2.4	6.00
60	72.6	70.9	68.4	66.0	63.0	60.0	55.9	52.9	50.1	1.8	6.48

Accessories

L-Series Circuit Breakers

LISTED
E305318

Accessories can be factory or field mounted on L-Series miniature molded case circuit breakers for enhanced control and monitoring capabilities. Field mounting kits include all necessary parts and instructions. Accessories can be gang mounted on a single controller (the Auxiliary Switch in the outside position). The mounting arrangement links the internal latch-pins for the tripping mechanisms, ensuring simultaneous trips. Handles are linked to simplify manual resetting.



Neutral Pole (63A/240VAC; 32A/480Y/277VAC)

Description	Type/ Cat. No.	Cable Max	Cable Min	Torque Max	Torque Min
Neutral	ALTN2L	25mm² 3 AWG	2.5mm² 12 AWG	2Nm 17.5 lb-in	1.5Nm 12 lb-in

Standard Pack: 10

Weight: 1.2kg (2.64 lb.)



Shunt Trip



Undervoltage Trip

Shunt Trip and Undervoltage Trip

Description	Shunt Trip Type/Cat. No.	Operational Voltage	Rated Coil Current	Undervoltage Trip* Type/Cat. No.
AC Coil:				
12V AC	FA12ACL	8.4 - 13.2V	6A	UV12ACL
24V AC	FA24ACL	16.8 - 26.4V	2.8A	UV24ACL
48V AC	FA48ACL	33.6 - 52.8V	0.8A	UV48ACL
60V AC	FA60ACL	42 - 66V	~0.7A	UV60ACL
110V AC	FA110ACL	77 - 121V	0.5A	UV110ACL
120V AC	FA120ACL	84 - 132V	~0.5A	UV120ACL
230V AC	FA230ACL	161 - 253V	0.6A	UV230ACL
277V AC	FA277ACL	194 - 305V	~0.5A	UV277ACL
400V AC	FA400ACL	280 - 440V	0.5A	UV400ACL
DC Coil:				
12V DC	FA12DCL	8.4 - 13.2V	~6A	UV12DCL
24V DC	FA24DCL	16.8 - 26.4V	3A	UV24DCL
48V DC	FA48DCL	33.6 - 52.8V	2A	UV48DCL
110V DC	FA110DCL	77 - 121V	0.6A	UV110DCL

* Reset-Hold Voltage = 0.85 x V_E; Drop-Out Voltage = 0.2 x V_E

Standard Pack: 10

Weight: 1.1kg (2.43 lb.)

Terminal Size - min/max	2.5 mm² (12 AWG) / 25mm² (3 AWG)
Terminal Torque - min/max	1.5 Nm (12 lb. in.) / 2 Nm (17.5 lb. in.)



Auxiliary Contact (6A/120VAC; 3A/240VAC)

Description	Type/ Cat. No.	Cable Max	Cable Min	Torque Max	Torque Min
1 x CO	H1COL	2.5mm² 12 AWG	0.5mm² 20 AWG	0.5Nm 4 lb-in	0.33Nm 3 lb-in
2 x CO	H2COL				
1 x CO, 1 Signal & Test Button	HSTCOL				

Standard Pack: 15

Weight: 0.5kg (1.32 lb.)



Lock-out Adapter

Description	Type/ Cat. No.
Yellow	EASS2L

Standard Pack: 10

Weight: 50g (1.76 oz.)



Front Mounting Kit with hardware

Description	Type/ Cat. No.	Weight
1 Pole	FMA1PL	40g (1.41 oz.)
2 Pole	FMA2PL	45g (1.59 oz.)
3 Pole	FMA3PL	50g (1.76 oz.)

Standard Pack: 1

Altech UL489 Busbar System

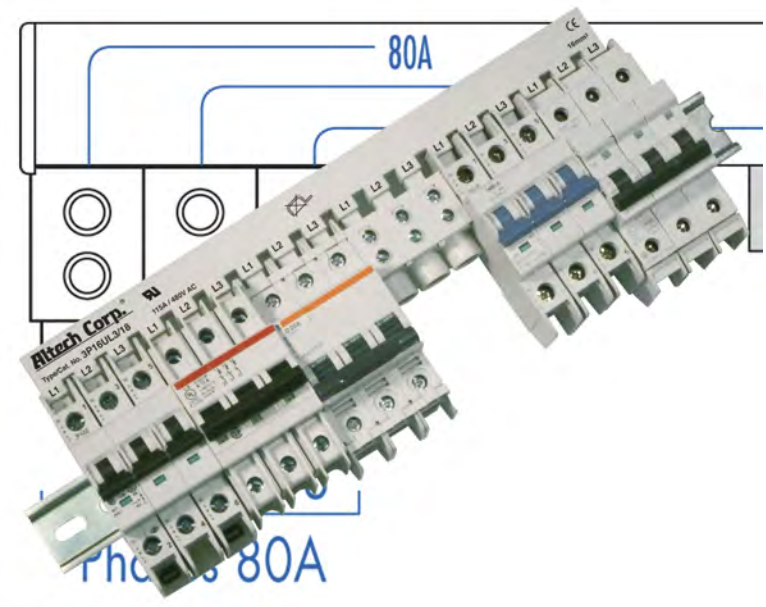
UL489 recognized
E305318

UL489 Listed Busbars

The Altech Busbar System is an innovative way to jumper up to 57 poles of Miniature Molded Case Circuit Breakers (MMCCB).

The advantages of this busbar system are:

- 30% Installation time savings
- Panel space savings
- Reduced maintenance
- High electrical ratings



Universal UL489 Busbar fits most UL489 Miniature Circuit Breakers in the market!

Please contact Altech for details and further information.

UL489 Busbar System

- Every pin configuration is possible by combination of existing 6, 12 and 18 pin busbars.
- Power Feeding:
  Power Feed Lug (115A), Direct Power Feed (115A)
- UL listed for Altech's L-Series of Miniature Circuit Breakers
- UL listed for use with most popular UL489 Miniature Circuit Breakers in the market.

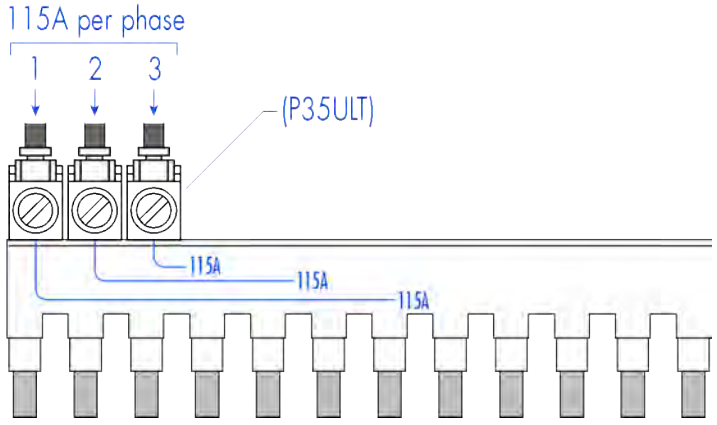
Technical Specifications	Busbars UL489
Material of Busbar	Copper
Material of Insulation (Housing)	Polyamid
Electrical Ratings	115A/480VAC
Short Circuit Withstand Rating	10kA
Applying Standards	UL489, VDE0660 Part 100, IEC60749, DIN EN60947-1

Power Feed Methods

End Feed Method

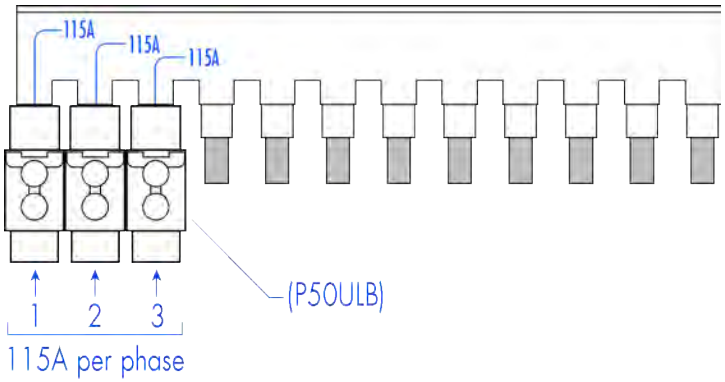
P35ULT*

With the **P35ULT** Power Feed Lug as a Start/End Feeding Device a maximum input current of **115A per Phase** can be achieved.



P50ULB*

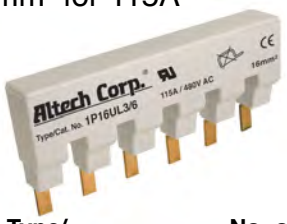
With the **P50ULB** Modular Direct Power Feed as a Start/End Feeding Device a maximum input current of **115A per Phase** can be achieved.



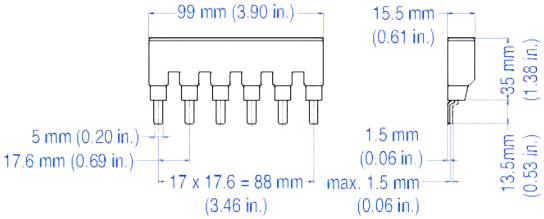
* *For complete specifications and description of Feeding Devices see page 63.*

1 PHASE BUSBAR

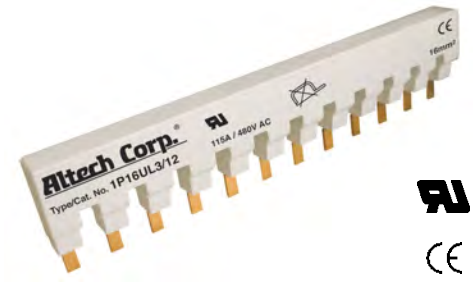
16mm² for 115A



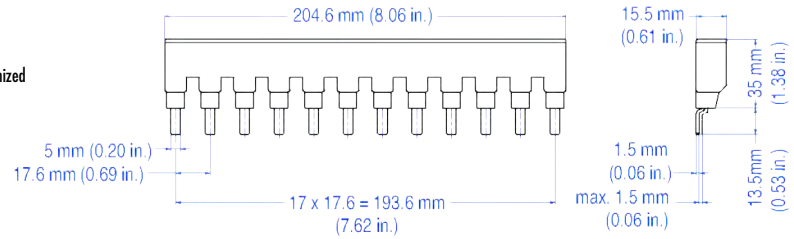
UL489 recognized
E305318



Type/ Cat. No.	No. of Pins	Length [mm]
1P16UL3/6	6	99



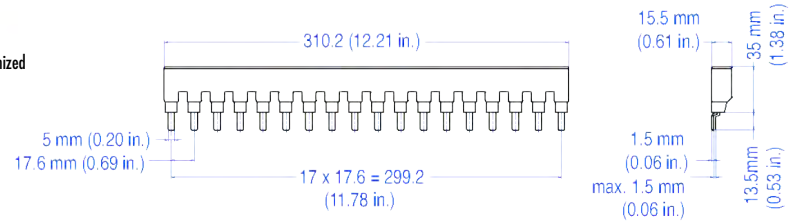
UL489 recognized
E305318



Type/ Cat. No.	No. of Pins	Length [mm]
1P16UL3/12	12	204.6



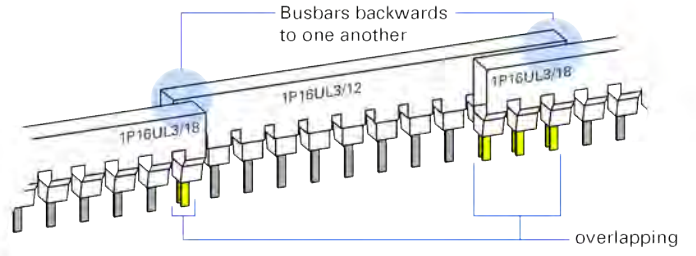
UL489 recognized
E305318



Type/ Cat. No.	No. of Pins	Length [mm]
1P16UL3/18	18	310.2

Example for different No. of Pins

eg. 44 pins use 1x 1P16UL3/12 + 2x 1P16UL3/18



- No. of overlapping pins of 2 busbars must be a multiplier of the No. of phases
- Overlapping busbars are backwards to each other

ACCESSORIES







Type/Cat. No:	P35ULT	P50ULB	BRUL *(3 per strip)*
Description:	Power Feed Lug	Modular Direct Power Feed	Insulation Cap

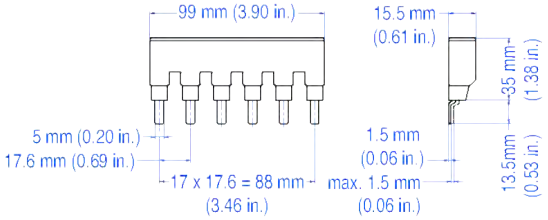
2 PHASE BUSBAR

16mm² for 115A



UL489 recognized
E305318

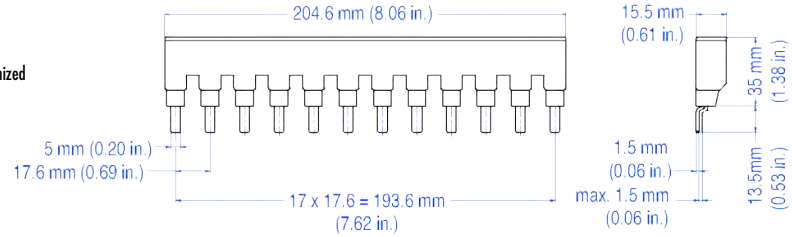
Type/ Cat. No.	No. of Pins	Length [mm]
2P16UL3/6	6	99

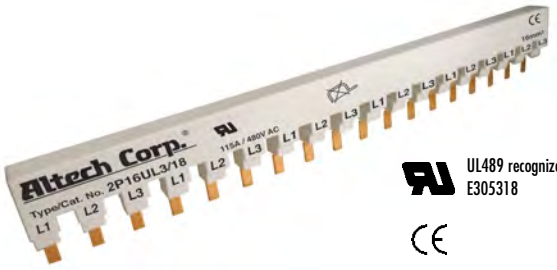




UL489 recognized
E305318

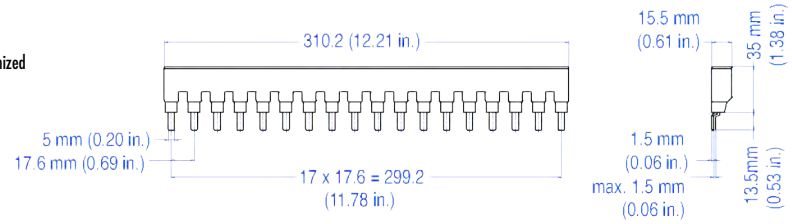
Type/ Cat. No.	No. of Pins	Length [mm]
2P16UL3/12	12	204.6





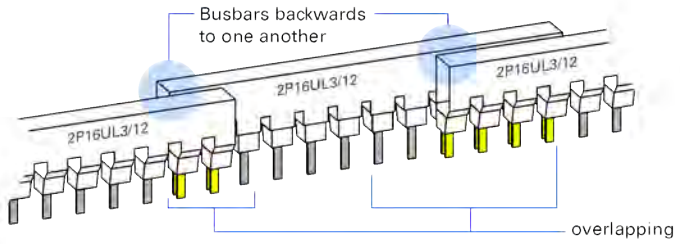
UL489 recognized
E305318

Type/ Cat. No.	No. of Pins	Length [mm]
2P16UL3/18	18	310.2



Example for different No. of Pins

eg. 30 pins use 3x 2P16UL3/12



- No. of overlapping pins of 2 busbars must be multiplier of the No. of phases
- Overlapping busbars are backwards to each other

ACCESSORIES







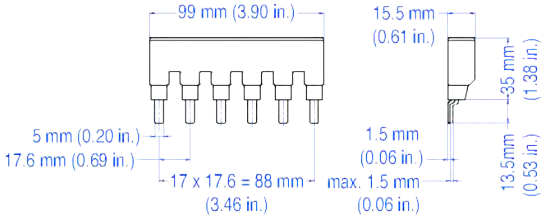
Type/Cat. No:	P35ULT	P50ULB	BRUL *(3 per strip)*
Description:	Power Feed Lug	Modular Direct Power Feed	Insulation Cap

3 PHASE BUSBAR

16mm² for 115A



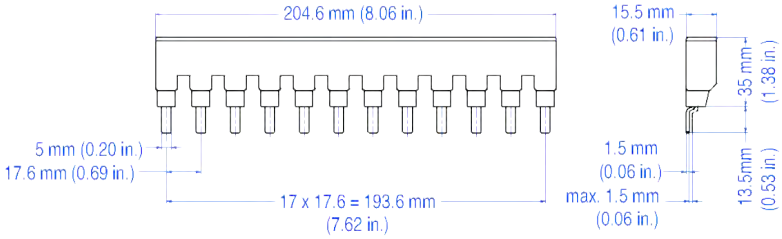
UL489 listed
E305318



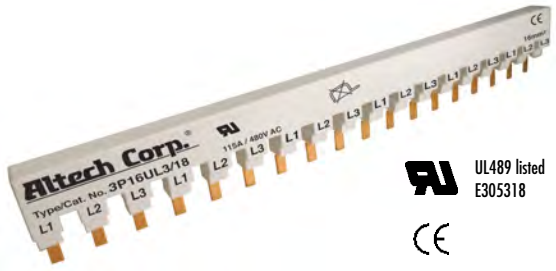
Type/ Cat. No.	No. of Pins	Length [mm]
3P16UL3/6	6	99



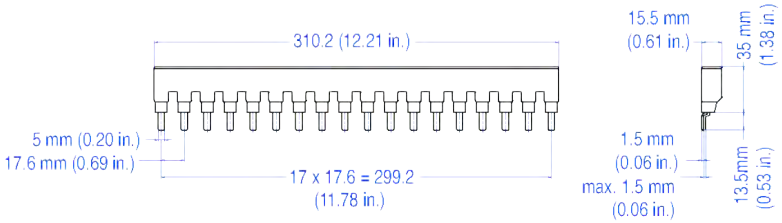
UL489 listed
E305318



Type/ Cat. No.	No. of Pins	Length [mm]
3P16UL3/12	12	204.6



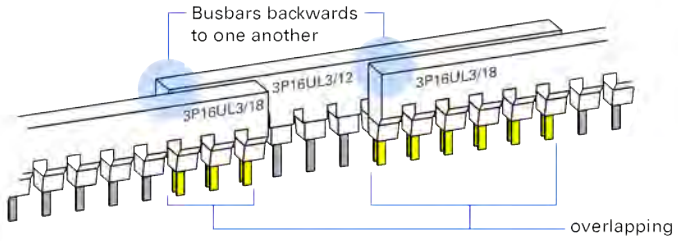
UL489 listed
E305318



Type/ Cat. No.	No. of Pins	Length [mm]
3P16UL3/18	18	310.2

Example for different No. of Pins

eg. 39 pins use 1x 3P16UL3/12 + 2x 3P16UL3/18



- No. of overlapping pins of 2 busbars must be multiplier of the No. of phases
- Overlapping busbars are backwards to each other

ACCESSORIES







Type/Cat. No:	P35ULT	P50ULB	BRUL *(3 per strip)*
Description:	Power Feed Lug	Modular Direct Power Feed	Insulation Cap

Power Feed Devices

Easy connection of power supply wires to the busbar/MCB. Power Feed Devices ensure permanent connection.

Power Feed Lug



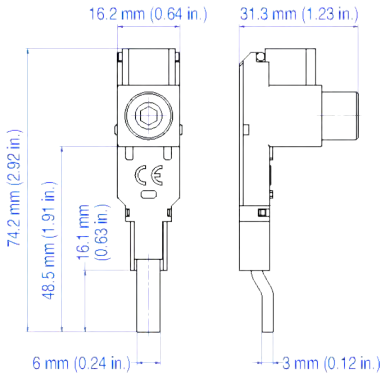
UL489 listed
E305318

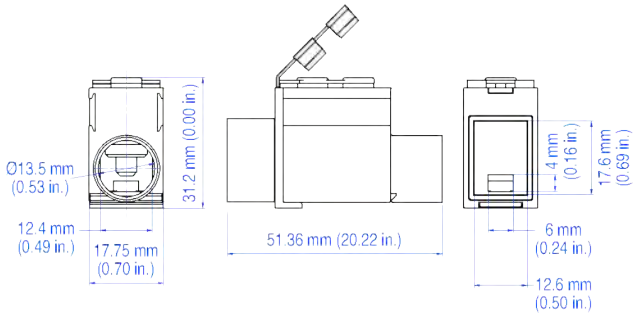
Modular Direct Power Feed



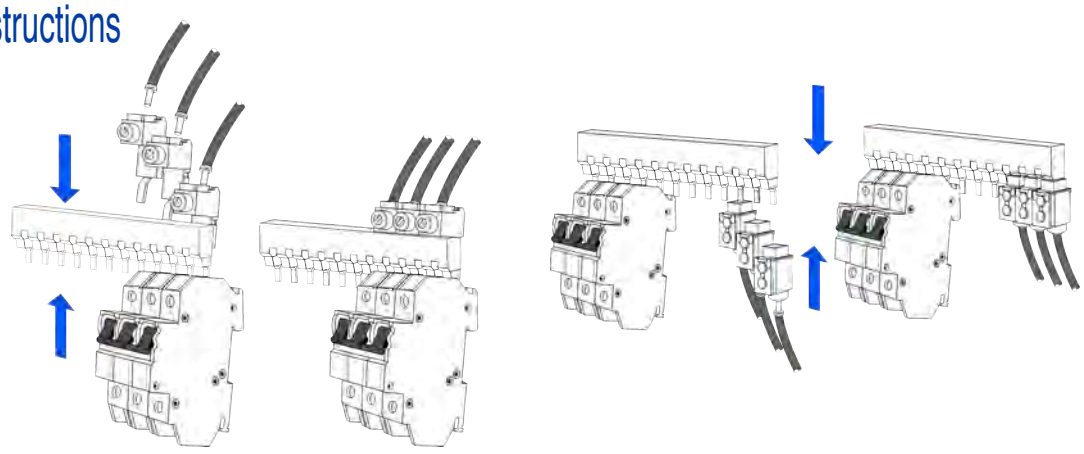
UL489 listed
E305318

Type/Cat. No.	P35ULT	P50ULB
Electrical Ratings	115A/480V AC	115A/480V AC
Conductors	75 C°	75 C°
Terminal Site Acceptability	14-2AWG(1.53mm²)	14-1AWG(1.5-50mm²)
Required Torque	4Nm (35.4 lb. in.)	3.5Nm/31 lb. in. (14-6AWG) 4Nm/35.4 lb. in. (4-1AWG)
Material of Lug	Brass	Brass
Insulation Material	Polyamid	Polyamid
For use with	UL489 1-3 phase Busbar	UL489 1-3 phase Busbar





Assembly Instructions



Miscellaneous Accessories

Insulation Caps



Type/Cat. No:	**BRUL** *(3 per strip)*
Description:	Insulation Cap

Altech Busbar Systems

Configuration and Assembly of UL489 Busbars

UL489 Busbars are available in 3 different Pin Configurations per Phase, (6, 12 and 18 Pins).

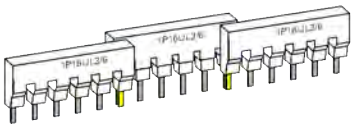
The UL489 busbar cannot be cut, since the creepage and clearance distance requirements from UL are too stringent. Therefore, to obtain the desired No. of Pins, Busbar-Pins can be overlapped as explained below:

1) Busbars are overlapped backwards to each other. Both Pins of each Busbar fit together in the terminals of the Minature Circuit Breaker.
2 The Number of overlapping Pins of 2 Busbar must be a multiplier of the Number of Phases to keep existing Phase sequence. (Can be overlapped by more than the number of phases).
3) Any available combination of the 3 different Pin configurations is possible.
4) In most cases there is more than 1 combination possible.
5) For more possible configurations see Busbar Selection Table on page 21.

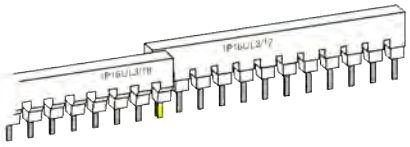
Configuration Examples*

1 Phase

16 Pins: 3 x 1P16UL3/6

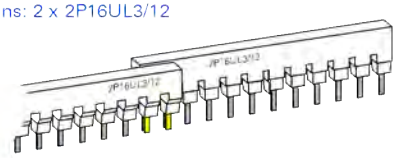


29 Pins: 1 x 1P16UL3/12 + 1 x 1P16UL3/18

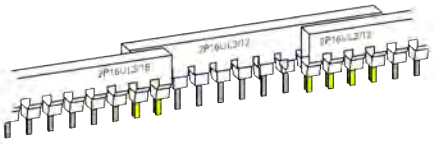


2 Phase

22 Pins: 2 x 2P16UL3/12

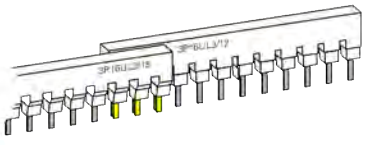


36 Pins: 2 x 2P16UL3/12 + 1 x 2P16UL3/18

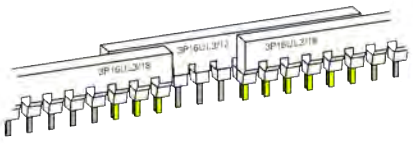


3 Phase

27 Pins: 1 x 3P16UL3/12 + 1 x 3P16UL3/18



39 Pins: 1 x 3P16UL3/12 + 2 x 3P16UL3/18



*For Questions, other configurations and detailed information please contact Altech Corp.

Busbar Selection Table

Altech Corp.®

1 Phase System

No. of Pins	Necessary Busbars
6	1x 1P16UL3/6
7	2x 1P16UL3/6
8	2x 1P16UL3/6
9	2x 1P16UL3/6
10	2x 1P16UL3/6
11	2x 1P16UL3/6
12	1x 1P16UL3/12 3x 1P16UL3/6
13	2x 1P16UL3/12 3x 1P16UL3/6 1x 1P16UL3/6 + 1x 1P16UL3/12
14	2x 1P16UL3/12 3x 1P16UL3/6 1x 1P16UL3/6 + 1x 1P16UL3/12
15	2x 1P16UL3/12 3x 1P16UL3/6 1x 1P16UL3/6 + 1x 1P16UL3/12
16	2x 1P16UL3/12 3x 1P16UL3/6 1x 1P16UL3/6 + 1x 1P16UL3/12
17	2x 1P16UL3/12 1x 1P16UL3/6 + 1x 1P16UL3/12
18	1x 1P16UL3/18 2x 1P16UL3/12 2x 1P16UL3/6 + 1x 1P16UL3/12 1x 1P16UL3/6 + 2x 1P16UL3/12
19	2x 1P16UL3/12 2x 1P16UL3/18 2x 1P16UL3/6 + 1x 1P16UL3/12 1x 1P16UL3/6 + 2x 1P16UL3/12 1x 1P16UL3/6 + 1x 1P16UL3/18 1x 1P16UL3/12 + 1x 1P16UL3/18
20	2x 1P16UL3/12 2x 1P16UL3/18 1x 1P16UL3/6 + 2x 1P16UL3/12 2x 1P16UL3/6 + 1x 1P16UL3/12 1x 1P16UL3/6 + 1x 1P16UL3/18 1x 1P16UL3/12 + 1x 1P16UL3/18
21	2x 1P16UL3/12 2x 1P16UL3/18 2x 1P16UL3/6 + 1x 1P16UL3/12 1x 1P16UL3/6 + 2x 1P16UL3/12 1x 1P16UL3/6 + 1x 1P16UL3/18 1x 1P16UL3/12 + 1x 1P16UL3/18
22	2x 1P16UL3/12 2x 1P16UL3/18 2x 1P16UL3/6 + 1x 1P16UL3/12 1x 1P16UL3/6 + 2x 1P16UL3/12 1x 1P16UL3/6 + 1x 1P16UL3/18 1x 1P16UL3/12 + 1x 1P16UL3/18
23	2x 1P16UL3/12 2x 1P16UL3/18 1x 1P16UL3/6 + 1x 1P16UL3/18 1x 1P16UL3/12 + 1x 1P16UL3/18
24	2x 1P16UL3/12 2x 1P16UL3/18 1x 1P16UL3/12 + 1x 1P16UL3/18 2x 1P16UL3/6 + 1x 1P16UL3/18 3x 1P16UL3/12
25	2x 1P16UL3/12 2x 1P16UL3/18 1x 1P16UL3/12 + 1x 1P16UL3/18 2x 1P16UL3/6 + 1x 1P16UL3/18 3x 1P16UL3/12
26	2x 1P16UL3/18 1x 1P16UL3/12 + 1x 1P16UL3/18 2x 1P16UL3/6 + 1x 1P16UL3/18 3x 1P16UL3/12
27	2x 1P16UL3/18 1x 1P16UL3/12 + 1x 1P16UL3/18 2x 1P16UL3/6 + 1x 1P16UL3/18 3x 1P16UL3/12
28	2x 1P16UL3/18 1x 1P16UL3/12 + 1x 1P16UL3/18 2x 1P16UL3/6 + 1x 1P16UL3/18 3x 1P16UL3/12
29	2x 1P16UL3/18 1x 1P16UL3/12 + 1x 1P16UL3/18 3x 1P16UL3/12
30	2x 1P16UL3/18 3x 1P16UL3/12 1x 1P16UL3/6 + 1x 1P16UL3/12 + 1x 1P16UL3/18 2x 1P16UL3/12 + 1x 1P16UL3/18 1x 1P16UL3/12 + 2x 1P16UL3/18
31	2x 1P16UL3/18 3x 1P16UL3/12 1x 1P16UL3/6 + 1x 1P16UL3/12 + 1x 1P16UL3/18 2x 1P16UL3/12 + 1x 1P16UL3/18 1x 1P16UL3/12 + 2x 1P16UL3/18
32	2x 1P16UL3/18 3x 1P16UL3/12 1x 1P16UL3/6 + 1x 1P16UL3/12 + 1x 1P16UL3/18 2x 1P16UL3/12 + 1x 1P16UL3/18 1x 1P16UL3/12 + 2x 1P16UL3/18
33	2x 1P16UL3/18 3x 1P16UL3/12 1x 1P16UL3/6 + 1x 1P16UL3/12 + 1x 1P16UL3/18 2x 1P16UL3/12 + 1x 1P16UL3/18 1x 1P16UL3/12 + 2x 1P16UL3/18 1x 1P16UL3/12 + 2x 1P16UL3/18
34	2x 1P16UL3/18 3x 1P16UL3/12 1x 1P16UL3/6 + 1x 1P16UL3/12 + 1x 1P16UL3/18 2x 1P16UL3/12 + 1x 1P16UL3/18 1x 1P16UL3/12 + 2x 1P16UL3/18
35	2x 1P16UL3/18 2x 1P16UL3/12 + 1x 1P16UL3/18 1x 1P16UL3/12 + 2x 1P16UL3/18
36	1x 1P16UL3/6 + 2x 1P16UL3/18 2x 1P16UL3/12 + 1x 1P16UL3/18 3x 1P16UL3/18 1x 1P16UL3/12 + 2x 1P16UL3/18
37	1x 1P16UL3/6 + 2x 1P16UL3/18 2x 1P16UL3/12 + 1x 1P16UL3/18 3x 1P16UL3/18 1x 1P16UL3/12 + 2x 1P16UL3/18
38	1x 1P16UL3/6 + 2x 1P16UL3/18 2x 1P16UL3/12 + 1x 1P16UL3/18 3x 1P16UL3/18 1x 1P16UL3/12 + 2x 1P16UL3/18
39	1x 1P16UL3/6 + 2x 1P16UL3/18 2x 1P16UL3/12 + 1x 1P16UL3/18 3x 1P16UL3/18 1x 1P16UL3/12 + 2x 1P16UL3/18
40	1x 1P16UL3/6 + 2x 1P16UL3/18 2x 1P16UL3/12 + 1x 1P16UL3/18 1x 1P16UL3/12 + 2x 1P16UL3/18 3x 1P16UL3/18
41	1x 1P16UL3/12 + 2x 1P16UL3/18 3x 1P16UL3/18
42	1x 1P16UL3/12 + 2x 1P16UL3/18 3x 1P16UL3/18
43	1x 1P16UL3/12 + 2x 1P16UL3/18 3x 1P16UL3/18
44	1x 1P16UL3/12 + 2x 1P16UL3/18 3x 1P16UL3/18
45	1x 1P16UL3/12 + 2x 1P16UL3/18 3x 1P16UL3/18
46	1x 1P16UL3/12 + 2x 1P16UL3/18 3x 1P16UL3/18
47	3x 1P16UL3/18
48	3x 1P16UL3/18
49	3x 1P16UL3/18
50	3x 1P16UL3/18
51	3x 1P16UL3/18
52	3x 1P16UL3/18

2 Phase System

No. of Pins	Necessary Busbars
6	1x 2P16UL3/6
8	2x 2P16UL3/6
10	2x 2P16UL3/6
12	3x 2P16UL3/6 1x 2P16UL3/12
14	3x 2P16UL3/6 2x 2P16UL3/12 1x 2P16UL3/6 + 1x 2P16UL3/12
16	2x 2P16UL3/12 1x 2P16UL3/6 + 1x 2P16UL3/12
18	1x 2P16UL3/18 2x 2P16UL3/12 2x 2P16UL3/6 + 1x 2P16UL3/12
20	2x 2P16UL3/6 + 1x 2P16UL3/12 1x 2P16UL3/6 + 1x 2P16UL3/18 2x 2P16UL3/12 2x 2P16UL3/18 1x 2P16UL3/12 + 1x 2P16UL3/18
22	2x 2P16UL3/12 2x 2P16UL3/18 1x 2P16UL3/6 + 1x 2P16UL3/18 1x 2P16UL3/12 + 1x 2P16UL3/18
24	2x 2P16UL3/6 + 1x 2P16UL3/18 1x 2P16UL3/6 + 2x 2P16UL3/12 3x 2P16UL3/12 2x 2P16UL3/18 1x 2P16UL3/12 + 1x 2P16UL3/18
26	2x 2P16UL3/6 + 1x 2P16UL3/18 1x 2P16UL3/6 + 2x 2P16UL3/12 3x 2P16UL3/12 2x 2P16UL3/18 1x 2P16UL3/12 + 1x 2P16UL3/18
28	3x 2P16UL3/12 2x 2P16UL3/18 1x 2P16UL3/12 + 1x 2P16UL3/18
30	1x 2P16UL3/6 + 1x 2P16UL3/12 + 1x 2P16UL3/18 3x 2P16UL3/12 2x 2P16UL3/12 + 1x 2P16UL3/18 2x 2P16UL3/18
32	1x 2P16UL3/6 + 1x 2P16UL3/12 + 1x 2P16UL3/18 3x 2P16UL3/12 2x 2P16UL3/12 + 1x 2P16UL3/18 2x 2P16UL3/18
34	1x 2P16UL3/6 + 1x 2P16UL3/12 + 1x 2P16UL3/18 2x 2P16UL3/12 + 1x 2P16UL3/18 2x 2P16UL3/18
36	1x 2P16UL3/6 + 2x 2P16UL3/18 3x 2P16UL3/18 2x 2P16UL3/12 + 1x 2P16UL3/18 1x 2P16UL3/12 + 2x 2P16UL3/18

3 Phase System

No. of Pins	Necessary Busbars
9	2x 3P16UL3/6
12	1x 3P16UL3/12 3x 3P16UL3/6
15	1x 3P16UL3/6 + 1x 3P16UL3/12 2x 3P16UL3/12
18	1x 3P16UL3/18 1x 3P16UL3/12 + 2x 3P16UL3/6 2x 3P16UL3/12
21	2x 3P16UL3/12 1x 3P16UL3/6 + 1x 3P16UL3/18 1x 3P16UL3/12 + 1x 3P16UL3/18 2x 3P16UL3/18
24	1x 3P16UL3/12 + 1x 3P16UL3/18 2x 3P16UL3/6 + 1x 3P16UL3/18 1x 3P16UL3/6 + 2x 3P16UL3/12 3x 3P16UL3/12 2x 3P16UL3/18
27	1x 3P16UL3/12 + 1x 3P16UL3/18 2x 3P16UL3/18 3x 3P16UL3/12
30	2x 3P16UL3/18 2x 3P16UL3/12 + 1x 3P16UL3/18 3x 3P16UL3/12 1x 3P16UL3/6 + 1x 3P16UL3/12 + 1x 3P16UL3/18
33	2x 3P16UL3/18 2x 3P16UL3/12 + 1x 3P16UL3/18
36	1x 3P16UL3/6 + 2x 3P16UL3/18 2x 3P16UL3/12 + 1x 3P16UL3/18 1x 3P16UL3/12 + 2x 3P16UL3/18 3x 3P16UL3/18
39	1x 3P16UL3/12 + 2x 3P16UL3/18 3x 3P16UL3/18
42	1x 3P16UL3/12 + 2x 3P16UL3/18 3x 3P16UL3/18
45	3x 3P16UL3/18
48	3x 3P16UL3/18

No. of Pins	Necessary Busbars
38	1x 2P16UL3/6 + 2x 2P16UL3/18 3x 2P16UL3/18 2x 2P16UL3/12 + 1x 2P16UL3/18 1x 2P16UL3/12 + 2x 2P16UL3/18
40	3x 2P16UL3/18 1x 2P16UL3/12 + 2x 2P16UL3/18
42	3x 2P16UL3/18 1x 2P16UL3/12 + 2x 2P16UL3/18
44	3x 2P16UL3/18 1x 2P16UL3/12 + 2x 2P16UL3/18
46	3x 2P16UL3/18
48	3x 2P16UL3/18
50	3x 2P16UL3/18

Note: For detailed information and examples see page 20.

TD / TS Series
Molded Case Circuit Breakers UL489 Listed



Molded Case Circuit Breaker

LISTED
E231289

- 4 Frame Sizes
- Compact Design
- Thermal Magnetic
- 240, 480, 600VAC
- 3 Poles
- Up to 100kA Short Circuit Interrupting Capacity
- **Circuit Breakers are supplied with line and load terminals**
- HACR rated
- CE version (without UL approval) available upon request

SPECIFICATIONS

	Current Rating	Wire Ratings	Calibration Temperature
TD125	15-125A / 600V AC	60°/ 75°C Cu only	40°C (104°F)
TS250	150-250A / 600V AC	60°/ 75°C Cu only	
TS400	300-400A / 600V AC	75°C Cu only	
TS800	500-800A / 600V AC	75°C Cu only	

INTERRUPTING CAPACITY

	TD125		TS250		TS400		TS800	
	NU	HU	NU	HU	NU	HU	NU	HU
240V	50	100	50	100	50	100	50	100
480V	35	65	35	65	35	65	35	65
600V	10	14	10	18	14	20	18	25

TERMINAL SIZE ACCEPTABILITY AND TERMINAL TORQUE

Frame Types	Wire Range		Tightening Torque [lb.in.]
	Conductor Cross-section	Number of Conductors	
TD125 (15 - 125A)	14 - 8 AWG	1	60
	6 - 1/0 AWG	1	90
TS250 (150 - 250A)	1 AWG	1	150
	1/0 - 2/0 AWG	1	180
	3/0 - 4/0 AWG	1	250
	300 - 400 kcmil	1	325
TS400 (300 - 400A)	250 - 400 kcmil	1	325
	500 kcmil	1	375
	3/0 AWG	2	250
TS800 (500 - 600A)	250 - 500 kcmil	up to 2	375
TS800 (700 - 800A)	300 - 500 kcmil	up to 2	500
	300 - 400 kcmil	up to 3	500

TRIP CHARACTERISTICS

FTU	Fixed-Thermal Fixed-Magnetic	Rated current *See trip curve pages 76-77*
FMU	Adjustable-Thermal Fixed-Magnetic	0.8 - 1 x current adjustable *See trip curve pages 76-77*
ATU	Adjustable-Thermal Adjustable-Magnetic	0.8 - 1 x current adjustable 5 - 10 x current adjustable

PART NUMBERING SYSTEM

S	–	TD125	NU	–	FTU	–	LL	–	15

Frame Type
TD125: 15-125A
TS250: 150-250A
TS400: 300-400A
TS800: 500-800A

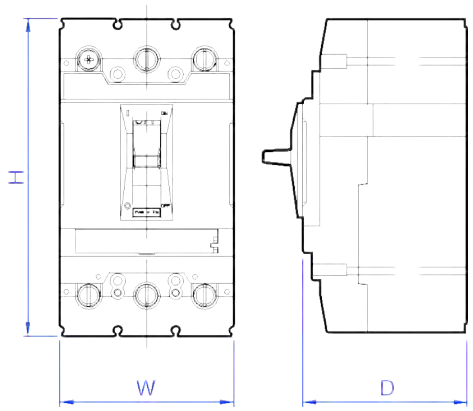
Interrupting Type
NU, HU
See page 66

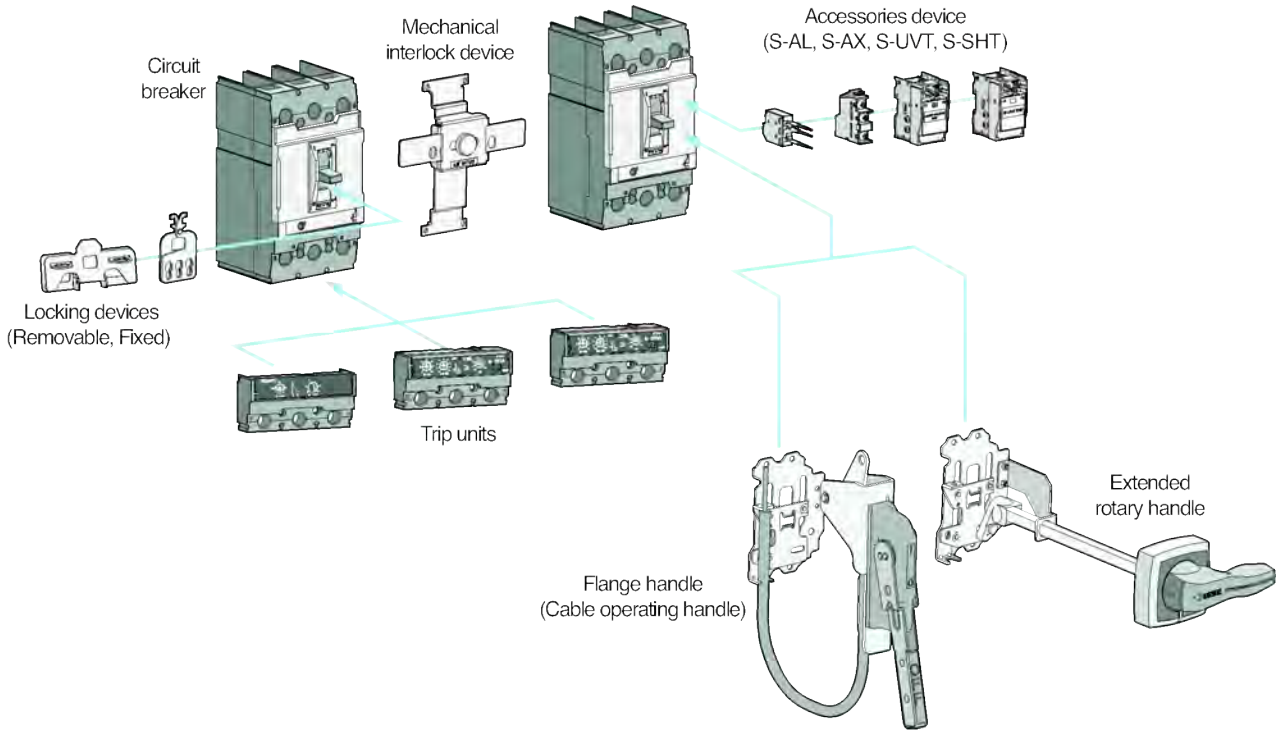
Trip Type
FTU, FMU, ATU

Rated Current (A)
15, 20, ..., 800

DIMENSIONS

Dimensions Frame types	Basic Dimensions W x H x D [inch/mm]
TD125	3.54 x 6.46 x 3.39/90 x 164 x 86
TS250	4.13 x 7.01 x 3.39/105 x 178 x 86
TS400	5.51 x 11.5 x 4.33/140 x 292 x 110
TS800	8.27 x 16.85 x 5.31/210 x 428 x 135





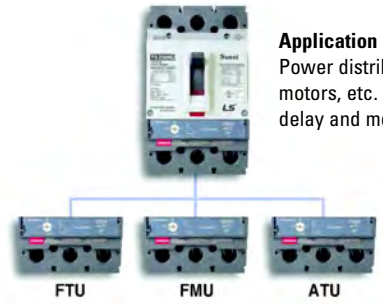
TD / TS Series Circuit Breakers

Normal Interrupting Capacity (NU)

Circuit Breakers are supplied with line and load terminals

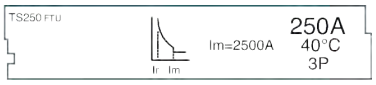
Interrupting Capacity

	TD125	TS250	TS400	TS800
240V	50	50	50	50
480V	35	35	35	35
600V	10	10	14	18



Application Examples:
Power distribution, power generation, motors, etc. Relatively short thermal trip delay and medium magnetic trip point.

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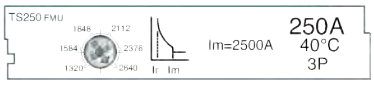


FTU

Fixed-thermal, Fixed-magnetic

Rated Current	Type/ Cat. No.
15A	S-TD125NU-FTU-LL-15
20A	S-TD125NU-FTU-LL-20
30A	S-TD125NU-FTU-LL-30
40A	S-TD125NU-FTU-LL-40
50A	S-TD125NU-FTU-LL-50
60A	S-TD125NU-FTU-LL-60
80A	S-TD125NU-FTU-LL-80
100A	S-TD125NU-FTU-LL-100
125A	S-TD125NU-FTU-LL-125
150A	S-TS250NU-FTU-LL-150
160A	S-TS250NU-FTU-LL-160
175A	S-TS250NU-FTU-LL-175
200A	S-TS250NU-FTU-LL-200
225A	S-TS250NU-FTU-LL-225
250A	S-TS250NU-FTU-LL-250
300A	S-TS400NU-FTU-LL-300
350A	S-TS400NU-FTU-LL-350
400A	S-TS400NU-FTU-LL-400
500A	S-TS800NU-FTU-LL-500
600A	S-TS800NU-FTU-LL-600
700A	S-TS800NU-FTU-LL-700
800A	S-TS800NU-FTU-LL-800

Standard Pack: 1
Weight:
TD125: 2.65 lb. TS400: 12.57 lb.
TS250: 4.19 lb. TS800: 29.98 lb.

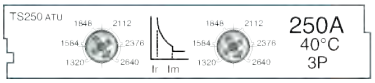


FMU*

Adjustable-thermal, Fixed-magnetic

Rated Current	Type/ Cat. No.
40A	S-TD125NU-FMU-LL-40
50A	S-TD125NU-FMU-LL-50
60A	S-TD125NU-FMU-LL-60
80A	S-TD125NU-FMU-LL-80
100A	S-TD125NU-FMU-LL-100
125A	S-TD125NU-FMU-LL-125
160A	S-TS250NU-FMU-LL-160
200A	S-TS250NU-FMU-LL-200
250A	S-TS250NU-FMU-LL-250
300A	S-TS400NU-FMU-LL-300
400A	S-TS400NU-FMU-LL-400
500A	S-TS800NU-FMU-LL-500
600A	S-TS800NU-FMU-LL-600
800A	S-TS800NU-FMU-LL-800

Standard Pack: 1
Weight:
TD125: 2.65 lb. TS400: 12.57 lb.
TS250: 4.19 lb. TS800: 29.98 lb.



ATU*

Adjustable-thermal, Adjustable-magnetic

Rated Current	Type/ Cat. No.
160A	S-TS250NU-ATU-LL-160
200A	S-TS250NU-ATU-LL-200
250A	S-TS250NU-ATU-LL-250
300A	S-TS400NU-ATU-LL-300
400A	S-TS400NU-ATU-LL-400
500A	S-TS800NU-ATU-LL-500
600A	S-TS800NU-ATU-LL-600
800A	S-TS800NU-ATU-LL-800

Standard Pack: 1
Weight:
TD125: 2.65 lb. TS400: 12.57 lb.
TS250: 4.19 lb. TS800: 29.98 lb.

Accessories (see pages 70-72)
Dimensions (see pages 73-75)
Trip Curves (see pages 76-77)

* *Not a stock item, please consult Altech for availability.*

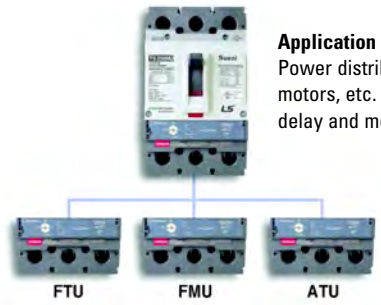
TD / TS Series Circuit Breakers

High Interrupting Capacity (HU)

Circuit Breakers are supplied with line and load terminals

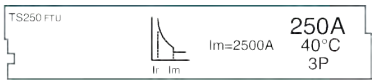
Interrupting Capacity

	TD125	TS250	TS400	TS800
240V	100	100	100	100
480V	65	65	65	65
600V	14	18	20	25



Application Examples:
Power distribution, power generation, motors, etc. Relatively short thermal trip delay and medium magnetic trip point.

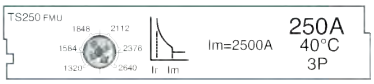
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FTU
Fixed-thermal, Fixed-magnetic

Rated Current	Type/ Cat. No.
15A	S-TD125HU-FTU-LL-15
20A	S-TD125HU-FTU-LL-20
30A	S-TD125HU-FTU-LL-30
40A	S-TD125HU-FTU-LL-40
50A	S-TD125HU-FTU-LL-50
60A	S-TD125HU-FTU-LL-60
80A	S-TD125HU-FTU-LL-80
100A	S-TD125HU-FTU-LL-100
125A	S-TD125HU-FTU-LL-125
150A	S-TS250HU-FTU-LL-150
160A	S-TS250HU-FTU-LL-160
175A	S-TS250HU-FTU-LL-175
200A	S-TS250HU-FTU-LL-200
225A	S-TS250HU-FTU-LL-225
250A	S-TS250HU-FTU-LL-250
300A	S-TS400HU-FTU-LL-300
350A	S-TS400HU-FTU-LL-350
400A	S-TS400HU-FTU-LL-400
500A	S-TS800HU-FTU-LL-500
600A	S-TS800HU-FTU-LL-600
700A	S-TS800HU-FTU-LL-700
800A	S-TS800HU-FTU-LL-800

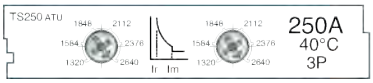
Standard Pack: 1
Weight:
TD125: 2.65 lb. TS400: 12.57 lb.
TS250: 4.19 lb. TS800: 29.98 lb.



FMU*
Adjustable-thermal, Fixed-magnetic

Rated Current	Type/ Cat. No.
40A	S-TD125HU-FMU-LL-40
50A	S-TD125HU-FMU-LL-50
60A	S-TD125HU-FMU-LL-60
80A	S-TD125HU-FMU-LL-80
100A	S-TD125HU-FMU-LL-100
125A	S-TD125HU-FMU-LL-125
160A	S-TS250HU-FMU-LL-160
200A	S-TS250HU-FMU-LL-200
250A	S-TS250HU-FMU-LL-250
300A	S-TS400HU-FMU-LL-300
400A	S-TS400HU-FMU-LL-400
500A	S-TS800HU-FMU-LL-500
600A	S-TS800HU-FMU-LL-600
800A	S-TS800HU-FMU-LL-800

Standard Pack: 1
Weight:
TD125: 2.65 lb. TS400: 12.57 lb.
TS250: 4.19 lb. TS800: 29.98 lb.



ATU*
Adjustable-thermal, Adjustable-magnetic

Rated Current	Type/ Cat. No.
160A	S-TS250HU-ATU-LL-160
200A	S-TS250HU-ATU-LL-200
250A	S-TS250HU-ATU-LL-250
300A	S-TS400HU-ATU-LL-300
400A	S-TS400HU-ATU-LL-400
500A	S-TS800HU-ATU-LL-500
600A	S-TS800HU-ATU-LL-600
800A	S-TS800HU-ATU-LL-800

Standard Pack: 1
Weight:
TD125: 2.65 lb. TS400: 12.57 lb.
TS250: 4.19 lb. TS800: 29.98 lb.

Accessories (see pages 70-72)
Dimensions (see pages 73-75)
Trip Curves (see pages 76-77)

* *Not a stock item, please consult Altech for availability.*

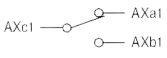
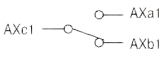
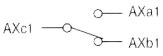
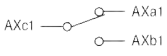
Accessories

Electrical Auxiliaries

Auxiliary Switch (S-AX), Alarm Switch (S-AL)

- Can be installed in all frame types

Contact Operation

MCCB	ON	OFF	TRIP	Cat. No.
Position of S-AX				S-AX
Position of S-AL				S-AL



Installation - *see page 71*

Technical Data

Conventional thermal current I_{th}	5A		
Rated operational current I_e with rated operational voltage U_e	Voltage	I_e (A)	
		Resistive Load	Inductive Load
- Altemating current 50/60Hz AC	125V	5	3
	250V	3	2
- Direct current DC	30V	4	3
	125V	0.4	0.4
	250V	0.2	0.2



Installation - *see page 71*

Shunt Release, S-SHT

- Can be installed in all frame types
- Range of operational voltage: 0.7 - 1.1 x Vn
- Frequency (only AC): 45Hz - 65Hz



Technical Data

	Control voltage (V)	Consumption			Cat. No.
		AC (VA)	DC (W)	mA	
Power consumption	DC 12V	-	0.36	30	S-SHT-12
	AC/DC 24V	0.58	0.58	24	S-SHT-24
	AC/DC 48V	1.22	1.23	25	S-SHT-48
	AC/DC 110~130V	1.36	1.37	10.5	S-SHT-120
	AC 220~240V/DC250V	1.80	1.88	7.5	S-SHT-230
	AC 380~500V	1.15	-	2.3	S-SHT-440
Max. opening time (msec)		50			
Tightening torque of terminal screw		7.1 lb.in.			

Installation - *see page 71*

Accessories

Electrical Auxiliaries

Undervoltage Release, S-UVT



- Can be installed in all frame types
- Reset-Hold Voltage = 0.85 x Vn
- Drop-Out Voltage = 0.35 - 0.7 x Vn
- Frequency (only AC): 45Hz - 65Hz

Technical Data

	Control voltage (V)	Consumption			Cat. No.
		AC (VA)	DC (W)	mA	
Power consumption	AC/DC 24V	0.64	0.65	27	S-UVT-24
	AC/DC 48V	1.09	1.10	23	S-UVT-48
	AC/DC 110~130V	0.73	0.75	5.8	S-UVT-120
	AC 200~240V/DC 250V	1.21	1.35	5.4	S-UVT-230
	AC 380~440V	1.67	-	3.8	S-UVT-410
	AC 440~480V	1.68	-	3.5	S-UVT-460
Max.opening time (msec)		50			
Tightening torque of terminal screw		7.1 lb.in.			
Transformer operating voltage (V) - Drop (Circuit breaker trips) - Rise (Circuit breaker can be switched on)		0.7~1.35Vn ~0.85Vn			

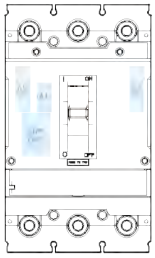
Installation - Maximum possibilities

Position	Accessory	TD125	TS250	TS400	TS800
Left	S-AX	–	1	3	3
	S-AL	1	1	–	–
	S-SHT or S-UVT	1	1	1	1
Right	S-AX	2	1	–	–
	S-AL	–	–	1	2

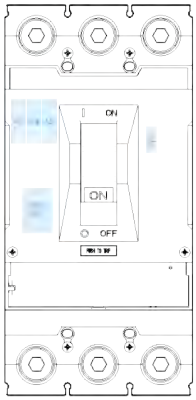
TD125



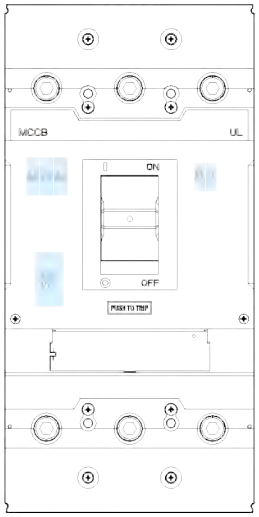
TS250



TS400

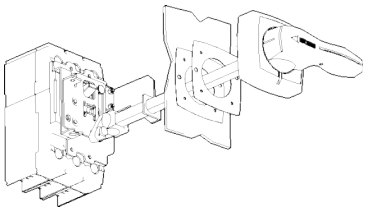


TS800



Accessories

Handle Kits





Extended Rotary Handle Kits*

Shaft length: 12”, (16”, 24”, upon request)

Frame Type	Cat. No. NEMA 1, 3R, 12	Cat. No. NEMA 4X
TD125	S-EHU1-12	S-EHU1-12/NEMA 4X
TS250	S-EHU2-12	S-EHU2-12/NEMA 4X
TS400	S-EHU3-12	S-EHU3-12/NEMA 4X
TS800	S-EHU4-12	S-EHU4-12/NEMA 4X

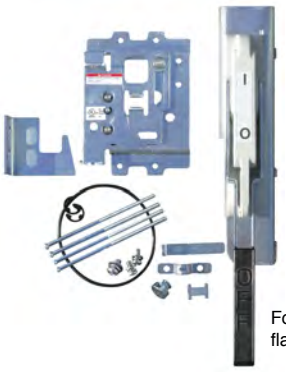
Dimensions (see page 75)

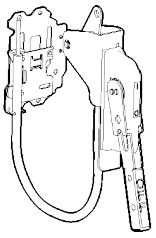
Flange Handle Kits*

Frame Type	Cable** Length	Cat. No. NEMA 1, 3R, 12
TD125	36”	S-FH1-36
TS250	48”	S-FH2-48
TS400	60”	S-FH3-60
TS800	72”	S-FH4-72

* Kits include all necessary hardware to mount to MCCB

*** Longer cable available upon request.*





Flange handle
(Cable operating handle)

For use with only right handed flange type enclosures.

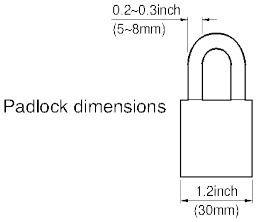
Locking Devices

Fixed Locking Device

MCCB	Function	Cat. No. Padlockable Device
TD125	OFF or ON position	S-PHL1
TS250	OFF or ON position	S-PHL2
TS400	OFF or ON position	S-PHL3
TS800	OFF or ON position	S-PHL4

Padlocks are not supplied.



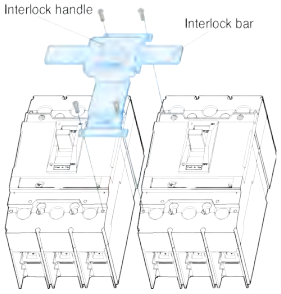


Mechanical Interlocking Device

MCCB	Cat. No. Interlocking Device
TD125	S-MIT13
TS250	S-MIT23
TS400	S-MIT33
TS800	S-MIT43

Padlocks are not supplied.



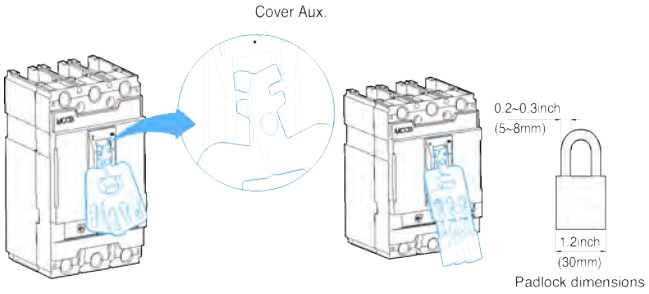


Removable Locking Device

MCCB	Function	Cat. No. Padlockable device
TD125	OFF position	S-PL1
TS250	OFF position	S-PL2
TS400	OFF position	S-PL3
TS800	OFF position	S-PL4

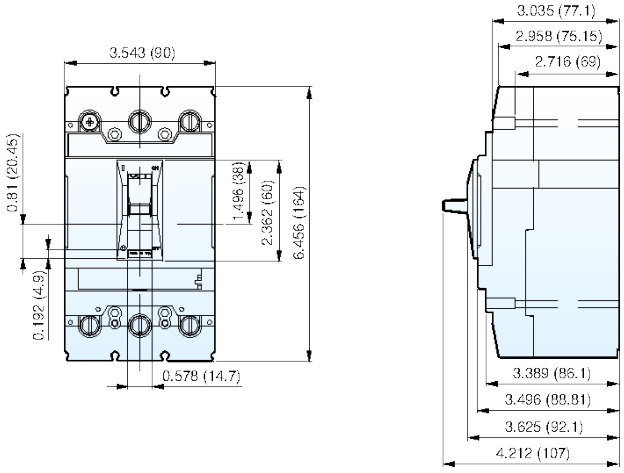
Padlocks are not supplied.



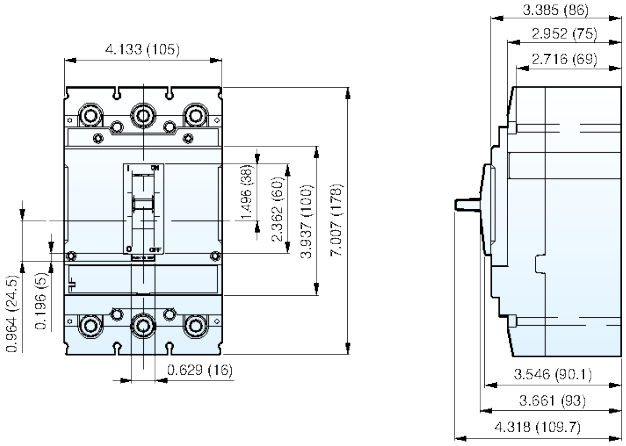


TD / TS Series Circuit Breakers Dimensions

TD125



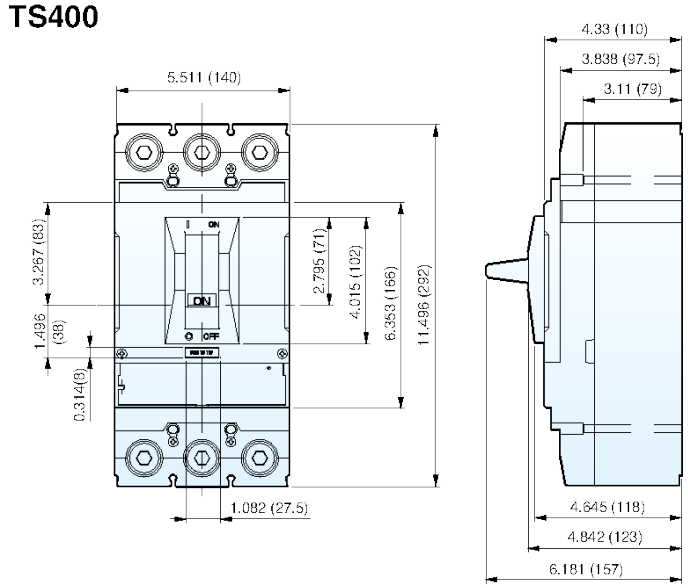
TS250



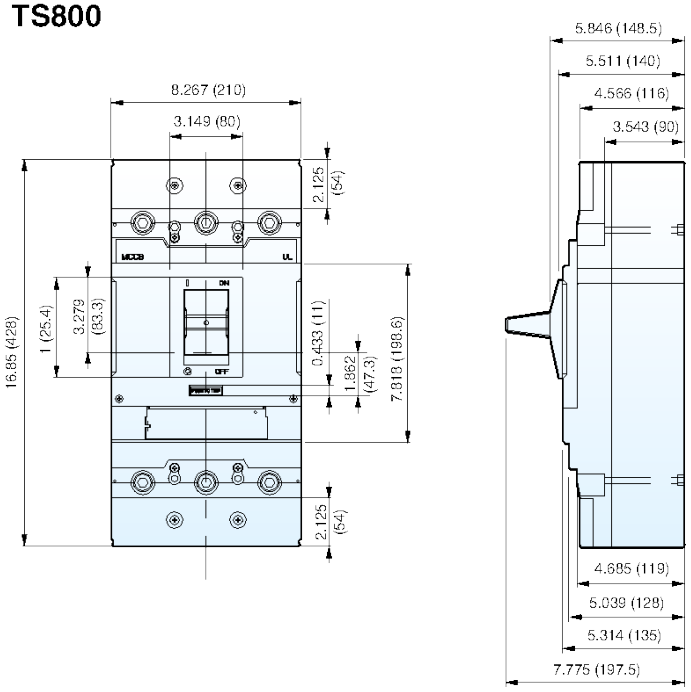
Dimensions shown in inches (mm)

TD / TS Series Circuit Breakers Dimensions

TS400



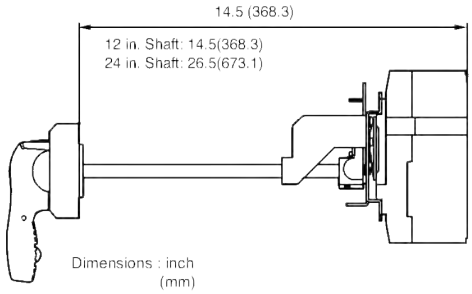
TS800



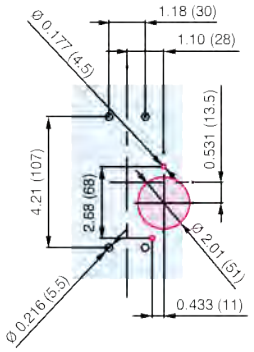
Dimensions shown in inches (mm)

Overall Dimensions - Extended Rotary Handles

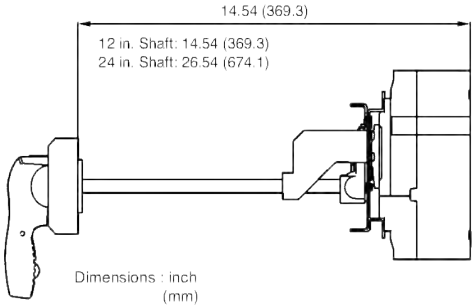
TD125

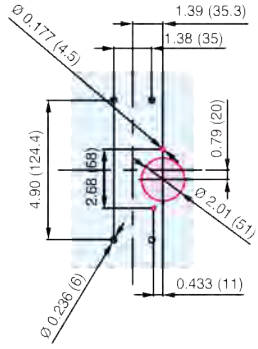


Panel drilling

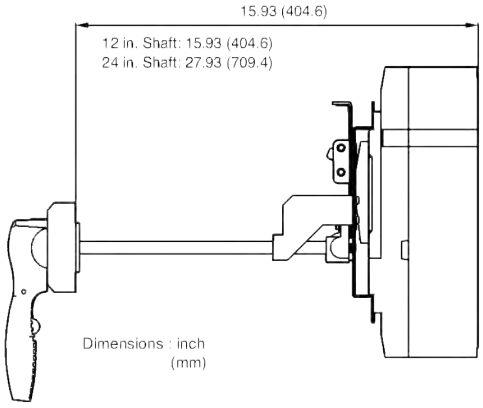


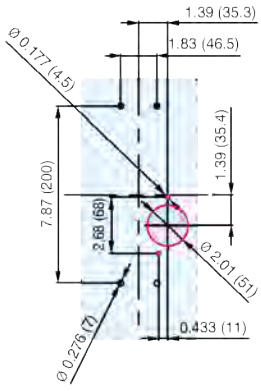
TS250



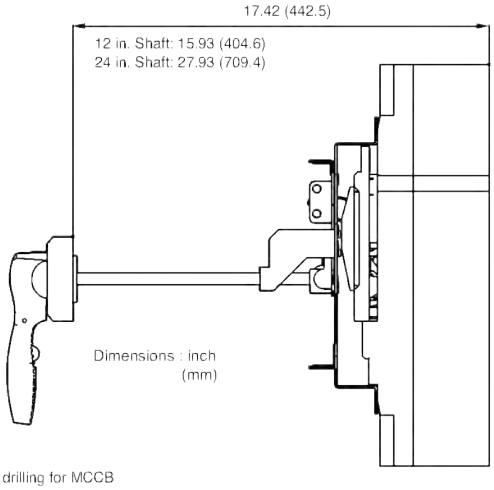


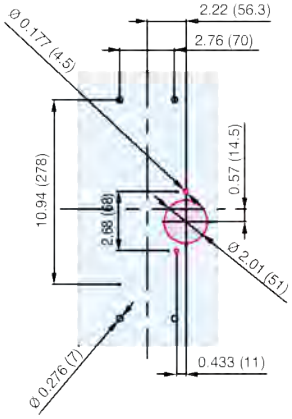
TS400





TS800

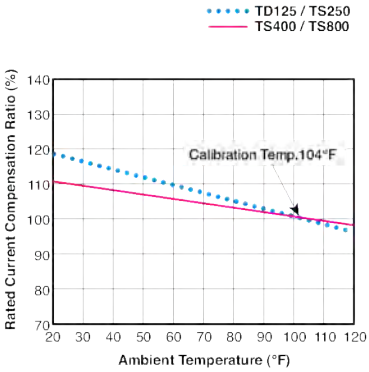




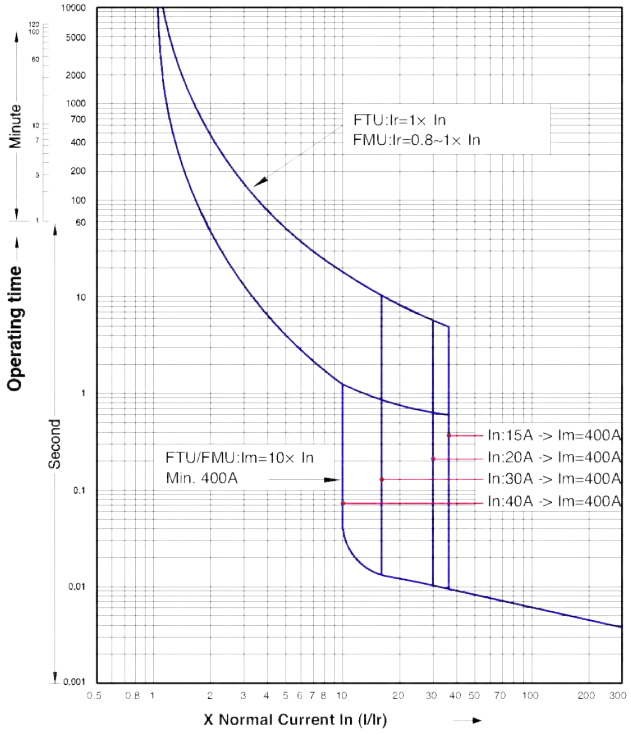
Panel drilling for MCCB

Panel drilling rotary handle

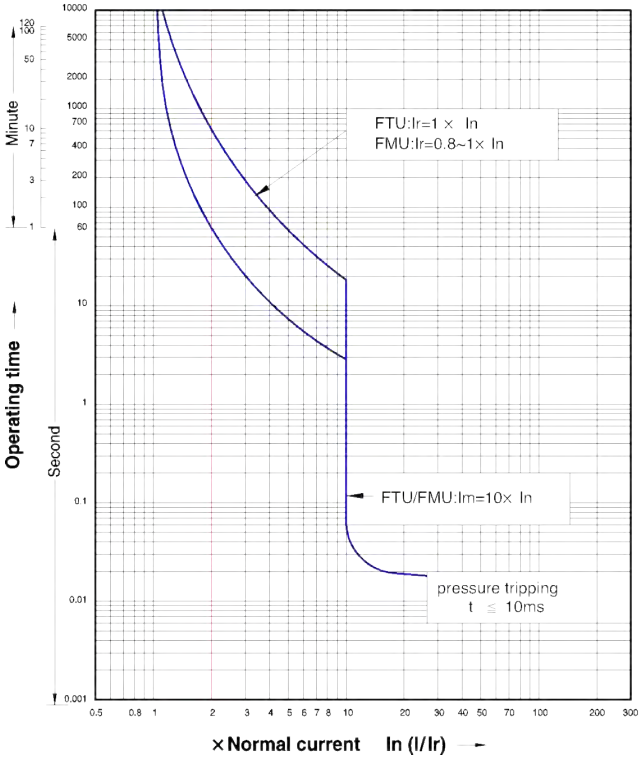
TD / TS Series Circuit Breakers Trip Curves



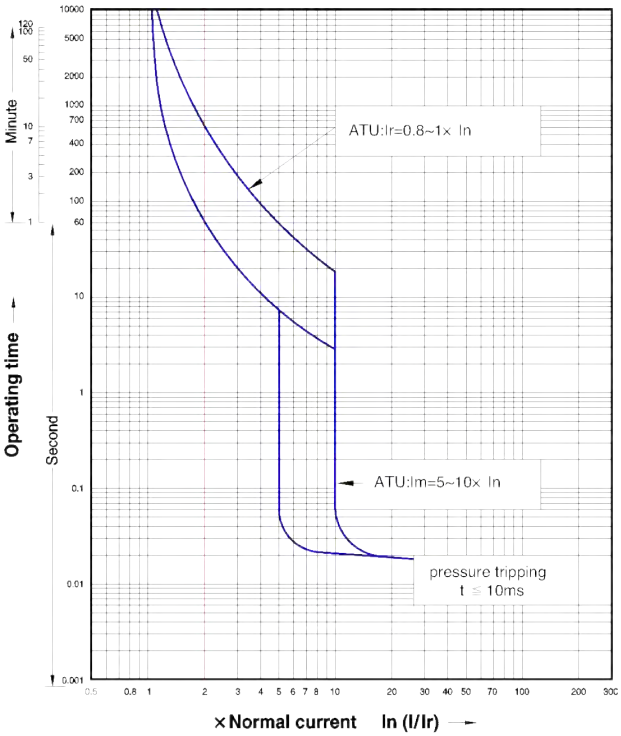
TD125 - FTU/FMU; 15~125A



TS250 - FTU/FMU; 150~250A

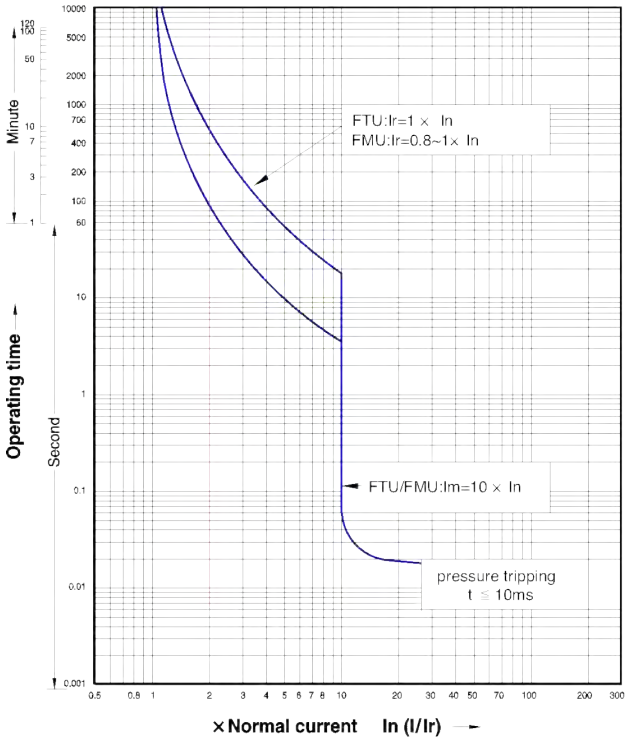


TS250 - ATU; 160~250A

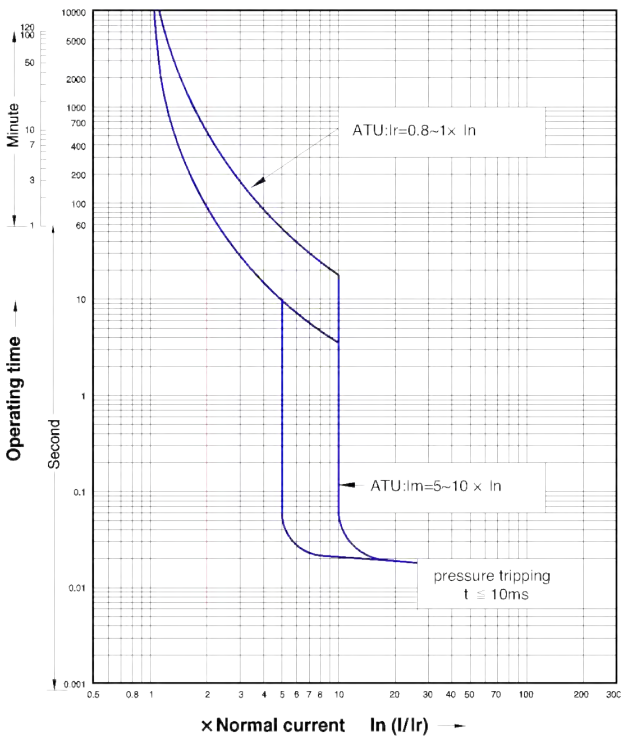


TD / TS Series
Circuit Breakers
Trip Curves

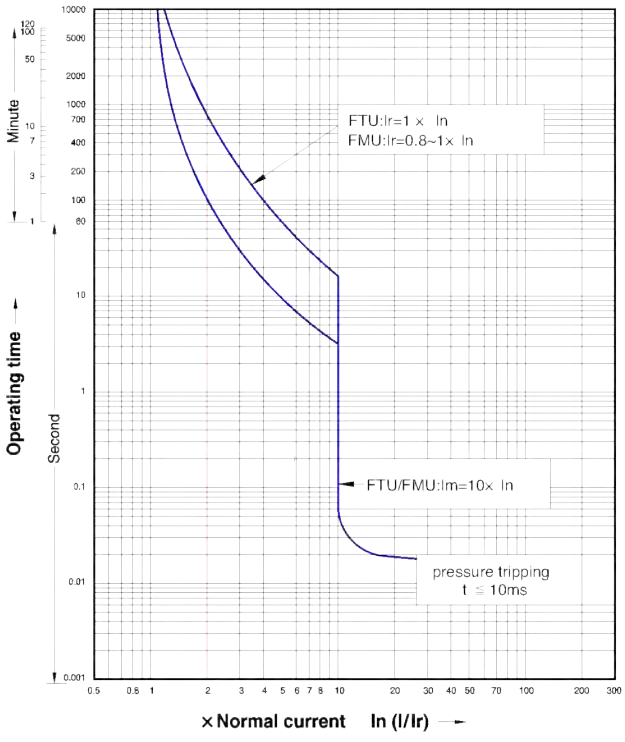
TS400 - FTU/FMU; 300~400A



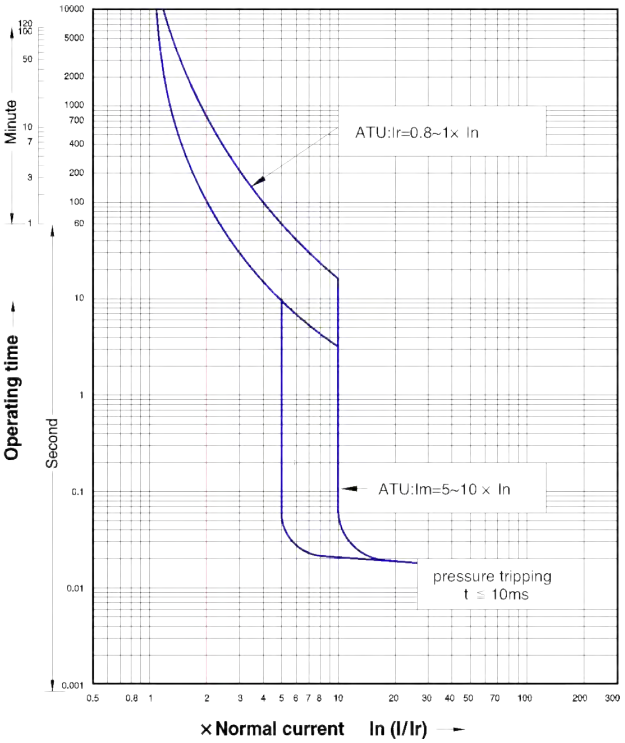
TS400 - ATU; 300~400A



TS800 - FTU/FMU; 500~800A



TS800 - ATU; 500~800A



FI Earth Leakage Circuit Breakers

FI compact Earth Leakage Circuit Breakers detect and interrupt earth (ground) faults. They are VDE approved for the European system of protecting people, animals, equipment and property from dangerous line-to-ground and shock hazard currents.

US applications include ground-fault protection of equipment (GFPE) using the 10mA and 30mA fault current ratings, especially when high distributed capacitance or other leakages cause excessive nuisance trips at lower fault currents. Applications for the 300mA rating are equipment protection and fire prevention, limiting the energy of a fault to less than the minimum ignition energy for many materials.

Type Designation

(a) (b) • (c)

(a) = 2-2 pole; 4-4 pole
(b) = 1-16A; 2-25A; 3-40A; 4-63A
(c) = 01 - 10mA
= 03 - 30mA
= 30 - 300mA



FI 2



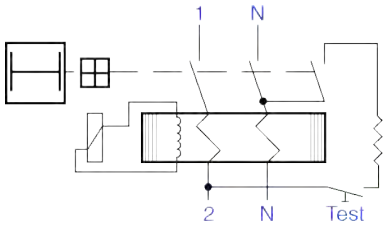
FI 4[a]

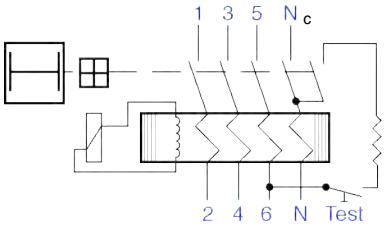
Maximum Rated Line Current	Fault Trip Current	Type	Cat. No.		Fault Trip Current	Type	Cat. No.	
16A	10mA	FI 21.01	**15.921**					
25A	30mA	FI 22.03	**15.922**		30mA	FI 42.03	**15.926**	
25A	300mA	FI 22.30	**15.924**		300mA	FI 42.30	**15.929**	
40A	30mA	FI 23.03	**15.923**		30mA	FI 43.03	**15.927**	
40A	300mA	FI 23.30	**15.925**		300mA	FI 43.30	**15.930**	
63A					30mA	FI 44.03	**15.928**	
63A					300mA	FI 44.30	**15.931**	

Earth Leakage Circuit Breaker with Auxiliary Contacts[b]					Earth Leakage Circuit Breaker with Auxiliary Contacts[b]			
25A	30mA	FI 22.03Y	**15.932**		30mA	FI 42.03Y	**15.933**	
40A	30mA	FI 23.03Y	**15.934**		30mA	FI 43.03Y	**15.935**	
63A					30mA	FI 44.03Y	**15.936**	

Voltage Rating (maximum)	240VAC, 50/60Hz (VDE: 125/220VAC, 50Hz)	415VAC, 50/60Hz (400Hz available on request) (VDE: 220/380VAC, 50Hz)
Short Circuit Capacity	Up to rated current (RC) 40A = 1.5kA, RC 63A = 2kA. 10kA in combination with series fuse of European Operation Class gL/gG: RC 16A = 63A fuse, RC 25/40A = 80A fuse, RC 63A = 100A fuse.	
Fault Trip Current Calibration	FI trips are calibrated at less than fault trip current for ensured safety (Typical trip range between 66.6-83.3% fault trip current, e.g., typical trip at 20-25mA for fault RC of 30mA)	
Typical Life	Fully functional after 4,000 operations to DIN/VDE 0664 (CEE27) and 16000 additional fault current trips.	
Standard Pack and Weight	1/290g (0.64 lb.); 1/390g (0.86 lb.) with auxiliary contact	1/450g (1.0 lb.) 1/550g (1.21 lb.) with auxiliary contact
Terminal Size Acceptability	16-6 AWG	14-3 AWG

Equivalent Circuit





[a] For 2-Phase applications, terminal 5 and 6 (next to Neutral terminals) must be connected to one phase for the test circuit to be operable.

[b] Provided with mounted Auxiliary Switch, one N.O., one N.C. isolated feedthrough contact (Form X double make and Y double break), which adds 9mm (.35 in.) to the width dimension.

[c] For voltage systems without a neutral conductor. Please use jumper from "1" or "3" to top "N" terminal. This will assure proper functioning of the "test" circuit.

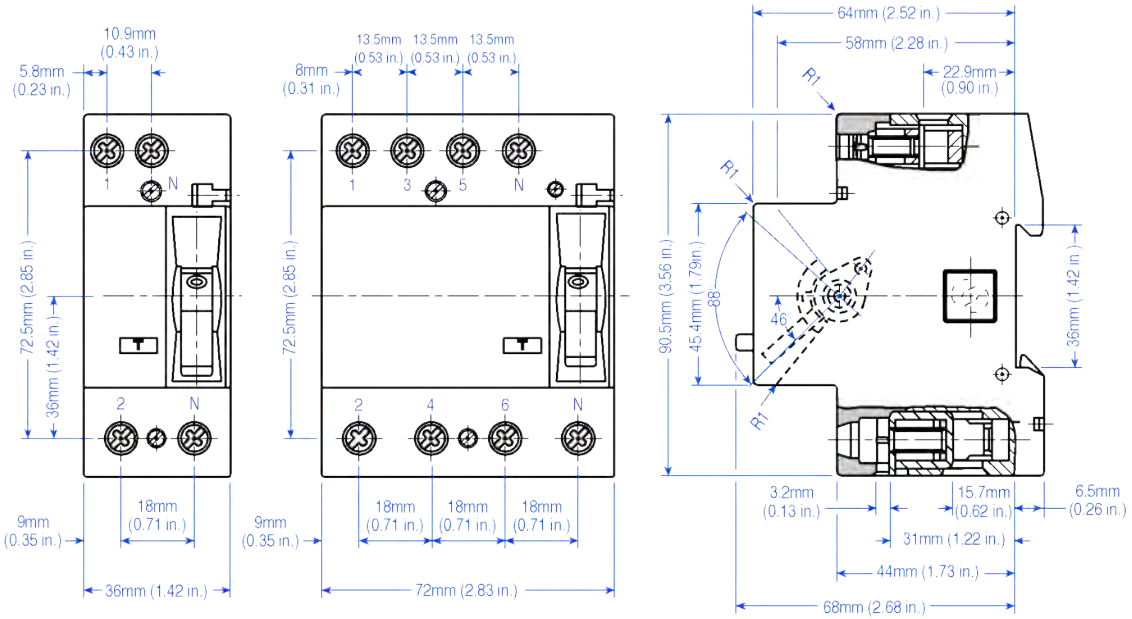
Note: If the power system has a marked conductor, it must connect through the FI and not be grounded at any point downstream.

HFI11 - Auxiliary Switch



Contact Rating	Wire Size	Type	Cat. No.
6A / 230V AC 1A / 220V DC or pulsed	4mm² (12 AWG)	HFI11	**15.991**

Std. Pk.: 1
Unit Weight: 45 grams (0.12 lb.)
Width: 9mm (.354in.)



FI 2 **FI 4** **FI 2 and FI 4**

Temperature Range	Environmental Information marked with “Snowflake” approval for -25°C to 40°C (-13°F to 104°F) ambient temperature. (Temperature effect on RC: for every 10°C temperature rise above 40°C decrease RC by 7%.)
Fluctuating Climate Conditions	To maximum 45°C, 95% relative humidity.
Electrical Shock Protection	Uninsulated electrically live parts within 30mm of the operating handle are “finger safe” (terminal screw heads) and uninsulated live parts within 100mm of the operating handle are “back-of-hand safe” (terminals).
Impact/Shock Protection	15g with impact force half-cycle sinusoidal and 11ms duration, 18 impacts total with 6 on each principal axis (3 impacts each face). FI is DIN Rail mounted during the test, and electrically loaded with 25% of Fault RC. Successful testing required no trip during the test, no damage and no loosened parts.
Vibration/Seismic Resistance	5g, at frequency of 55Hz to 2,000Hz, applied for 35 ± 5 minutes along each of the three principal axes, plus 5 minutes of application at every established critical resonant frequency. FI is DIN Rail mounted during the test, and loaded with 25% Fault RC. To pass, the FI did not trip at 25% Fault RC, but did trip between each of the principal axis tests when the fault current was raised to 125% Fault RC, and there was no damage and no loosened parts. Suitable for machinery and mobile vehicle applications.
Housing Class	Ingress Protection (IP) Class 40; internal working components and live parts (excluding terminals) are protected against ingress of solid objects greater than 1mm diameter (class 4-), but have no protection from ingress of water (class-0).
Non-Sinusoidal Fault	The FI is tested and approval stamped for tripping sensitivity to non-sinusoidal fault currents, which become zero or almost zero within one cycle of the line frequency. Waveforms and allowed trip-current ranges are as follows: 1. AC Sinusoidal Fault - 0.5-1.0 times Fault RC 2a. Pulsating DC Fault; Positive and Negative Half-Waves - 0.35-1.4 times Fault RC 2b. Phased Half-Wave, 90° - 0.25-1.4 times Fault RC Phased Half-Wave, 135° - 0.11-1.4 times Fault RC 3. Pulsating DC on 6mA DC (continuous) Base - Max. 1.4 times Fault RC + 6mA
Insulation Category	At VDE rated voltage, suitable for Class C environments with relatively high dust and moisture levels and little HVAC control, e.g., industrial, commercial, agricultural; on machine tools, hoists, warehouse equipment, etc.; in boiler rooms, unheated storage, covered shipping/receiving, open workshops, etc.

EK Series Enclosures



Standard Features

- **Protection Level:** IP65 - Nema Type 4x
- **Technical:** Smooth Sidewalls
  Tinted Transparent Door
- **Enclosure Material:** Polycarbonate
- **Door Material:** Polycarbonate
- **Gasket Material:** Polyurethane
- **Temperature Range:** -35°C to 120°C (-31°F to 248°F)
- **Color:** Light Gray
- **Included Accessories:** 35mm DIN Rail
  2 ea. 9mm (0.35 in.) Filler Strips
  Label Strip

E208470
E254144

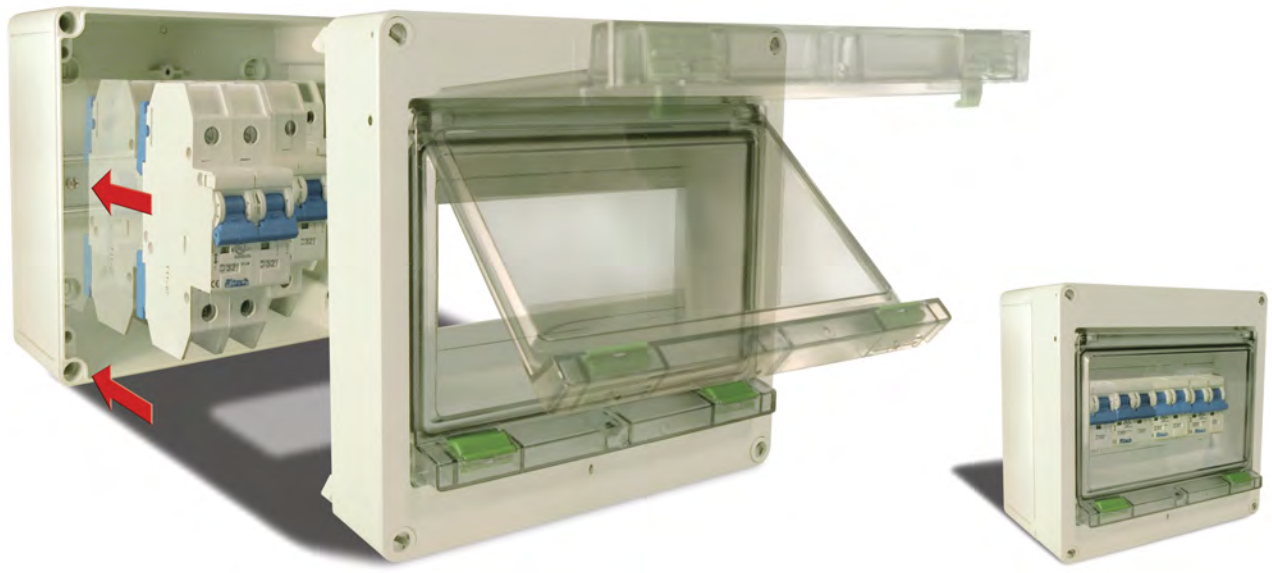
Cat. No.	Max # of* CB Poles	Height	Width	Depth
542-502	2-3*	130mm (5.12in.)	94mm (3.70in.)	80 mm (3.15in.)
542-504	4	180mm (7.09in.)	110mm (4.33in.)	110mm (4.33in.)
542-508	8	180mm (7.09in.)	182mm (7.17in.)	110mm (4.33in.)
542-512	12	180mm (7.09in.)	254mm (10.0in.)	110mm (4.33in.)
542-524	24	360mm (14.21in.)	254mm (10.0in.)	110mm (4.33in.)

Accessories

Key Lock
Cat. No. 548-102

Lock enclosure door to prevent unauthorized access to circuit breakers.





Old No.	New No.
1BU1.6	1B1.6UM
1BU10	1B10UM
1BU13	1B13UM
1BU15	1B15UM
1BU16	1B16UM
1BU1	1B1UM
1BU2.5	1B2.5UM
1BU20	1B20UM
1BU25	1B25UM
1BU2	1B2UM
1BU3.5	1B3.5UM
1BU30	1B30UM
1BU32	1B32UM
1BU3	1B3UM
1BU40	1B40UM
1BU4	1B4UM
1BU50	1B50UM
1BU5	1B5UM
1BU60	1B60UM
1BU63	1B63UM
1BU6	1B6UM
1CU03	1C03UM
1CU05	1C05UM
1CU075	1C075UM
1CU1.6	1C1.6UM
1CU10	1C10UM
1CU13	1C13UM
1CU15	1C15UM
1CU16	1C16UM
1CU1	1C1UM
1CU2.5	1C2.5UM
1CU20	1C20UM
1CU25	1C25UM
1CU2	1C2UM
1CU3.5	1C3.5UM
1CU30	1C30UM
1CU32	1C32UM
1CU3	1C3UM
1CU40	1C40UM
1CU4	1C4UM
1CU50	1C50UM
1CU5	1C5UM
1CU60	1C60UM
1CU63	1C63UM
1CU6	1C6UM
1CU8	1C8UM
1DU03	1D03UM
1DU05	1D05UM
1DU075	1D075UM
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1DU15	1D15UM
1DU16	1D16UM
1DU1	1D1UM
1DU2.5	1D2.5UM
1DU20	1D20UM
1DU25	1D25UM
1DU2	1D2UM
1DU3.5	1D3.5UM
1DU30	1D30UM
1DU32	1D32UM
1DU3	1D3UM
1DU40	1D40UM
1DU4	1D4UM
1DU50	1D50UM
1DU5	1D5UM
1DU60	1D60UM
1DU63	1D63UM
1DU6	1D6UM
1DU8	1D8UM
1EU03	1E03UM
1EU05	1E05UM
1EU075	1E075UM
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1EU125	1E125UM
1EU12	1E12UM
1EU13	1E13UM
1EU15	1E15UM
1EU16	1E16UM
1EU1	1E1UM
1EU2.5	1E2.5UM
1EU20	1E20UM
1EU25	1E25UM
1EU2	1E2UM
1EU3.5	1E3.5UM
1EU30	1E30UM
1EU32	1E32UM
1EU3	1E3UM
1EU40	1E40UM
1EU4	1E4UM
1EU50	1E50UM
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1GU125	1G125UM
1GU12	1G12UM
1GU13	1G13UM
1GU15	1G15UM
1GU16	1G16UM
1GU1	1G1UM
1GU2.5	1G2.5UM
1GU20	1G20UM
1GU25	1G25UM
1GU2	1G2UM
1GU3.5	1G3.5UM
1GU30	1G30UM
1GU32	1G32UM
1GU3	1G3UM
1GU40	1G40UM
1GU4	1G4UM
1GU50	1G50UM
1GU5	1G5UM
1GU60	1G60UM
1GU63	1G63UM
1GU6	1G6UM
1GU8	1G8UM
1ZU03	1Z03UM
1ZU05	1Z05UM
1ZU075	1Z075UM
1ZU1.6	1Z1.6UM
1ZU10	1Z10UM
1ZU125	1Z125UM
1ZU12	1Z12UM
1ZU13	1Z13UM
1ZU15	1Z15UM
1ZU16	1Z16UM
1ZU1	1Z1UM
1ZU2.5	1Z2.5UM
1ZU20	1Z20UM
1ZU25	1Z25UM
1ZU2	1Z2UM
1ZU3.5	1Z3.5UM
1ZU30	1Z30UM
1ZU32	1Z32UM
1ZU3	1Z3UM
1ZU40	1Z40UM
1ZU4	1Z4UM
1ZU50	1Z50UM
1ZU5	1Z5UM
1ZU6	1Z6UM
1ZU8	1Z8UM
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2BU10	2B10UM
2BU13	2B13UM
2BU15	2B15UM
2BU16	2B16UM
2BU1	2B1UM
2BU2.5	2B2.5UM
2BU20	2B20UM
2BU25	2B25UM
2BU2	2B2UM
2BU3.5	2B3.5UM
2BU30	2B30UM
2BU32	2B32UM
2BU3	2B3UM
2BU40	2B40UM
2BU4	2B4UM
2BU50	2B50UM
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2CU10	2C10UM
2CU13	2C13UM
2CU15	2C15UM
2CU16	2C16UM
2CU1	2C1UM
2CU2.5	2C2.5UM
2CU20	2C20UM
2CU25	2C25UM
2CU2	2C2UM
2CU3.5	2C3.5UM
2CU30	2C30UM
2CU32	2C32UM
2CU3	2C3UM
2CU40	2C40UM
2CU4	2C4UM
2CU50	2C50UM
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2CU8	2C8UM
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2DU10	2D10UM
2DU13	2D13UM
2DU15	2D15UM
2DU16	2D16UM
2DU1	2D1UM
2DU2.5	2D2.5UM
2DU20	2D20UM
2DU25	2D25UM
2DU2	2D2UM
2DU3.5	2D3.5UM
2DU30	2D30UM
2DU32	2D32UM
2DU3	2D3UM
2DU40	2D40UM
2DU4	2D4UM
2DU50	2D50UM

UL508 Old to New Cross List

Old No.	New No.
2DU5	2D5UM
2DU60	2D60UM
2DU63	2D63UM
2DU6	2D6UM
2DU8	2D8UM
2EU03	2E03UM
2EU05	2E05UM
2EU075	2E075UM
2EU1.6	2E1.6UM
2EU10	2E10UM
2EU125	2E125UM
2EU12	2E12UM
2EU13	2E13UM
2EU15	2E15UM
2EU16	2E16UM
2EU1	2E1UM
2EU2.5	2E2.5UM
2EU20	2E20UM
2EU25	2E25UM
2EU2	2E2UM
2EU3.5	2E3.5UM
2EU30	2E30UM
2EU32	2E32UM
2EU3	2E3UM
2EU40	2E40UM
2EU4	2E4UM
2EU50	2E50UM
2EU5	2E5UM
2EU60	2E60UM
2EU63	2E63UM
2EU6	2E6UM
2EU8	2E8UM
2GU03	2G03UM
2GU05	2G05UM
2GU08	2G08UM
2GU1.6	2G1.6UM
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2GU125	2G125UM
2GU12	2G12UM
2GU13	2G13UM
2GU15	2G15UM
2GU16	2G16UM
2GU1	2G1UM
2GU2.5	2G2.5UM
2GU20	2G20UM
2GU25	2G25UM
2GU2	2G2UM
2GU3.5	2G3.5UM
2GU30	2G30UM
2GU32	2G32UM
2GU3	2G3UM
2GU40	2G40UM
2GU4	2G4UM
2GU50	2G50UM
2GU5	2G5UM
2GU60	2G60UM
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2GU6	2G6UM
2GU8	2G8UM
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2ZU05	2Z05UM
2ZU075	2Z075UM
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2ZU12	2Z12UM
2ZU13	2Z13UM
2ZU15	2Z15UM
2ZU16	2Z16UM
2ZU1	2Z1UM
2ZU2.5	2Z2.5UM
2ZU20	2Z20UM
2ZU25	2Z25UM
2ZU2	2Z2UM
2ZU3.5	2Z3.5UM
2ZU30	2Z30UM
2ZU32	2Z32UM
2ZU3	2Z3UM
2ZU40	2Z40UM
2ZU4	2Z4UM
2ZU50	2Z50UM
2ZU5	2Z5UM
2ZU6	2Z6UM
2ZU8	2Z8UM
3BU1.6	3B1.6UM
3BU10	3B10UM
3BU13	3B13UM
3BU15	3B15UM
3BU16	3B16UM
3BU1	3B1UM
3BU2.5	3B2.5UM
3BU20	3B20UM
3BU25	3B25UM
3BU2	3B2UM
3BU3.5	3B3.5UM
3BU30	3B30UM
3BU32	3B32UM
3BU3	3B3UM
3BU40	3B40UM
3BU4	3B4UM
3BU50	3B50UM
3BU5	3B5UM
3BU60	3B60UM
3BU63	3B63UM
3BU6	3B6UM
3CU03	3C03UM
3CU05	3C05UM
3CU075	3C075UM
3CU1.6	3C1.6UM
3CU10	3C10UM
3CU13	3C13UM
3CU15	3C15UM
3CU16	3C16UM
3CU1	3C1UM
3CU2.5	3C2.5UM
3CU20	3C20UM
3CU25	3C25UM
3CU2	3C2UM
3CU3.5	3C3.5UM
3CU30	3C30UM
3CU32	3C32UM
3CU3	3C3UM
3CU40	3C40UM
3CU4	3C4UM
3CU50	3C50UM
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3CU63	3C63UM
3CU6	3C6UM
3CU8	3C8UM
3DU03	3D03UM
3DU05	3D05UM
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3DU3.5	3D3.5UM
3DU30	3D30UM
3DU32	3D32UM
3DU3	3D3UM
3DU40	3D40UM
3DU4	3D4UM
3DU50	3D50UM
3DU5	3D5UM
3DU60	3D60UM
3DU63	3D63UM
3DU6	3D6UM
3DU8	3D8UM
3EU03	3E03UM
3EU05	3E05UM
3EU075	3E075UM
3EU1.6	3E1.6UM
3EU10	3E10UM
3EU125	3E125UM
3EU12	3E12UM
3EU13	3E13UM
3EU15	3E15UM
3EU16	3E16UM
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3EU63	3E63UM
3EU6	3E6UM
3EU8	3E8UM
3GU03	3G03UM
3GU05	3G05UM
3GU08	3G08UM
3GU1.6	3G1.6UM
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3GU15	3G15UM
3GU16	3G16UM
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3GU25	3G25UM
3GU2	3G2UM
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3GU30	3G30UM
3GU32	3G32UM
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3GU40	3G40UM
3GU4	3G4UM
3GU50	3G50UM
3GU5	3G5UM
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3GU6	3G6UM
3GU8	3G8UM
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3ZU075	3Z075UM
3ZU1.6	3Z1.6UM
3ZU10	3Z10UM
3ZU125	3Z125UM
3ZU12	3Z12UM

Old No.	New No.
3ZU13	3Z13UM
3ZU15	3Z15UM
3ZU16	3Z16UM
3ZU1	3Z1UM
3ZU2.5	3Z2.5UM
3ZU20	3Z20UM
3ZU25	3Z25UM
3ZU2	3Z2UM
3ZU3.5	3Z3.5UM
3ZU30	3Z30UM
3ZU32	3Z32UM
3ZU3	3Z3UM
3ZU40	3Z40UM
3ZU4	3Z4UM
3ZU50	3Z50UM
3ZU5	3Z5UM
3ZU6	3Z6UM
3ZU8	3Z8UM
2BNU1	2B1UM + N63UM
2BNU1.6	2B1UM + N63UM
2BNU10	2B1UM + N63UM
2BNU13	2B1UM + N63UM
2BNU15	2B1UM + N63UM
2BNU16	2B1UM + N63UM
2BNU2	2B1UM + N63UM
2BNU2.5	2B1UM + N63UM
2BNU20	2B1UM + N63UM
2BNU25	2B1UM + N63UM
2BNU3	2B1UM + N63UM
2BNU3.5	2B1UM + N63UM
2BNU30	2B1UM + N63UM
2BNU32	2B1UM + N63UM
2BNU4	2B1UM + N63UM
2BNU40	2B1UM + N63UM
2BNU5	2B1UM + N63UM
2BNU50	2B1UM + N63UM
2BNU6	2B1UM + N63UM
2BNU60	2B1UM + N63UM
2BNU63	2B1UM + N63UM
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2CNU05	2B1UM + N63UM
2CNU075	2B1UM + N63UM
2CNU1	2B1UM + N63UM
2CNU1.6	2B1UM + N63UM
2CNU10	2B1UM + N63UM
2CNU13	2B1UM + N63UM
2CNU15	2B1UM + N63UM
2CNU16	2B1UM + N63UM
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2DNU05	2B1UM + N63UM
2DNU075	2B1UM + N63UM
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2DNU15	2B1UM + N63UM
2DNU16	2B1UM + N63UM
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2DNU25	2B1UM + N63UM
2DNU3	2B1UM + N63UM
2DNU3.5	2B1UM + N63UM
2DNU30	2B1UM + N63UM
2DNU32	2B1UM + N63UM
2DNU4	2B1UM + N63UM
2DNU40	2B1UM + N63UM
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2DNU63	2B1UM + N63UM
2DNU8	2B1UM + N63UM
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2ENU15	2B1UM + N63UM
2ENU16	2B1UM + N63UM
2ENU2	2B1UM + N63UM
2ENU2.5	2B1UM + N63UM
2ENU20	2B1UM + N63UM
2ENU25	2B1UM + N63UM
2ENU3	2B1UM + N63UM
2ENU3.5	2B1UM + N63UM
2ENU30	2B1UM + N63UM
2ENU32	2B1UM + N63UM
2ENU4	2B1UM + N63UM
2ENU40	2B1UM + N63UM
2ENU5	2B1UM + N63UM
2ENU50	2B1UM + N63UM
2ENU6	2B1UM + N63UM
2ENU60	2B1UM + N63UM
2ENU63	2B1UM + N63UM
2ENU8	2B1UM + N63UM
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2GNU05	2B1UM + N63UM
2GNU08	2B1UM + N63UM
2GNU1	2B1UM + N63UM
2GNU1.6	2B1UM + N63UM
2GNU10	2B1UM + N63UM
2GNU12	2B1UM + N63UM
2GNU125	2B1UM + N63UM
2GNU13	2B1UM + N63UM
2GNU15	2B1UM + N63UM
2GNU16	2B1UM + N63UM
2GNU2	2B1UM + N63UM
2GNU2.5	2B1UM + N63UM
2GNU20	2B1UM + N63UM
2GNU25	2B1UM + N63UM
2GNU3	2B1UM + N63UM
2GNU3.5	2B1UM + N63UM
2GNU30	2B1UM + N63UM
2GNU32	2B1UM + N63UM
2GNU4	2B1UM + N63UM
2GNU40	2B1UM + N63UM
2GNU5	2B1UM + N63UM
2GNU50	2B1UM + N63UM
2GNU6	2B1UM + N63UM
2GNU60	2B1UM + N63UM
2GNU63	2B1UM + N63UM
2GNU8	2B1UM + N63UM
2ZNU03	2B1UM + N63UM
2ZNU05	2B1UM + N63UM
2ZNU075	2B1UM + N63UM
2ZNU1	2B1UM + N63UM
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2ZNU10	2B1UM + N63UM
2ZNU12	2B1UM + N63UM
2ZNU125	2B1UM + N63UM
2ZNU13	2B1UM + N63UM
2ZNU15	2B1UM + N63UM
2ZNU16	2B1UM + N63UM
2ZNU2	2B1UM + N63UM
2ZNU2.5	2B1UM + N63UM
2ZNU20	2B1UM + N63UM
2ZNU25	2B1UM + N63UM
2ZNU3	2B1UM + N63UM
2ZNU3.5	2B1UM + N63UM
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2ZNU4	2B1UM + N63UM
2ZNU5	2B1UM + N63UM
2ZNU6	2B1UM + N63UM
2ZNU8	2B1UM + N63UM
EASS	EASS
FA110U	FA110UM
FA12U	FA12UM
FA24U	FA24UM
FA48U	FA48UM
X	H10UM
H11U	H11UM
X	H12UM
X	H21UM
15.901U	MA016UM
15.902U	MA025UM
15.903U	MA040UM
15.904U	MA063UM
15.905U	MA1.0UM
15.906U	MA1.6UM
15.910U	MA10UM
15.911U	MA16UM
15.907U	MA2.5UM
15.912U	MA20UM
15.913U	MA25UM
15.914U	MA32UM
15.908U	MA4.0UM
15.915U	MA40UM
15.909U	MA6.3UM
UA120	UA120UM
UA240	UA220UM
UA277	X
UA415	X
UA480	X

Index

Part No.	Page
15.921	78
15.922	78
15.923	78
15.924	78
15.925	78
15.926	78
15.927	78
15.928	78
15.929	78
15.930	78
15.931	78
15.932	78
15.933	78
15.934	78
15.935	78
15.936	78
15.960	47
15.991	78
18/25CAP3P	43
1B1.6UM	24
1B10UM	24
1B13UM	24
1B15UM	24
1B16UM	24
1B1UM	24
1B2.5UM	24
1B20UM	24
1B25UM	24
1B2UM	24
1B3.5UM	24
1B30UM	24
1B32UM	24
1B3UM	24
1B40UM	24
1B4UM	24
1B50UM	24
1B5UM	24
1B60UM	24
1B63UM	24
1B6UM	24
1BU05R	13
1BU10R	13
1BU12R	13
1BU13R	13
1BU15R	13
1BU16R	13
1BU1R	13
1BU20R	13
1BU25R	13
1BU2R	13
1BU30R	13
1BU32R	13
1BU3R	13
1BU40R	13
1BU4R	13
1BU50R	13
1BU5R	13
1BU60R	13
1BU63R	13
1BU6R	13
1BU8R	13
1C03UM	25
1C05UM	25
1C075UM	25
1C1.6UM	25
1C10UM	25
1C13UM	25
1C15UM	25
1C16UM	25
1C1UM	25
1C2.5UM	25
1C20UM	25
1C25UM	25
1C2UM	25
1C3.5UM	25
1C30UM	25
1C32UM	25
1C3UM	25
1C40UM	25
1C4UM	25
1C50UM	25
1C5UM	25
1C60UM	25
1C63UM	25
1C6UM	25
1C8UM	25
1CU02L	53
1CU05L	53
1CU05R	14
1CU1.6L	53
1CU10L	53
1CU10R	14
1CU12L	53
1CU12R	14
1CU13L	53
1CU13R	14
1CU15L	53
1CU15R	14
1CU16L	53
1CU16R	14
1CU1L	53
1CU1R	14
1CU20L	53
1CU20R	14
1CU25L	53
1CU25R	14
1CU2L	53
1CU2R	14
1CU30L	53
1CU30R	14
1CU32L	53
1CU32R	14
1CU3L	53
1CU3R	14
1CU40L	53
1CU40R	14
1CU4L	53
1CU4R	14
1CU50L	53
1CU50R	14
1CU5L	53
1CU5R	14
1CU60L	53
1CU60R	14
1CU63L	53
1CU63R	14
1CU6L	53
1CU6R	14
1CU8L	53
1CU8R	14
1D03UM	26
1D05UM	26
1D075UM	26
1D1.6UM	26
1D10UM	26
1D13UM	26
1D15UM	26
1D16UM	26
1D1UM	26
1D2.5UM	26
1D20UM	26
1D25UM	26
1D2UM	26
1D3.5UM	26
1D30UM	26
1D32UM	26
1D3UM	26
1D40UM	26
1D4UM	26
1D50UM	26
1D5UM	26
1D60UM	26
1D63UM	26
1D6UM	26
1D8UM	26
1DU02L	54
1DU05L	54
1DU05R	15
1DU1.6L	54
1DU10L	54
1DU10R	15
1DU12L	54
1DU12R	15
1DU13L	54
1DU13R	15
1DU15L	54
1DU15R	15
1DU16L	54
1DU16R	15
1DU1L	54
1DU1R	15
1DU20L	54
1DU20R	15
1DU25L	54
1DU25R	15
1DU2L	54
1DU2R	15
1DU30L	54
1DU30R	15
1DU32L	54
1DU32R	15
1DU3L	54
1DU3R	15
1DU40L	54
1DU40R	15
1DU4L	54
1DU4R	15
1DU50L	54
1DU50R	15
1DU5L	54
1DU5R	15
1DU60L	54
1DU60R	15
1DU63L	54
1DU63R	15
1DU6L	54
1DU6R	15
1DU8L	54
1DU8R	15
1E03UM	27
1E05UM	27
1E075UM	27
1E1.6UM	27
1E10UM	27
1E125UM	27
1E12UM	27
1E13UM	27
1E15UM	27
1E16UM	27
1E1UM	27
1E2.5UM	27
1E20UM	27
1E25UM	27
1E2UM	27
1E3.5UM	27
1E30UM	27
1E32UM	27
1E3UM	27
1E40UM	27
1E4UM	27
1E50UM	27
1E5UM	27
1E60UM	27
1E63UM	27
1E6UM	27
1E8UM	27
1G03UM	28
1G05UM	28
1G08UM	28
1G1.6UM	28
1G10UM	28
1G125UM	28
1G12UM	28
1G13UM	28
1G15UM	28
1G16UM	28
1G1UM	28
1G2.5UM	28
1G20UM	28
1G25UM	28
1G2UM	28
1G3.5UM	28
1G30UM	28
1G32UM	28
1G3UM	28
1G40UM	28
1G4UM	28
1G50UM	28
1G5UM	28
1G60UM	28
1G63UM	28
1G6UM	28
1G8UM	28
1P16UL3/12	60
1P16UL3/18	60
1P16UL3/6	60
1P18U1/10	36
1P18U1/11	36
1P18U1/12	36
1P18U1/13	36
1P18U1/14	36
1P18U1/15	36
1P18U1/16	36
1P18U1/17	36
1P18U1/18	36
1P18U1/19	36
1P18U1/2	36
1P18U1/20	36
1P18U1/21	36
1P18U1/22	36
1P18U1/23	36
1P18U1/24	36
1P18U1/25	36
1P18U1/26	36
1P18U1/27	36
1P18U1/28	36
1P18U1/29	36
1P18U1/3	36
1P18U1/30	36
1P18U1/31	36
1P18U1/32	36
1P18U1/33	36
1P18U1/34	36
1P18U1/35	36
1P18U1/36	36
1P18U1/37	36
1P18U1/38	36
1P18U1/39	36
1P18U1/4	36
1P18U1/40	36
1P18U1/41	36
1P18U1/42	36
1P18U1/43	36
1P18U1/44	36
1P18U1/45	36
1P18U1/46	36
1P18U1/47	36
1P18U1/48	36
1P18U1/49	36
1P18U1/5	36
1P18U1/50	36
1P18U1/51	36
1P18U1/52	36
1P18U1/53	36
1P18U1/54	36

Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page
1P18U1/55	36	1Z40UM	29	2C3.5UM	25	2D13UM	26	2DU6R	15
1P18U1/56	36	1Z4UM	29	2C30UM	25	2D15UM	26	2DU8L	54
1P18U1/57	36	1Z50UM	29	2C32UM	25	2D16UM	26	2DU8R	15
1P18U1/6	36	1Z5UM	29	2C3UM	25	2D1UM	26	2E03UM	27
1P18U1/7	36	1Z6UM	29	2C40UM	25	2D2.5UM	26	2E05UM	27
1P18U1/8	36	1Z8UM	29	2C4UM	25	2D20UM	26	2E075UM	27
1P18U1/9	36	2B1.6UM	24	2C50UM	25	2D25UM	26	2E1.6UM	27
1P18U1H/10	37	2B10UM	24	2C5UM	25	2D2UM	26	2E10UM	27
1P18U1H/11	37	2B13UM	24	2C60UM	25	2D3.5UM	26	2E125UM	27
1P18U1H/12	37	2B15UM	24	2C63UM	25	2D30UM	26	2E12UM	27
1P18U1H/13	37	2B16UM	24	2C6UM	25	2D32UM	26	2E13UM	27
1P18U1H/14	37	2B1UM	24	2C8UM	25	2D3UM	26	2E15UM	27
1P18U1H/15	37	2B2.5UM	24	2CU02L	53	2D40UM	26	2E16UM	27
1P18U1H/16	37	2B20UM	24	2CU05L	53	2D4UM	26	2E1UM	27
1P18U1H/17	37	2B25UM	24	2CU05R	14	2D50UM	26	2E2.5UM	27
1P18U1H/18	37	2B2UM	24	2CU1.6L	53	2D5UM	26	2E20UM	27
1P18U1H/19	37	2B3.5UM	24	2CU10L	53	2D60UM	26	2E25UM	27
1P18U1H/2	37	2B30UM	24	2CU10R	14	2D63UM	26	2E2UM	27
1P18U1H/20	37	2B32UM	24	2CU12L	53	2D6UM	26	2E3.5UM	27
1P18U1H/21	37	2B3UM	24	2CU12R	14	2D8UM	26	2E30UM	27
1P18U1H/22	37	2B40UM	24	2CU13L	53	2DU02L	54	2E32UM	27
1P18U1H/23	37	2B4UM	24	2CU13R	14	2DU05L	54	2E3UM	27
1P18U1H/24	37	2B50UM	24	2CU15L	53	2DU05R	15	2E40UM	27
1P18U1H/25	37	2B5UM	24	2CU15R	14	2DU1.6L	54	2E4UM	27
1P18U1H/26	37	2B60UM	24	2CU16L	53	2DU10L	54	2E50UM	27
1P18U1H/27	37	2B63UM	24	2CU16R	14	2DU10R	15	2E5UM	27
1P18U1H/28	37	2B6UM	24	2CU1L	53	2DU12L	54	2E60UM	27
1P18U1H/29	37	2BU05R	13	2CU1R	14	2DU12R	15	2E63UM	27
1P18U1H/3	37	2BU10R	13	2CU20L	53	2DU13L	54	2E6UM	27
1P18U1H/30	37	2BU12R	13	2CU20R	14	2DU13R	15	2E8UM	27
1P18U1H/31	37	2BU13R	13	2CU25L	53	2DU15L	54	2G03UM	28
1P18U1H/32	37	2BU15R	13	2CU25R	14	2DU15R	15	2G05UM	28
1P18U1H/33	37	2BU16R	13	2CU2L	53	2DU16L	54	2G08UM	28
1P18U1H/34	37	2BU1R	13	2CU2R	14	2DU16R	15	2G1.6UM	28
1P18U1H/35	37	2BU20R	13	2CU30L	53	2DU1L	54	2G10UM	28
1P18U1H/36	37	2BU25R	13	2CU30R	14	2DU1R	15	2G125UM	28
1P18U1H/4	37	2BU2R	13	2CU32L	53	2DU20L	54	2G12UM	28
1P18U1H/5	37	2BU30R	13	2CU32R	14	2DU20R	15	2G13UM	28
1P18U1H/6	37	2BU32R	13	2CU3L	53	2DU25L	54	2G15UM	28
1P18U1H/7	37	2BU3R	13	2CU3R	14	2DU25R	15	2G16UM	28
1P18U1H/8	37	2BU40R	13	2CU40L	53	2DU2L	54	2G1UM	28
1P18U1H/9	37	2BU4R	13	2CU40R	14	2DU2R	15	2G2.5UM	28
1Z03UM	29	2BU50R	13	2CU4L	53	2DU30L	54	2G20UM	28
1Z05UM	29	2BU5R	13	2CU4R	14	2DU30R	15	2G25UM	28
1Z075UM	29	2BU60R	13	2CU50L	53	2DU32L	54	2G2UM	28
1Z1.6UM	29	2BU63R	13	2CU50R	14	2DU32R	15	2G3.5UM	28
1Z10UM	29	2BU6R	13	2CU5L	53	2DU3L	54	2G30UM	28
1Z125UM	29	2BU8R	13	2CU5R	14	2DU3R	15	2G32UM	28
1Z12UM	29	2C03UM	25	2CU60L	53	2DU40L	54	2G3UM	28
1Z13UM	29	2C05UM	25	2CU60R	14	2DU40R	15	2G40UM	28
1Z15UM	29	2C075UM	25	2CU63L	53	2DU4L	54	2G4UM	28
1Z16UM	29	2C1.6UM	25	2CU63R	14	2DU4R	15	2G50UM	28
1Z1UM	29	2C10UM	25	2CU6L	53	2DU50L	54	2G5UM	28
1Z2.5UM	29	2C13UM	25	2CU6R	14	2DU50R	15	2G60UM	28
1Z20UM	29	2C15UM	25	2CU8L	53	2DU5L	54	2G63UM	28
1Z25UM	29	2C16UM	25	2CU8R	14	2DU5R	15	2G6UM	28
1Z2UM	29	2C1UM	25	2D03UM	26	2DU60L	54	2G8UM	28
1Z3.5UM	29	2C2.5UM	25	2D05UM	26	2DU60R	15	2P16UL3/12	61
1Z30UM	29	2C20UM	25	2D075UM	26	2DU63L	54	2P16UL3/18	61
1Z32UM	29	2C25UM	25	2D1.6UM	26	2DU63R	15	2P16UL3/6	61
1Z3UM	29	2C2UM	25	2D10UM	26	2DU6L	54	2P18U3/10	38

Index

Part No.	Page
2P18U3/12	38
2P18U3/14	38
2P18U3/16	38
2P18U3/18	38
2P18U3/20	38
2P18U3/22	38
2P18U3/24	38
2P18U3/26	38
2P18U3/28	38
2P18U3/30	38
2P18U3/32	38
2P18U3/34	38
2P18U3/36	38
2P18U3/38	38
2P18U3/4	38
2P18U3/40	38
2P18U3/42	38
2P18U3/44	38
2P18U3/46	38
2P18U3/48	38
2P18U3/50	38
2P18U3/52	38
2P18U3/54	38
2P18U3/56	38
2P18U3/6	38
2P18U3/8	38
2P18U3H/10	39
2P18U3H/12	39
2P18U3H/14	39
2P18U3H/16	39
2P18U3H/18	39
2P18U3H/20	39
2P18U3H/22	39
2P18U3H/24	39
2P18U3H/26	39
2P18U3H/28	39
2P18U3H/30	39
2P18U3H/32	39
2P18U3H/34	39
2P18U3H/36	39
2P18U3H/38	39
2P18U3H/4	39
2P18U3H/40	39
2P18U3H/42	39
2P18U3H/44	39
2P18U3H/46	39
2P18U3H/48	39
2P18U3H/50	39
2P18U3H/52	39
2P18U3H/54	39
2P18U3H/56	39
2P18U3H/6	39
2P18U3H/8	39
2P25U3/10	38
2P25U3/12	38
2P25U3/14	38
2P25U3/16	38
2P25U3/18	38
2P25U3/20	38
2P25U3/22	38
2P25U3/24	38
2P25U3/26	38
2P25U3/28	38
2P25U3/30	38
2P25U3/32	38
2P25U3/34	38
2P25U3/36	38
2P25U3/38	38
2P25U3/4	38
2P25U3/40	38
2P25U3/42	38
2P25U3/44	38
2P25U3/46	38
2P25U3/48	38
2P25U3/50	38
2P25U3/52	38
2P25U3/54	38
2P25U3/56	38
2P25U3/6	38
2P25U3/8	38
2P25U3H/10	39
2P25U3H/12	39
2P25U3H/14	39
2P25U3H/16	39
2P25U3H/18	39
2P25U3H/20	39
2P25U3H/22	39
2P25U3H/24	39
2P25U3H/26	39
2P25U3H/28	39
2P25U3H/30	39
2P25U3H/32	39
2P25U3H/34	39
2P25U3H/36	39
2P25U3H/38	39
2P25U3H/4	39
2P25U3H/40	39
2P25U3H/42	39
2P25U3H/44	39
2P25U3H/46	39
2P25U3H/48	39
2P25U3H/50	39
2P25U3H/52	39
2P25U3H/54	39
2P25U3H/56	39
2P25U3H/6	39
2P25U3H/8	39
2Z03UM	29
2Z05UM	29
2Z075UM	29
2Z1.6UM	29
2Z10UM	29
2Z125UM	29
2Z12UM	29
2Z13UM	29
2Z15UM	29
2Z16UM	29
2Z1UM	29
2Z2.5UM	29
2Z20UM	29
2Z25UM	29
2Z2UM	29
2Z3.5UM	29
2Z30UM	29
2Z32UM	29
2Z3UM	29
2Z40UM	29
2Z4UM	29
2Z50UM	29
2Z5UM	29
2Z6UM	29
2Z8UM	29
3B1.6UM	24
3B10UM	24
3B13UM	24
3B15UM	24
3B16UM	24
3B1UM	24
3B2.5UM	24
3B20UM	24
3B25UM	24
3B2UM	24
3B3.5UM	24
3B30UM	24
3B32UM	24
3B3UM	24
3B40UM	24
3B4UM	24
3B50UM	24
3B5UM	24
3B60UM	24
3B63UM	24
3B6UM	24
3BU05R	13
3BU10R	13
3BU12R	13
3BU13R	13
3BU15R	13
3BU16R	13
3BU1R	13
3BU20R	13
3BU25R	13
3BU2R	13
3BU30R	13
3BU32R	13
3BU3R	13
3BU40R	13
3BU4R	13
3BU50R	13
3BU5R	13
3BU60R	13
3BU63R	13
3BU6R	13
3BU8R	13
3C03UM	25
3C05UM	25
3C075UM	25
3C1.6UM	25
3C10UM	25
3C13UM	25
3C15UM	25
3C16UM	25
3C1UM	25
3C2.5UM	25
3C20UM	25
3C25UM	25
3C2UM	25
3C3.5UM	25
3C30UM	25
3C32UM	25
3C3UM	25
3C40UM	25
3C4UM	25
3C50UM	25
3C5UM	25
3C60UM	25
3C63UM	25
3C6UM	25
3C8UM	25
3CU02L	53
3CU05L	53
3CU05R	14
3CU1.6L	53
3CU10L	53
3CU10R	14
3CU12L	53
3CU12R	14
3CU13L	53
3CU13R	14
3CU15L	53
3CU15R	14
3CU16L	53
3CU16R	14
3CU1L	53
3CU1R	14
3CU20L	53
3CU20R	14
3CU25L	53
3CU25R	14
3CU2L	53
3CU2R	14
3CU30L	53
3CU30R	14
3CU32L	53
3CU32R	14
3CU3L	53
3CU3R	14
3CU40L	53
3CU40R	14
3CU4L	53
3CU4R	14
3CU50L	53
3CU50R	14
3CU5L	53
3CU5R	14
3CU60L	53
3CU60R	14
3CU63L	53
3CU63R	14
3CU6L	53
3CU6R	14
3CU8L	53
3CU8R	14
3D03UM	26
3D05UM	26
3D075UM	26
3D1.6UM	26
3D10UM	26
3D13UM	26
3D15UM	26
3D16UM	26
3D1UM	26
3D2.5UM	26
3D20UM	26
3D25UM	26
3D2UM	26
3D3.5UM	26
3D30UM	26
3D32UM	26
3D3UM	26
3D40UM	26
3D4UM	26
3D50UM	26
3D5UM	26
3D60UM	26
3D63UM	26
3D6UM	26
3D8UM	26
3DU02L	54
3DU05L	54
3DU05R	15
3DU1.6L	54
3DU10L	54
3DU10R	15
3DU12L	54
3DU12R	15
3DU13L	54
3DU13R	15
3DU15L	54
3DU15R	15
3DU16L	54
3DU16R	15
3DU1L	54
3DU1R	15
3DU20L	54
3DU20R	15
3DU25L	54
3DU25R	15
3DU2L	54
3DU2R	15
3DU30L	54
3DU30R	15
3DU32L	54
3DU32R	15
3DU3L	54
3DU3R	15
3DU40L	54
3DU40R	15
3DU4L	54
3DU4R	15
3DU50L	54
3DU50R	15
3DU5L	54
3DU5R	15
3DU60L	54

Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page
3DU60R	15	3P16UL3/12	62	3P25U3H/24	41	DC1CU2L	55	DC2DU10L	55
3DU63L	54	3P16UL3/18	62	3P25U3H/27	41	DC1CU30L	55	DC2DU12L	55
3DU63R	15	3P16UL3/6	62	3P25U3H/30	41	DC1CU32L	55	DC2DU13L	55
3DU6L	54	3P18U3/12	40	3P25U3H/33	41	DC1CU3L	55	DC2DU15L	55
3DU6R	15	3P18U3/15	40	3P25U3H/36	41	DC1CU40L	55	DC2DU16L	55
3DU8L	54	3P18U3/18	40	3P25U3H/39	41	DC1CU4L	55	DC2DU1L	55
3DU8R	15	3P18U3/21	40	3P25U3H/42	41	DC1CU50L	55	DC2DU20L	55
3E03UM	27	3P18U3/24	40	3P25U3H/45	41	DC1CU5L	55	DC2DU25L	55
3E05UM	27	3P18U3/27	40	3P25U3H/48	41	DC1CU60L	55	DC2DU2L	55
3E075UM	27	3P18U3/30	40	3P25U3H/51	41	DC1CU63L	55	DC2DU30L	55
3E1.6UM	27	3P18U3/33	40	3P25U3H/54	41	DC1CU6L	55	DC2DU32L	55
3E10UM	27	3P18U3/36	40	3P25U3H/57	41	DC1CU8L	55	DC2DU3L	55
3E125UM	27	3P18U3/39	40	3P25U3H/6	41	DC1DU02L	55	DC2DU40L	55
3E12UM	27	3P18U3/42	40	3P25U3H/9	41	DC1DU05L	55	DC2DU4L	55
3E13UM	27	3P18U3/45	40	3Z03UM	29	DC1DU1.6L	55	DC2DU50L	55
3E15UM	27	3P18U3/48	40	3Z05UM	29	DC1DU10L	55	DC2DU5L	55
3E16UM	27	3P18U3/51	40	3Z075UM	29	DC1DU12L	55	DC2DU60L	55
3E1UM	27	3P18U3/54	40	3Z1.6UM	29	DC1DU13L	55	DC2DU63L	55
3E2.5UM	27	3P18U3/57	40	3Z10UM	29	DC1DU15L	55	DC2DU6L	55
3E20UM	27	3P18U3/6	40	3Z125UM	29	DC1DU16L	55	DC2DU8L	55
3E25UM	27	3P18U3/9	40	3Z12UM	29	DC1DU1L	55	EASS	47
3E2UM	27	3P18U3H/12	41	3Z13UM	29	DC1DU20L	55	EASS2	17
3E3.5UM	27	3P18U3H/15	41	3Z15UM	29	DC1DU25L	55	EASS2L	57
3E30UM	27	3P18U3H/18	41	3Z16UM	29	DC1DU2L	55	FA110ACL	57
3E32UM	27	3P18U3H/21	41	3Z1UM	29	DC1DU30L	55	FA110ACR	17
3E3UM	27	3P18U3H/24	41	3Z2.5UM	29	DC1DU32L	55	FA110DCL	57
3E40UM	27	3P18U3H/27	41	3Z20UM	29	DC1DU3L	55	FA110DCR	17
3E4UM	27	3P18U3H/30	41	3Z25UM	29	DC1DU40L	55	FA110UM	46
3E50UM	27	3P18U3H/33	41	3Z2UM	29	DC1DU4L	55	FA120ACL	57
3E5UM	27	3P18U3H/36	41	3Z3.5UM	29	DC1DU50L	55	FA120ACR	17
3E60UM	27	3P18U3H/39	41	3Z30UM	29	DC1DU5L	55	FA12ACL	57
3E63UM	27	3P18U3H/42	41	3Z32UM	29	DC1DU60L	55	FA12ACR	17
3E6UM	27	3P18U3H/45	41	3Z3UM	29	DC1DU63L	55	FA12DCL	57
3E8UM	27	3P18U3H/48	41	3Z40UM	29	DC1DU6L	55	FA12DCR	17
3G03UM	28	3P18U3H/51	41	3Z4UM	29	DC1DU8L	55	FA12UM	46
3G05UM	28	3P18U3H/54	41	3Z50UM	29	DC2CU02L	55	FA230ACL	57
3G08UM	28	3P18U3H/57	41	3Z5UM	29	DC2CU05L	55	FA230ACR	17
3G1.6UM	28	3P18U3H/6	41	3Z6UM	29	DC2CU1.6L	55	FA24ACL	57
3G10UM	28	3P18U3H/9	41	3Z8UM	29	DC2CU10L	55	FA24ACR	17
3G125UM	28	3P25U3/12	40	542-502	80	DC2CU12L	55	FA24DCL	57
3G12UM	28	3P25U3/15	40	542-504	80	DC2CU13L	55	FA24DCR	17
3G13UM	28	3P25U3/18	40	542-508	80	DC2CU15L	55	FA24UM	46
3G15UM	28	3P25U3/21	40	542-512	80	DC2CU16L	55	FA277ACL	57
3G16UM	28	3P25U3/24	40	542-524	80	DC2CU1L	55	FA277ACR	17
3G1UM	28	3P25U3/27	40	ALTN2	17	DC2CU20L	55	FA400ACL	57
3G2.5UM	28	3P25U3/30	40	ALTN2L	57	DC2CU25L	55	FA400ACR	17
3G20UM	28	3P25U3/33	40	BRS5	43	DC2CU2L	55	FA48ACL	57
3G25UM	28	3P25U3/36	40	BRUL	63	DC2CU30L	55	FA48ACR	17
3G2UM	28	3P25U3/39	40	BS.UL	47	DC2CU32L	55	FA48DCL	57
3G3.5UM	28	3P25U3/42	40	DC TR11 C	20	DC2CU3L	55	FA48DCR	17
3G30UM	28	3P25U3/45	40	DC1CU02L	55	DC2CU40L	55	FA48UM	46
3G32UM	28	3P25U3/48	40	DC1CU05L	55	DC2CU4L	55	FA60ACL	57
3G3UM	28	3P25U3/51	40	DC1CU1.6L	55	DC2CU50L	55	FA60ACR	17
3G40UM	28	3P25U3/54	40	DC1CU10L	55	DC2CU5L	55	FMA1PL	57
3G4UM	28	3P25U3/57	40	DC1CU12L	55	DC2CU60L	55	FMA2PL	57
3G50UM	28	3P25U3/6	40	DC1CU13L	55	DC2CU63L	55	FMA3PL	57
3G5UM	28	3P25U3/9	40	DC1CU15L	55	DC2CU6L	55	G45-14-2	49
3G60UM	28	3P25U3H/12	41	DC1CU16L	55	DC2CU8L	55	G45-14-3	49
3G63UM	28	3P25U3H/15	41	DC1CU1L	55	DC2DU02L	55	G45-14-4	49
3G6UM	28	3P25U3H/18	41	DC1CU20L	55	DC2DU05L	55	G45-14-5	49
3G8UM	28	3P25U3H/21	41	DC1CU25L	55	DC2DU1.6L	55	G54-14-2	49

Index

Part No.	Page
G54-14-3	49
G54-14-4	49
G54-14-5	49
GE2-14	49
H10UM	46
H11UM	46
H12UM	46
H1COL	57
H1COR	17
H21UM	46
H2COL	57
H2COR	17
HMS01	49
HMS02	49
HMS10	49
HMS11	49
HMS20	49
HSTCOL	57
HSTCOR	17
MA016UM	44
MA025UM	44
MA040UM	44
MA063UM	44
MA1.0UM	44
MA1.6UM	44
MA10UM	44
MA16UM	44
MA2.5UM	44
MA20UM	44
MA25UM	44
MA32UM	44
MA4.0UM	44
MA40UM	44
MA6.3UM	44
MS.F55	49
MS.G55	49
MS.PS2	49
MS.PV	49
MS.SLG2	49
MS.SLG3	49
MS.SLJ2	49
MS.SLJ3	49
MS.SLR2	49
MS.SLR3	49
MS.SLW2	49
MS.SLW3	49
MS016	48
MS025	48
MS04	48
MS063	48
MS1	48
MS1.6	48
MS10	48
MS16	48
MS2.5	48
MS20	48
MS25	48
MS4	48
MS6.3	48
N63UM	24-29
N63UM	46
NA	24
NA	24
NA	24
NA	24
NA	24
NA	24
NA	24
NA	24
NA	25
NA	25
NA	25
NA	25
NA	25
NA	25
NA	25
NA	25
NA	26
NA	26
NA	26
NA	26
NA	26
NA	26
NA	26
NA	26
NA	26
NA	27
NA	27
NA	27
NA	28
NA	28
NA	28
NA	29
NA	29
NA	29
P35ULT	63
P50UB	42
P50ULB	63
P50UT	42
P95UB	43
S-AL	70
S-AX	70
S-EHU1-12	72
S-EHU1-12/NEMA 4X	72
S-EHU2-12	72
S-EHU2-12/NEMA 4X	72
S-EHU3-12	72
S-EHU3-12/NEMA 4X	72
S-EHU4-12	72
S-EHU4-12/NEMA 4X	72
S-FH1-36	72
S-FH1-36/NEMA 4X	72
S-FH2-48	72
S-FH2-48/NEMA 4X	72
S-FH3-60	72
S-FH3-60/NEMA 4X	72
S-FH4-72	72
S-FH4-72/NEMA 4X	72
S-MIT13	72
S-MIT23	72
S-MIT33	72
S-MIT43	72
S-PHL1	72
S-PHL2	72
S-PHL3	72
S-PHL4	72
S-PL1	72
S-PL2	72
S-PL3	72
S-PL4	72
S-SHT	70
S-TD125HU-FMU-LL-100	69
S-TD125HU-FMU-LL-125	69
S-TD125HU-FMU-LL-40	69
S-TD125HU-FMU-LL-50	69
S-TD125HU-FMU-LL-60	69
S-TD125HU-FMU-LL-80	69
S-TD125HU-FTU-LL-100	69
S-TD125HU-FTU-LL-125	69
S-TD125HU-FTU-LL-15	69
S-TD125HU-FTU-LL-20	69
S-TD125HU-FTU-LL-30	69
S-TD125HU-FTU-LL-40	69
S-TD125HU-FTU-LL-50	69
S-TD125HU-FTU-LL-60	69
S-TD125HU-FTU-LL-80	69
S-TD125NU-FMU-LL-100	68
S-TD125NU-FMU-LL-125	68
S-TD125NU-FMU-LL-40	68
S-TD125NU-FMU-LL-50	68
S-TD125NU-FMU-LL-60	68
S-TD125NU-FMU-LL-80	68
S-TD125NU-FTU-LL-100	68
S-TD125NU-FTU-LL-125	68
S-TD125NU-FTU-LL-15	68
S-TD125NU-FTU-LL-20	68
S-TD125NU-FTU-LL-30	68
S-TD125NU-FTU-LL-40	68
S-TD125NU-FTU-LL-50	68
S-TD125NU-FTU-LL-60	68
S-TD125NU-FTU-LL-80	68
S-TS250HU-ATU-LL-160	69
S-TS250HU-ATU-LL-200	69
S-TS250HU-ATU-LL-250	69
S-TS250HU-FMU-LL-160	69
S-TS250HU-FMU-LL-200	69
S-TS250HU-FMU-LL-250	69
S-TS250HU-FTU-LL-150	69
S-TS250HU-FTU-LL-160	69
S-TS250HU-FTU-LL-175	69
S-TS250HU-FTU-LL-200	69
S-TS250HU-FTU-LL-225	69
S-TS250HU-FTU-LL-250	69
S-TS250NU-ATU-LL-160	68
S-TS250NU-ATU-LL-200	68
S-TS250NU-ATU-LL-250	68
S-TS250NU-FMU-LL-160	68
S-TS250NU-FMU-LL-200	68
S-TS250NU-FMU-LL-250	68
S-TS250NU-FTU-LL-150	68
S-TS250NU-FTU-LL-160	68
S-TS250NU-FTU-LL-175	68
S-TS250NU-FTU-LL-200	68
S-TS250NU-FTU-LL-225	68
S-TS250NU-FTU-LL-250	68
S-TS400HU-ATU-LL-300	69
S-TS400HU-ATU-LL-400	69
S-TS400HU-FMU-LL-300	69
S-TS400HU-FMU-LL-400	69
S-TS400HU-FTU-LL-300	69
S-TS400HU-FTU-LL-350	69
S-TS400HU-FTU-LL-400	69
S-TS400NU-ATU-LL-300	68
S-TS400NU-ATU-LL-400	68
S-TS400NU-FMU-LL-300	68
S-TS400NU-FMU-LL-400	68
S-TS400NU-FTU-LL-300	68
S-TS400NU-FTU-LL-350	68
S-TS400NU-FTU-LL-400	68
S-TS800HU-ATU-LL-500	69
S-TS800HU-ATU-LL-600	69
S-TS800HU-ATU-LL-800	69
S-TS800HU-FTU-LL-500	69
S-TS800HU-FTU-LL-600	69
S-TS800HU-FTU-LL-700	69
S-TS800HU-FTU-LL-800	69
S-TS800NU-ATU-LL-500	68
S-TS800NU-ATU-LL-600	68
S-TS800NU-ATU-LL-800	68
S-TS800NU-FMU-LL-500	68
S-TS800NU-FMU-LL-500	69
S-TS800NU-FMU-LL-600	68
S-TS800NU-FMU-LL-600	69
S-TS800NU-FMU-LL-800	68
S-TS800NU-FMU-LL-800	69
S-TS800NU-FTU-LL-500	68
S-TS800NU-FTU-LL-600	68
S-TS800NU-FTU-LL-700	68
S-TS800NU-FTU-LL-800	68
S-UVT	71
TR-11BX630.5A	19
TR-11BX630.9A	19
TR-11BX631.2A	19
TR-11BX631.5A	19
TR-11BX631.8A	19
TR-11BX631A	19
TR-11BX632.2A	19
TR-11BX632.5A	19
TR-11BX632.7A	19
TR-11BX632A	19
TR-11BX633.3A	19
TR-11BX633A	19
TR-11BX634A	19
TR-11BX635A	19
TR-11BX636A	19
TR-11BY6310A	19
TR-11BY6312A	19
TR-11BY6315A	19
TR-11BY6316A	19
TR-11BY636.5A	19
TR-11BY637A	19
TR-11BY638A	19

Part No.	Page
TR-11BY639A	19
TR-11CX630.5A	19
TR-11CX630.9A	19
TR-11CX631.2A	19
TR-11CX631.5A	19
TR-11CX631.8A	19
TR-11CX631A	19
TR-11CX632.2A	19
TR-11CX632.5A	19
TR-11CX632.7A	19
TR-11CX632A	19
TR-11CX633.3A	19
TR-11CX633A	19
TR-11CX634A	19
TR-11CX635A	19
TR-11CX636A	19
TR-11CY6310A	19
TR-11CY6312A	19
TR-11CY6315A	19
TR-11CY6316A	19
TR-11CY636.5A	19
TR-11CY637A	19
TR-11CY638A	19
TR-11CY639A	19
TR-11SX630.5A	19
TR-11SX630.9A	19
TR-11SX631.2A	19
TR-11SX631.5A	19
TR-11SX631.8A	19
TR-11SX631A	19
TR-11SX632.2A	19
TR-11SX632.5A	19
TR-11SX632.7A	19
TR-11SX632A	19
TR-11SX633.3A	19
TR-11SX633A	19
TR-11SX634A	19
TR-11SX635A	19
TR-11SX636A	19
TR-11SY6310A	19
TR-11SY6312A	19
TR-11SY6315A	19
TR-11SY6316A	19
TR-11SY636.5A	19
TR-11SY637A	19
TR-11SY638A	19
TR-11SY639A	19
TR-11WX630.5A	19
TR-11WX630.9A	19
TR-11WX631.2A	19
TR-11WX631.5A	19
TR-11WX631.8A	19
TR-11WX631A	19
TR-11WX632.2A	19
TR-11WX632.5A	19
TR-11WX632.7A	19
TR-11WX632A	19
TR-11WX633.3A	19
TR-11WX633A	19
TR-11WX634A	19
TR-11WX635A	19
TR-11WX636A	19
TR-11WY6310A	19
TR-11WY6312A	19
TR-11WY6315A	19
TR-11WY6316A	19
TR-11WY636.5A	19
TR-11WY637A	19
TR-11WY638A	19
TR-11WY639A	19
UA120UM	46
UA220UM	46
UV110ACL	57
UV110ACR	17
UV110DCL	57
UV110DCR	17
UV120ACL	57
UV120ACR	17
UV12ACL	57
UV12ACR	17
UV12DCL	57
UV12DCR	17
UV230ACL	57
UV230ACR	17
UV24ACL	57
UV24ACR	17
UV24DCL	57
UV24DCR	17
UV277ACL	57
UV277ACR	17
UV400ACL	57
UV400ACR	17
UV48ACL	57
UV48ACR	17
UV48DCL	57
UV48DCR	17
UV60ACL	57
UV60ACR	17