

control, signalling and safety isolation transformers

open type single phase



0442 35



0442 68

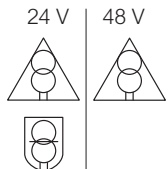


0442 71

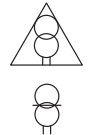
Dimensions and technical information (p. 107)

IP 2x or xxB up to 400 VA
 IP xxA above 400 VA - IK 04
 Conform to IEC/EN 61558-2-2 and 2-4 or 2-6
 UL506 and CSA C22-2-N°66
 Products suitable for building into equipment conforming to EN 61131-2, EN 60204-1 and EN 60439-1 standards
 Insulated covers up to 1 000 VA provided
 Interference/disturbance filter included
 Screw fix to mounting plate or clip on to DIN rail up to 250 VA
 Supplied with 0V/Earth connection link up to 1 000 VA

Pack	Cat. Nos.	Single phase		
		Primary : 230-400 V ± 15 V		
		Secondary : 24-48 V		
		Supplied with 2 links		
		Power in VA according to IEC and CSA	Power in VA according to UL	Admissible instantaneous power at cos φ = 0.5
1	0442 31	40	40	52
1	0442 32	63	63	87
1	0442 33	100	100	150
1	0442 34	160	140	250
1	0442 35	250	210	420
1	0442 36	400	300	900
1	0442 37	630	500	1 700
1	0442 38	1 000	700	2 000
1	0442 39	1 600	700	8 500
1	0442 40	2 500	1 400	3 300



Pack	Cat. Nos.	Single phase		
		Safety isolating transformers		
		Primary : 230-400 V ± 15 V		
		Secondary : 115-230 V		
		Supplied with 2 links		
		Power in VA according to IEC and CSA	Power in VA according to UL	Admissible instantaneous power at cos φ = 0.5
1	0442 61	40	40	50
1	0442 62	63	63	86
1	0442 63	100	100	150
1	0442 64	160	140	250
1	0442 65	250	210	430
1	0442 66	400	300	1 200
1	0442 67	630	500	1 600
1	0442 68	1 000	700	2 000
1	0442 69	1 600	700	6 100
1	0442 70	2 500	1 300	7 100
1	0442 71	4 000	2 400	11 400



Secondary protection

Transformers can be protected by a gG type fuse or by a C type circuit breaker (p. 91 and 79)

Multiple fixing possibilities

- For DIN rail (p. 26)
- For Lina 12.5 plates (p. 23)
- For Lina 25 plates (p. 23)

For 460 V primary voltage range available for marine applications

Contact us on +44 (0) 845 605 4333

For modular transformers

see p. 116

control, signalling and safety isolation transformers

open type single phase

■ Dimensions

Fig. 1 : 40 to 400 VA

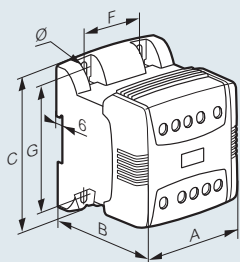


Fig. 2 : 630 to 1 000 VA

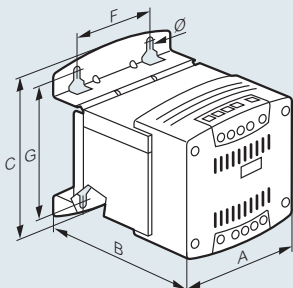


Fig. 3 : 1 600 to 2 500 VA

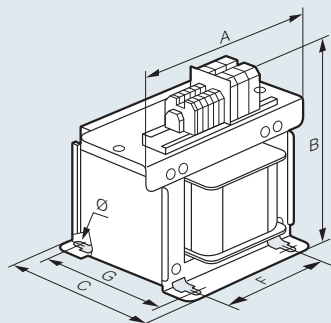
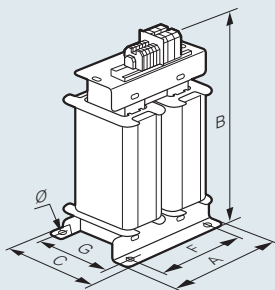
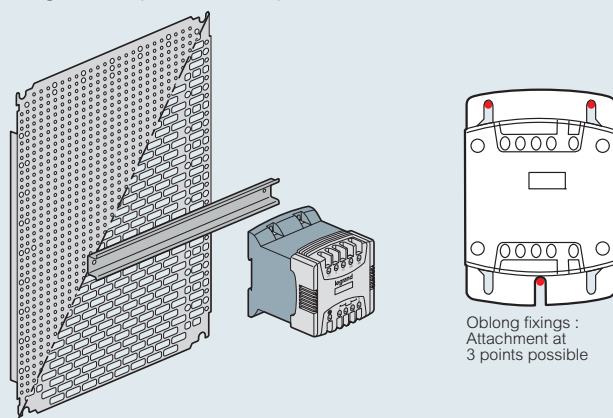


Fig. 4 : 4 000 to 8 000 VA



■ Fixing

On perforated plates Lina 25 and on Lina 12-5 plates, see p. 23
On symmetrical rail \perp up to 250 VA
fixing centres pitch 25 mm up to 1000 VA



Cat. Nos.	Power (VA)	Fig.	Dimensions (mm)			Fixing ⁽¹⁾ (mm)			Weight (Kg)
			A	B	C	F	G	Ø	
0442 31/61	40	1	94	78	113	50	100	5-2	1-23
0442 32/62	63	1	94	85	113	50	100	5-2	1-56
0442 33/63	100	1	94	94	113	50	100	5-2	1-95
0442 34/64	160	1	94	112	113	50	100	5-2	2-6
0442 35/65	250	1	106	123	115	50	100	5-2	3-82
0442 36/66	400	1	120	140	140	62.5	125	5-2	5-62
0442 37/67	630	2	150	158	206	100	175	7	9-9
0442 38/68	1000	2	150	199	206	100	175	7	14-9
0442 39/69	1600	3	220	245	191	150	153	9	25-6
0442 40/70	2500	3	300	292	171	200	114	9	33-1
0442 71	4000	4	230	340	205	180	130	11	31

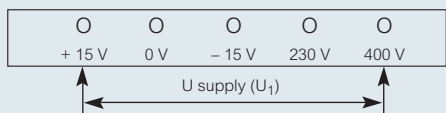
Note : 40-250 VA transformers have juxtaposed windings with an insulated barrier to provide insulation and interference filtering. Higher ratings have an electrostatic screen between windings

(1) Up to 250 VA may be fixed to symmetrical \perp DIN rail

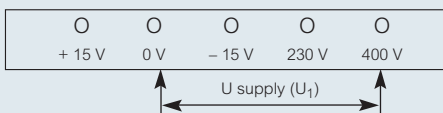
■ Electrical characteristics

Single phase 50-60 Hz - Class 1
Insulation voltage between windings : 4 510 V
Maximum ambient operating temperatures : 50 °C without derating

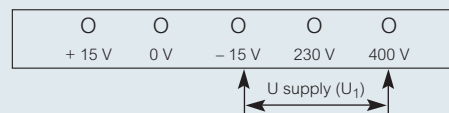
Voltage adjustment



1) if $U_1 > 230$ or 400 V
2) if $I_2 < I_{2n}$ (if the load is less than the nominal load reduce the secondary voltage)



if $U_1 = 230$ or 400 V with load $I_2 = I_{2n}$



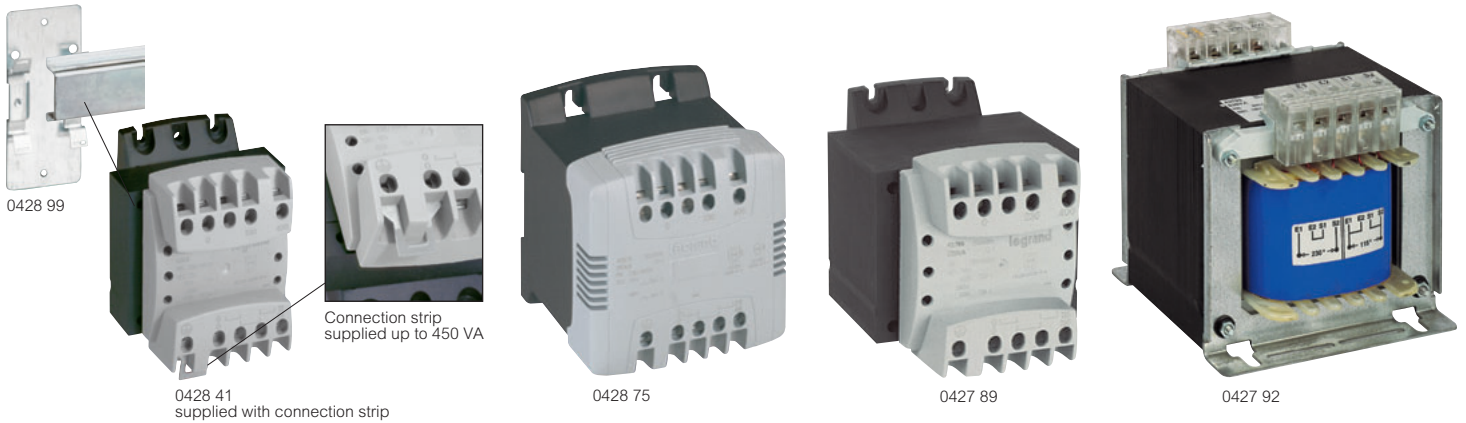
if $U_1 < 230$ or 400 V with load $I_2 = I_{2n}$

Cat. Nos.	Power (VA)	Admissible instantaneous power (VA) at $\cos \varphi$ of :									No-load loss (W)	On-load loss ⁽¹⁾ (W)	Voltage drop as (%) with $\cos \varphi$:			Efficiency (%) with $\cos \varphi$:			Ucc (%)	Connection capacity			
		0-2	0-3	0-4	0-5	0-6	0-7	0-8	0-9	1			0-3	0-6	1	0-3	0-6	1		Primary cable (mm ²)		Secondary cable (mm ²)	
Primary 230-400 V \pm 15 V - Secondary 24-48 V																							
0442 31	40	63	58	55	52	50	48	48	49	60	3-9	7-3	8-7	10-5	8-5	62	77	84	10-0	1 to 4	1 to 4	1 to 4	1 to 4
0442 32	63	110	102	94	87	83	79	77	78	91	6-0	14-2	7-5	9-4	8-5	57	73	82	9-0	1 to 4	1 to 4	1 to 4	1 to 4
0442 33	100	200	180	160	150	140	130	130	130	150	8-2	15-1	7-3	9-3	8-9	66	80	87	8-9	1 to 4	1 to 4	1 to 4	1 to 4
0442 34	160	340	300	270	250	230	220	210	210	230	11-2	24-6	5-8	7-6	7-7	66	80	87	7-2	1 to 4	1 to 4	1 to 4	1 to 4
0442 35	250	550	490	450	420	400	380	370	370	430	14-9	31-4	5-2	6-6	6-2	70	83	89	6-1	1 to 4	1 to 4	1 to 4	1 to 4
0442 36	400	1800	1300	1100	900	800	700	600	600	500	18-3	46-3	2-1	3-7	5-6	72	84	90	4-2	1 to 4	1 to 4	1 to 4	1 to 4
0442 37	630	2700	2200	1900	1700	1500	1300	1200	1200	1200	24-1	49-4	2-0	3-0	3-9	79	88	93	3-3	1 to 16	1 to 16	1 to 16	1 to 16
0442 38	1000	3400	2800	2300	2000	1800	1600	1500	1400	1300	44-2	74-4	1-3	1-9	2-9	80	89	93	2-4	1 to 16	1 to 16	1 to 16	1 to 16
0442 39	1600	12800	10900	9500	8500	7700	7100	6700	6400	6600	65-5	94-7	1-1	1-6	1-9	84	91	94	1-7	2-5 to 10	1-5 to 16	4 to 16	1-5 to 25
0442 40	2500	4300	3900	3600	3300	3100	3000	2900	2900	3400	86-5	143-4	1-8	2-2	2-0	84	91	95	1-9	4 to 16	1-5 to 25	4 to 35	2-5 to 50
Primary 230-400 V \pm 15 V - Secondary 115-230 V																							
0442 61	40	62	57	53	50	48	47	46	47	57	3-9	7-4	8-7	10-5	8-8	62	76	84	10-1	1 to 4	1 to 4	1 to 4	1 to 4
0442 62	63	110	100	93	86	82	78	76	76	90	6-0	11-8	7-6	9-6	8-9	62	76	84	9-2	1 to 4	1 to 4	1 to 4	1 to 4
0442 63	100	200	180	160	150	140	140	130	130	150	8-2	17-3	7-2	9-2	8-6	63	78	85	8-7	1 to 4	1 to 4	1 to 4	1 to 4
0442 64	160	330	300	270	250	240	230	220	220	250	11-2	23-4	5-8	7-4	7-1	67	80	87	6-9	1 to 4	1 to 4	1 to 4	1 to 4
0442 65	250	560	510	460	430	410	390	380	370	430	14-9	31-7	5-2	6-6	6-2	70	83	89	6-1	1 to 4	1 to 4	1 to 4	1 to 4
0442 66	400	2200	1700	1400	1200	1000	910	830	760	730	18-3	43-9	2-1	3-6	5-2	73	85	90	4-1	1 to 4	1 to 4	1 to 4	1 to 4
0442 67	630	2700	2200	1800	1600	1400	1200	1100	1000	1000	24-1	53-2	2-1	3-3	4-5	78	88	92	3-6	1 to 16	1 to 16	1 to 16	1 to 16
0442 68	1000	3400	2800	2300	2000	1800	1600	1500	1400	1300	44-2	73-6	1-3	2-0	2-7	80	89	93	2-2	1 to 16	1 to 16	1 to 16	1 to 16
0442 69	1600	8700	7500	6600	6100	5400	5000	4700	4500	4700	65-5	95-3	1-1	1-5	1-8	83	91	94	1-5	2-5 to 10	1-5 to 16	2-5 to 10	1-5 to 16
0442 70	2500	9200	8300	7600	7100	6700	6300	6200	6100	7100	86-5	150-1	1-8	2-3	2-2	83	91	94	2-0	4 to 16	1-5 to 25	4 to 16	1-5 to 25
0442 71	4000	16500	14300	12700	11400	10500	9800	9200	8900	9500	87-4	234-8	2-1	2-9	3-3	84	91	94	2-7	4 to 16	1-5 to 25	4 to 16	1-5 to 25

(1) Total losses at nominal load

compact transformers

open type single phase



Technical information and dimensions (p. 109)
Transformer protection (p. 111)

Isolating and safety isolating <50 V transformers
 Designed to meet the needs of users with specific VA ratings such as original equipment manufacturers
 The terminals are designed to provide easy and quick connections
 Transformers up to 160 VA can be clipped to rail using accessory or directly fixed using screws through the easily accessible fixing points
 Multiple fixing possibilities :
 - clip to DIN rail using Cat. No. 0044 16 or 0428 99 (≤ 160 VA)
 - screw directly on to Lina 12.5 or Lina 25 mounting plate (≥ 220 VA)
 Recommended protection :
 • for 40 and 63 VA : Type T fuses (5x20) time delay fuse to IEC 60127
 • for >100 VA use MCB Type C

Pack	Cat. Nos.	Single phase	
Safety isolating transformers			
Primary : 230-400 V			
Secondary : 12-24 V			
		Power in VA according to IEC/EN	Admissible instantaneous power at $\cos \varphi$ 0.5
1	0428 40	40 VA	55
1	0428 41	63 VA	91
1	0428 42	100 VA	140
1	0428 43	160 VA	205
1	0428 44	220 VA	290
1	0428 45	310 VA	345
1	0428 47	630 VA	1 520
Primary : 230-400 V			
Secondary : 24 V			
		Power in VA according to IEC/EN	Admissible instantaneous power at $\cos \varphi$ 0.5
1	0428 55	40 VA	55
1	0428 56	63 VA	91
1	0428 57	100 VA	140
1	0428 58	160 VA	205
1	0428 59	220 VA	290
1	0428 60	310 VA	345
1	0428 61	450 VA	1 100
1	0428 62	630 VA	1 520
Safety isolating transformers			
Primary : 230-400 V			
Secondary : 24-48 V			
		Power in VA according to IEC/EN	Admissible instantaneous power at $\cos \varphi$ 0.5
1	0428 70	40 VA	55
1	0428 71	63 VA	91
1	0428 72	100 VA	140
1	0428 73	160 VA	205
1	0428 74	220 VA	290
1	0428 75	310 VA	345
1	0428 77	630 VA	1 520

Pack	Cat. Nos.	Single phase	
Isolating transformers			
Primary : 230-400 V			
Secondary : 115 V			
With centre tap			
		Power in VA according to IEC/EN	Admissible instantaneous power at $\cos \varphi$ 0.5
1	6423 62	63 VA	91
1	6423 63	100 VA	140
1	6423 64	160 VA	205
1	6423 65	220 VA	290
1	6423 66	310 VA	345
1	6423 68	630 VA	1 520
Isolating transformers			
Primary : 230-400 V			
Secondary : 115-230 V			
		Power in VA according to IEC/EN	Admissible instantaneous power at $\cos \varphi$ 0.5
1	0427 85	40 VA	55
1	0427 86	63 VA	91
1	0427 87	100 VA	140
1	0427 88	160 VA	205
1	0427 89	220 VA	290
1	0427 90	310 VA	345
1	0427 92	630 VA	1 520

Pack	Cat. Nos.	Accessories
10	0044 16	Clips for fixing up to 160 VA on to rail EN 60715
		Claw width 10 mm Threaded hole for M4 screws (Use two clips per transformer)
5	0428 99	Mounting bracket DIN rail mounting bracket

Note : Other VA ratings available on request. Please consult us

For modular transformers

see p. 116

For protection devices

see p. 79

compact transformers

open type single phase

Technical information

Conform to IEC/EN 61558-2-4 for 48 V, 115 V and 230 V and IEC/EN 61558-2-6 for 12 V and 24 V secondary

Products suitable for building into equipment conforming to EN 61131-2, EN 60204-1 and EN 60439-1 standards

IP 2x or xxB up to 250 VA - IK 04

Single phase 50-60 Hz - class I

Insulation voltage : Primary/Secondary 4 470 V

Primary/Earth 2 240 V

Secondary/Earth (12 - 24 V) = 250 V ; 48, 115 and 230 V = 1 780 V

Max. ambient operating temperature : 35 °C without derating

Protected against accidental contact with live parts up to 220 VA

Dimensions

Fig. 1 - 40 to 220 VA

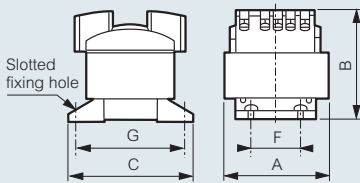


Fig. 2 - 310 VA⁽¹⁾

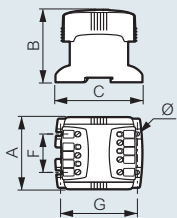
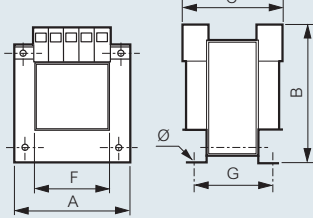


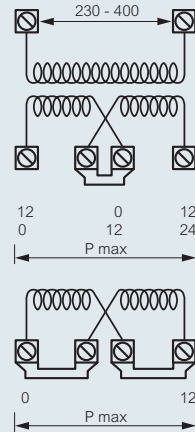
Fig. 3 - 450 to 630 VA



(1) Subject to secondary voltage (see tables)

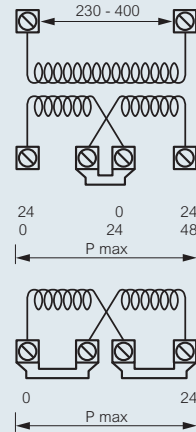
Primary : 230 - 400 V
Secondary : 12 - 0 - 12 V
0 - 12 - 24 V

Cat. Nos.
0428 40 to 0428 47



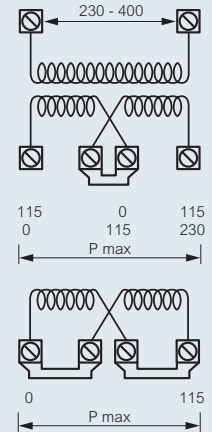
Primary : 230 - 400 V
Secondary : 24 - 0 - 24 V
0 - 24 - 48 V

Cat. Nos.
0428 70 to 0428 77



Primary : 230 - 400 V
Secondary : 115 - 0 - 115 V
0 - 115 - 230 V

Cat. Nos.
0427 85 to 0427 92



Electrical characteristics

Cat. Nos.	Power (VA)	Dimensions (mm)			Fixing (mm)			Weight (kg)	No-load loss (W)	Total losses @ 100% load (W)	Voltage drop as % with		Efficiency with		Ucc %	Primary connection cable mm ²			Secondary connection cable mm ²			Fig.
		A	B	C	F	G	Ø				cos φ 1	cos φ 0.45	cos φ 1	cos φ 0.45		flexible	rigid	Ø mm	flexible	rigid	Ø mm	
Primary 230-400 V - 24 V or 2 x 12 V secondary																						
0428 40	40	84	70	98	40	86	4.5	0.9	3.7	13.1	18.3	12.7	0.75	0.6	15.6	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 41	63	84	77	98	40	86	4.5	1.3	4.9	16.3	13.5	10.2	0.8	0.6	11.8	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 42	100	84	86	98	40	86	4.5	1.6	6.2	21.0	10.5	8.7	0.8	0.7	9.5	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 43	160	84	104	98	40	86	4.5	2.4	9.1	31.8	8.8	7.4	0.8	0.7	7.9	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 44	220	96	115	110	40	98	4.5	3.4	12.6	40.0	6.9	6.3	0.85	0.7	6.5	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 45	310	106	123	115	50	100	5.2	3.8	14.2	54.9	7.3	6.2	0.85	0.7	8.2	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	2
0428 47	630	126	126	141	90	105	6.5	8.0	25.5	62.4	4.3	2.6	0.91	0.82	3.5	1 to 4	1 to 4	4.5	1 to 16	1 to 25	6.5	3
Primary 230-400 V - 24 V secondary																						
0428 55	40	84	70	98	40	86	4.5	0.9	3.7	13.1	18.3	12.7	0.75	0.58	15.6	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 56	63	84	77	98	40	86	4.5	1.3	4.9	16.3	13.5	10.2	0.79	0.64	11.8	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 57	100	84	86	98	40	86	4.5	1.6	6.2	21.0	10.5	8.7	0.83	0.68	9.5	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 58	160	84	104	98	40	86	4.5	2.4	9.1	31.8	8.8	7.4	0.83	0.69	7.9	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 59	220	96	115	110	40	98	4.5	3.4	12.6	40.0	6.9	6.3	0.85	0.71	6.5	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 60	310	106	123	115	50	100	5.2	3.82	14.2	54.9	7.3	6.2	0.85	0.72	8.2	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	2
0428 61	630	126	126	126	90	94	6.5	6.0	21.8	63.9	6.0	3.2	0.88	0.76	4.9	1 to 4	1 to 4	4.5	1 to 16	1 to 25	6.5	3
0428 62	630	126	126	141	90	105	6.5	8.0	25.5	62.4	4.3	2.6	0.91	0.82	3.5	1 to 4	1 to 4	4.5	1 to 16	1 to 25	6.5	3
Primary 230-400 V - 48 V or 2 x 24 V secondary																						
0428 70	40	84	77	98	40	86	4.5	1.3	3.7	12.9	18.0	12.5	0.8	0.6	15.4	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 71	63	84	86	98	40	86	4.5	1.6	4.9	16.5	13.7	10.3	0.8	0.6	11.9	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 72	100	84	104	98	40	86	4.5	2.4	6.2	21.0	10.4	8.7	0.8	0.7	9.4	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 73	160	84	104	98	40	86	4.5	2.4	9.1	31.6	8.7	7.3	0.8	0.7	7.8	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 74	220	96	115	110	40	98	4.5	3.4	12.6	39.5	6.7	6.2	0.85	0.7	6.3	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0428 75	310	106	123	115	50	100	5.2	3.8	14.2	54.9	7.3	6.2	0.85	0.7	8.2	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	2
0428 77	630	126	126	141	90	105	6.5	8.0	25.5	63.3	4.2	2.6	0.9	0.8	3.5	1 to 4	1 to 4	4.5	1 to 16	1 to 25	6.5	3
Primary 230-400 V - 115-230 V secondary																						
0427 85	40	84	70	98	40	86	4.5	1.0	3.7	10.9	18.5	12.7	0.75	0.58	15.7	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0427 86	63	84	77	98	40	86	4.5	1.3	4.9	15.6	12.5	9.7	0.80	0.65	11.0	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0427 87	100	84	86	98	40	86	4.5	1.6	6.2	21.1	10.7	8.9	0.83	0.68	9.7	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0427 88	160	84	104	98	40	88	4.5	2.4	9.1	32.3	8.8	7.3	0.83	0.69	7.9	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0427 89	220	96	115	110	40	98	4.5	3.4	12.6	40.1	6.8	6.2	0.85	0.71	6.4	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	1
0427 90	310	106	123	115	50	100	5.2	3.8	14.2	54.0	7.3	6.2	0.85	0.7	8.2	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	2
0427 92	630	126	126	123	90	105	6.5	7.8	25.5	64.6	4.3	2.6	0.91	0.81	3.5	1 to 4	1 to 4	4.5	1 to 4	1 to 4	4.5	3

how to calculate the rated power of a transformer

In equipment containing control devices, the transformer power depends on the maximum power required at a given moment (inrush power), the permanent power, the voltage drop and power factor

When determining the permissible instantaneous power (inrush power) required, the following factors should always be taken into account :

- two inrush currents cannot occur at the same time
- power factor $\cos \varphi$ equals 0.5
- at maximum, 80% of devices are supplied at the same time (this percentage can be calculated precisely for each device)

■ Determination of the inrush power

Where a simplified calculation of the power is required, the following formula can be used :

$$P_{\text{inrush}} = 0.8 (\Sigma P_m + \Sigma P_v + P_a)$$

ΣP_m : sum of all contactor steady state power levels (holding power)

ΣP_v : sum of all power levels of indicators and LEDs⁽¹⁾

P_a : inrush power of the largest contactor

Example :

A machine tool control cabinet comprising :

- 10 contactors for 4 kW motors, with a steady state power of 8 VA
- 2 contactors for 18.5 kW motor, with a steady state power of 20 VA
- 1 contactor for 45 kW motor, with a steady state power of 20 VA, and an inrush power of 250 VA $\cos \varphi$ 0.5
- 20 remote control relays, with a steady state power of 4 VA
- 30 signalling LEDs, with a consumption of 1 VA each

$$-\Sigma P_m = 220 \text{ VA } \{ (10 \times 8 \text{ VA}) + (2 \times 20 \text{ VA}) + (1 \times 20 \text{ VA}) + (20 \times 4 \text{ VA}) \}$$

$$-\Sigma P_v = 30 \text{ VA } (30 \times 1 \text{ VA})$$

$$-P_a = 250 \text{ VA}$$

$$P_{\text{inrush}} = 0.8 (220 + 30 + 250) = 400 \text{ VA at } \cos \varphi \text{ 0.5}$$

■ Determination of the rated power of a transformer

For control transformers, in particular, simply start with an inrush power at $\cos \varphi$ 0.5 and read the size from the table below

Rated power in VA IEC and CSA	Admissible instantaneous power in VA IEC/EN 61558-2-2 with $\cos \varphi$ of :								
	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
40	90	80	72	66	61	57	53	51	53
63	160	140	130	120	110	100	90	90	90
100	240	190	170	160	150	140	130	130	140
160	480	400	350	300	270	240	220	200	190
250	830	690	590	510	450	400	360	330	310
400	1 600	1 400	1 200	1 000	900	800	800	700	700
630	2 000	1 800	1 500	1 400	1 200	1 100	1 100	1 000	1 000
1 000	5 400	4 600	4 000	3 600	3 200	3 000	2 700	2 600	2 500
1 600	9 000	8 000	7 200	6 600	6 100	5 700	5 400	5 300	5 600
2 500	7 300	6 600	6 000	5 700	5 200	4 900	4 700	4 600	5 100
4 000	34 500	28 800	24 400	17 000	16 600	16 400	14 800	13 400	12 400

From the example above, an inrush of 460 VA at $\cos \varphi$ 0.5 gives a transformer size of 250 VA

■ Checking the selection

As a precaution, make the following checks on each of your devices :

- first calculate the sum of the steady state power for the coils and the LEDs powered at the same time
- then apply a coefficient : use either our hypothetical figure of 80% of devices at steady state power, or the actual calculation for your equipment
- the power of the chosen transformer shall be greater than or equal to the result of the calculation

(1) LED = Light Emitting Diode

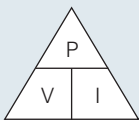
■ General information

Transformers take around 25 times the load at switch on

$VA \div V =$ current in the winding
either PRIMARY or SECONDARY

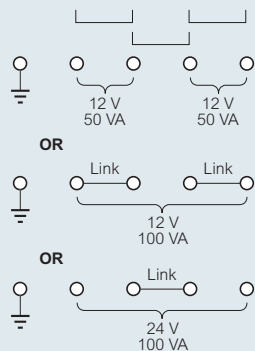
$$\text{i.e. } \frac{300 \text{ VA}}{12 \text{ V}} = 25 \text{ A} \times 25 = 625 \text{ A}$$

The power triangle :



■ Secondary power/voltage information

Example : compact transformer 100 VA - 12/24 V Cat. No. 0428 42



■ Identification of markings

• Changing voltage



Isolation transformer (functional insulation between primary and secondary)



Auto transformer (no insulation between primary and secondary)

• Control circuit power supply



Control transformer (functional insulation between primary and secondary)

• Electric shock protection

- Protection against direct and indirect contact by :



Safety transformers (reinforced insulation between primary and secondary, no-load voltage < 50 V)

- Protection against indirect contact by :



Circuit separation transformers (reinforced insulation between primary and secondary)

The transformer function(s) can either be defined by the equipment designer or can be imposed by installation guidelines or the equipment standard

Definitions of electrical shock :

- Electric shocks : physiopathological effect resulting from an electrical current passing through the human body
- Direct contact : persons coming into contact with live parts (connected to the mains)
- Indirect contact : persons coming into contact with grounding which is accidentally live following an insulation fault

protection of transformers, primary and secondary circuits

Protection of transformers

In accordance with the IEC/EN 61558 standard, transformers must be protected against overload and short-circuit conditions which may occur during normal operation.

The standard does not specify the type or location of the protective device : it is the manufacturer's responsibility to choose the most suitable position, either on the primary or secondary side. The rating, type and location of the protective device are to be indicated on the device identification plate.

Protection of the primary and secondary circuits

General

Circuits must be protected against overload and short-circuit conditions. Protection against overload is compulsory if the circuit is likely to be affected by an overload current. This protection can be installed at the supply source or end of the circuit.

Protection against a short-circuit is compulsory in all installations ; this protection has to be installed at the supply source of the circuit.

Supply circuits (transformer primary)

The transformer is a device which cannot itself generate overload. Its supply circuit therefore only requires protection against a short-circuit. When a transformer is energised, a very high inrush current (around 25 In)⁽¹⁾ is produced for approximately 10 ms.

When protecting the circuit, both factors must be considered.

Legrand offers three possibilities :

- type aM cartridge fuses,
- type D MCBs (with magnetic tripping set at 12 In average)
- type C MCBs (with magnetic tripping set at 7 In average)

Example : control transformer 630 VA - 230/24 V Cat. No. 0442 37

In primary 2.74 A (VA ÷ V)

I inrush at power-up 68.5 A (25 x 2.74 A)

Protection against a short-circuit can be provided by :

- type aM 6 A cartridge fuse
- type D 6 A MCBs
- type C 13 A MCBs - (16 A nearest UK)

Primary protection

Minimum protection rating for primary supply of the transformer :

Power (VA)	230 V single-phase			400 V single-phase			400 V three-phase		
	aM fuse	C MCB	D MCB	aM fuse	C MCB	D MCB	aM fuse	C MCB	D MCB
40	0.5	1		0.25	1				
50	1	1	1	0.5	1				
63	1	2	1	0.5	1				
100	1	3	1	1	2	1			
150	2	6	2	1	3	1			
160	2	6	2	1	3	1	1		
200	2	6	3	1	3	2			
250	2	6	3	1	6	2	1		
300	4	10	6	2	6	2			
400	4	10	6	2	6	2	2		
500	6	16	6	4	10	3			
630	6	16	6	4	10	3	2	6	2
750	8	16	10	6	10	6	2	6	3
1 000	10	20	10	6	16	6	4	10	3
1 250	10	25	16	6	20	10	4	10	6
1 500	10	32	16	10	20	10	4	16	6
1 600	10	32	16	10	20	10	6	16	6
2 000	12	40	16	10	25	10			
2 500	16	50	20	10	32	16	6	20	10
3 000	16	50	32	12	40	20			
3 500	20	50	32	16	40	20			
4 000	20	80	32	16	50	20	10	32	16
5 000	25	100	40	16	63	25	12	32	16

These values are given for information only for transformers with inrush currents of around 25 In.

(1) In = nominal rating of circuit

Protection of the secondary circuit

The secondary circuit must be protected against overload and short-circuit conditions. For overload, check that the protection rating chosen is lower than or equal to the transformer secondary current. For short-circuit, ensure that a short-circuit occurring at the furthest point of the circuit will trigger the protective device within 5 seconds.

Legrand offers two possibilities :

- type gG cartridge fuses
- type C MCBs (with magnetic tripping set at 7 In average)

If the transformer only supplies a single circuit, and provided the calculations show perfect compatibility, transformer protection (if on secondary) and circuit protection can be one and the same. A single protective device performs both functions (see table of transformer protective devices).

If the transformer supplies several circuits, overload and short-circuit calculations must be performed for each individual circuit. To check that the device chosen is suitable, an approximate minimum short-circuit value can be obtained using the following formula.

Formula for determining the secondary protection rating

Calculate the minimum short-circuit at the furthest point on the circuit :

$$I_{c/c \text{ min.}} = \frac{U_s}{\left(\frac{U_s^2}{P} \times \frac{U_{c/c \%}}{100}\right) + \frac{2\rho l}{S}}$$

Us = transformer secondary voltage

P = transformer power

U c/c % = transformer short-circuit voltage

l = line length in m

S = line cross section in mm²

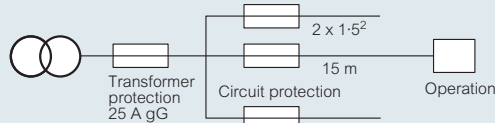
ρ copper = 0.027 Ω mm²/m

Choose the protection rating so as to obtain a cut-off time of 5 seconds max. for a current I c/c defined above :

$$\text{type gG fuse : } I_n \leq \frac{I_{c/c \text{ min.}}}{4}$$

$$\text{type C MCB : } I_n \leq \frac{I_{c/c \text{ min.}}}{8}$$

Example : control transformer 630 VA - 230/24 V Cat. No. 0442 37



$$I_{c/c \text{ min.}} = \frac{24}{\left(\frac{24^2}{630} \times \frac{3.3}{100}\right) + \frac{2 \times 0.027 \times 15}{1.5}} = 44.42 \text{ A} = \text{Use either :}$$

$$\frac{44.42}{4} = 11.10 \rightarrow \text{gG fuse 10 A max.} \quad \frac{44.42}{8} = 5.55 \rightarrow \text{C type MCB 5 A max.}$$

Secondary protection

Ratings and types of protective devices to be used for single phase transformer protection according to VA rating and secondary voltage

Rated power (VA) IEC/CSA	24 V			48 V			110 V			230 V		
	Fuse A	Type	Curve C MCB	Fuse A	Type	Curve C MCB	Fuse A	Type	Curve C MCB	Fuse A	Type	Curve C MCB
40	2	T		1	T		400 m	T		200 m	T	
50	2	T	2	1	T	1	500 m	T	0.5	200 m	T	0.2
63	3-15	T		1.6	T		630 m	T		315 m	T	
100	4	gG	4	2	gG	2	1	gG	1	0.5	gG	0.5
150	6	gG	6	4	gG	4	2	gG	2	1	gG	1
160	8	gG	8	4	gG	4	2	gG	2	1	gG	1
200	8	gG	8	4	gG	4	2	gG	2	1	gG	1
250	10	gG	10	6	gG	6	2	gG	2	1	gG	1
300	12	gG	12	6	gG	6	4	gG	4	2	gG	2
400	16	gG	16	8	gG	8	4	gG	4	2	gG	2
500	20	gG	20	10	gG	10	6	gG	6	2	gG	2
630	25	gG	25	12	gG	12	6	gG	6	3	gG	3
750		gG		16	gG	16	8	gG	8	4	gG	4
1 000	40	gG	40	20	gG	20	8	gG	8	4	gG	4
1 250		gG			gG		12	gG	12		gG	
1 500		gG			gG		16	gG	13	8	gG	8
1 600	63	gG	63	32	gG	32	16	gG	13	8	gG	8
2 000		gG			gG		20	gG	20	8	gG	8
2 500	100	gG	100	50	gG	50	20	gG	20	10	gG	10
3 000		gG			gG		32	gG	32		gG	
3 500		gG			gG		32	gG	32		gG	
4 000		gG			gG		32	gG	32	16	gG	16
5 000		gG			gG		50	gG	50		gG	