QUEENSLAND URBAN UTILITIES

LUGGAGE POINT WASTE WATER PLANT

EFFLUENT PUMP STATION SWITCHBOARD

ELECTRICAL SWITCHBOARD OPERATION AND MAINTENANCE MANUAL

Developed by:

J & P RICHARDSON INDUSTRIES
CAMPBELL AVENUE
WACOL QLD 4076

ABN 23 001 952 325
ACN 001 952 325
Ph. (07) 3271 2911
Fax. (07) 3271 3623

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1 INTRODUCTION

These operating instructions cover the QUEENSLAND URBAN UTILITIES, Luggage Point Waste Water Plant – Effluent Pump Station Switchboard electrical equipment supplied by J & P Richardson Industries Pty Ltd in 2012.

1.1 OPERATING INSTRUCTIONS

Normal operation of the pumping station is in the automatic mode with control by means of a In The Pipe Line, which receives level signals from a Pressure Transducer.

Manual Emergency operation control of the station is available by means of selector switch on the common control compartment of the switchboard.

2 DESCRIPTION OF OPERATION

2.1 STATION OVERVIEW

The pump station has 2 pumps that are driven by VFD's (Variable Frequency Drives). Either pump operates alone and is sequenced.

The effluent is drawn from the final effluent channel and provides service water to the plant. The delivery pressure is controlled by sending the pressure valve to a control PLC that compares the actual delivery pressure with the set point in the SCADA system.

The pump curve, indicates a dead head pressure of 640kPa for the 16.75inch impellor scenario and a speed of 1450rpm. The motor name plate indicates a speed of 1470rpm. Unfortunately the pump does not include the impellor details on the name plate, but based on the site readings I think it is reasonable to assume 16.75inch is installed

The switchboard has its own internal GE PLC and connects via hardwire to PLC 03 to provide and receive SCADA data.

Each drive can be set in 'Remote' 'Off' or 'Local'.

In 'Remote' the pump is started and stopped and the controlled to the SCADA set point. In 'Off' it will not run. In 'Local' th VFD speed can be controlled by the potentiometer on the escutcheon panel.

Depending on the power being drawn the drives could be run at over speed with current limit set in the VFD.

3 ELECTRICAL EQUIPMENT TECHNICAL INFORMATION

3.1 CIRCUIT BREAKERS & CHASSIS

- TERASAKI – **S400NN3** 3P 400A NON-AUTO Circuit Breaker
- TERASAKI – **T2CF403SLNG** Shrouds
- TERASAKI – **T2HS40R5GM** Handle

- TERASAKI – **E250NJ3100** 3P 100A Circuit Breaker
- TERASAKI – **E250NJ3250** 3P 250A Circuit Breaker
- TERASAKI – **T2CR253SG** Shrouds
- TERASAKI – **T2CF253SSNBA** Shrouds + Handle

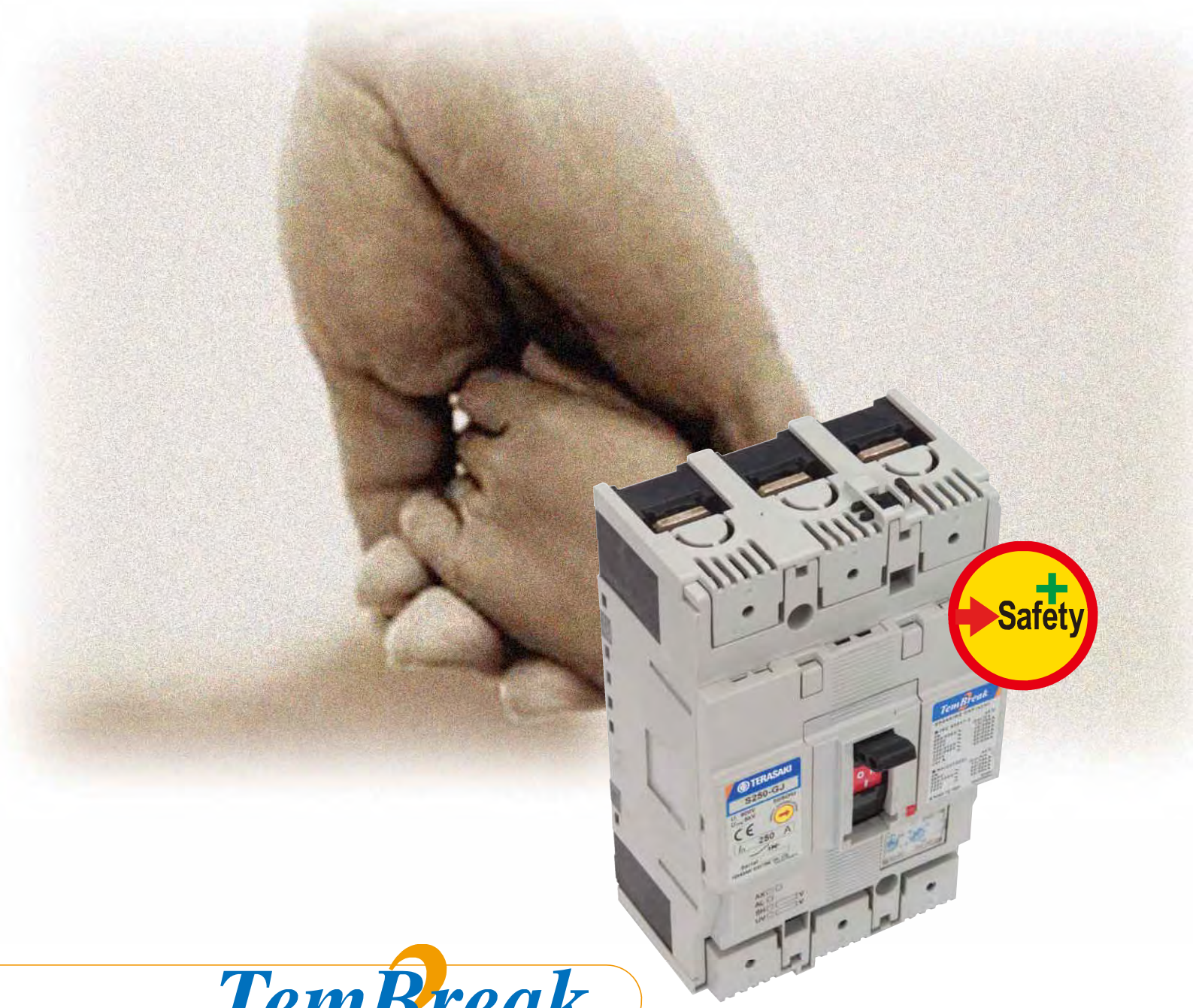
- TERASAKI – **DTCB10104C** 1P 4A Circuit Breaker
- TERASAKI – **DTCB10110C** 1P 10A Circuit Breaker
- TERASAKI – **DTCB10316C** 3P 16A Earth Leakage Circuit Breaker
- TERASAKI – **DTCB10332C** 3P 32A Earth Leakage Circuit Breaker

- TERASAKI – **DSRCM-32-30-3PN** 3P+N 32A Earth Leakage Circuit Breaker

- TERASAKI – **DSRCBH-16-30A** 1P 16A Earth Leakage Circuit Breaker

- TERASAKI – **CD2-42/18-3U** 42P Chassis

TERASAKI
Innovators in Protection Technology



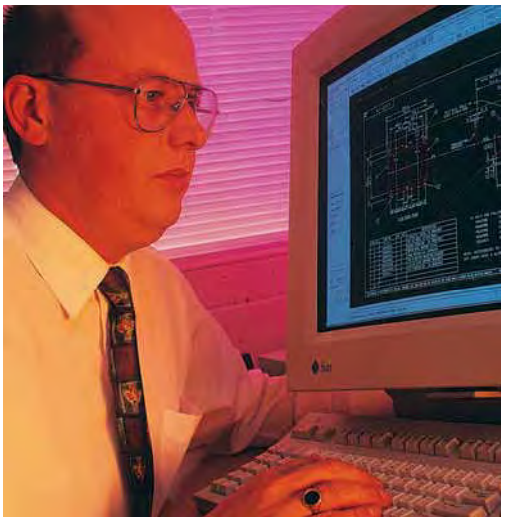
TemBreak2

The Ultimate Safety Breaker

OUR CUSTOMER CARE COMMITMENTS

Quality is Guaranteed

All products supplied from this catalogue carry a guarantee against defects in materials and workmanship for a period of 12 months from date of purchase as standard.



Quality is Accredited

Terasaki has ISO 9001 accreditation for the manufacture, sale and distribution of all products featured in this catalogue.

Ordering is Easy

We have made ordering easy for you by colour coding the sections of this catalogue and including order codes. If you need help with ordering or selection, please call one of the telephone numbers shown below.

Technical Support is Free

We offer free technical support and application software to all customers. This could range from selecting a product for an unusual application through to carrying out a protection study. Please call one of the telephone numbers shown below.

CUSTOMER SERVICE CONTACT DETAILS

Italy:	+39 02 92278300	**Australia and New Zealand:**	+61 3 9429 2999
Spain & Latin America:	+34 93 8796050	**Brazil:**	+55 21 33019898
Sweden:	+46 8 55628230	**Malaysia:**	+60 3 55493820
Denmark:	+45 70 260057	**Singapore:**	+65 6425 4915
UK and all other countries in Europe, Middle East and Africa:	+44 141 9411940	**China:**	+86 20 8270 8556
		Japan and all other countries in Asia:	+81 6 67919323

Safety and protection are the prime purposes of Terasaki products. You care about safety and protection. The users of products you specify care about safety and protection.
We call TemBreak 2 the Ultimate Safety Breaker. Throughout this catalogue you will see our Safety+ mark. This is designed to draw your attention to safety features which exceed international standards.

Please read further to discover the benefits of TemBreak 2.

THE TEMBREAK 2 PRODUCT LINES

TEMBREAK 2

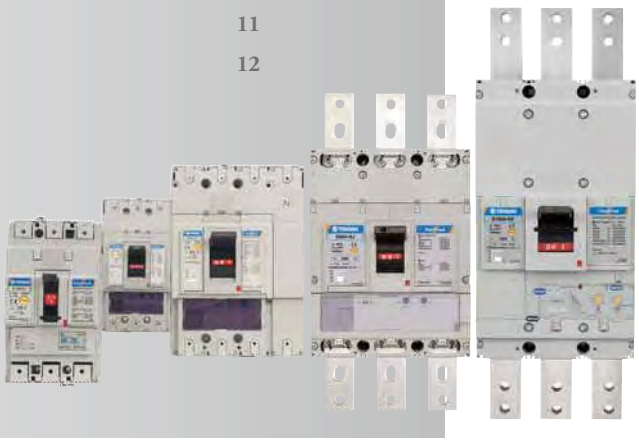
MOULDED CASE CIRCUIT BREAKERS

Rated current (I_n) from 20A to 1600A. Breaking Capacity (I_{cu}) from 25kA to 200kA at 415V AC.

TEMBREAK 2

MOULDED CASE CIRCUIT BREAKERS

16A TO 1600A



WELCOME TO TEMBREAK 2

EASY SELECTION GUIDE

The TemBreak 2 range of products includes:

- Moulded Case Circuit Breakers (MCCBs)
- Switch-Disconnectors in the same compact moulded case frame sizes as MCCBs
- A comprehensive range of accessories which are common to MCCBs and Switch-Disconnectors. All internal accessories are common to all frame sizes.

Key to Model and Type Designations

Model Denoted by

Type Denoted by

E	Economical
S	Standard
H	High
L	Limiting*

C,S	Low breaking capacity
N	Medium breaking capacity
G,R	High breaking capacity
P	Extra High breaking capacity

S | 125 | G | J

Frame rating, In (A)

F	Fixed thermal, fixed or adjustable magnetic
J	Adjustable thermal, adjustable magnetic
E	Electronic protection
N	No protection

*All TemBreak 2 MCCBs limit short-circuit faults by opening in less than 5ms. Limiting (L) models open particularly quickly.

EASY SELECTION GUIDE

Frame Rating (A)

125

160/250

400/630

800/1000

1250/1600

MCCBs

	125			160/250			400/630			800/1000			1250/1600		
	Model	Type	I_{cu} (kA)	Model	Type	I_{cu} (kA)	Model	Type	I_{cu} (kA)	Model	Type	I_{cu} (kA)	Model	Type	I_{cu} (kA)
E	E125	NJ	25	E250	NJ	25	E400	NJ	25						
							E630	NE	36						
S	S125	NF	25	S160	NF	25	S400	CJ	36	S800	CJ	36	S1250	SE	50
	S125	NJ	36	S160	NJ	36	S400	NJ	50	S800	NJ	50	S1250	NE	70
	S125	GJ	65	S160	GJ	65	S400	NE	50	S800	NE	50	S1250	GE	85
				S250	NJ	36	S400	GJ	70	S800	RJ	70	S1600	SE	50
				S250	NE	36	S400	GE	70	S800	RE	70	S1600	NE	85
				S250	GJ	65	S400	PJ	85	S1000	SE	50			
				S250	GE	65	S400	PE	85	S1000	NE	70			
				S250	PE	70	S630	CE	50						
							S630	GE	70						
H	H125*	NJ	125	H160	NJ	125	H400	NE	125	H800	NE	125			
				H250	NJ	125									
				H250	NE	125									
L	L125*	NJ	200	L160	NJ	200	L400	NE	200	L800	NE	200			
				L250	NJ	200									
I_n (A)	125 ↕ 16			250 ↕ 16			630 ↕ 250			1000 ↕ 630			1600 ↕ 1250		

Switch-Disconnectors

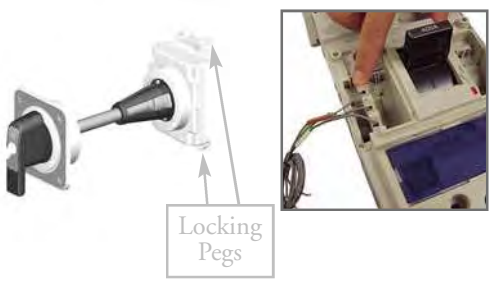
125		160/250		400/630		800/1000		1250/1600	
Model	Type	Model	Type	Model	Type	Model	Type	Model	Type
S125	NN	S160	NN	S400	NN	S800	NN	S1250	NN
		S250	NN	S630	NN	S1000	NN	S1600	NN

Note: All breaking capacities are r.m.s. symmetrical at 415V AC

*250A Frame

10 REASONS TO USE TEMBREAK 2

1. FIELD-INSTALLABLE ACCESSORIES



Accessories can be fitted by the switchboard builder or added by the end-user.

Handles and motor operators can be rapidly fitted using the locking pegs. It takes **less than 10 seconds to secure a handle or motor** to the MCCB – a great time saving compared to alternative products.

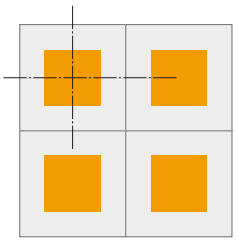
All accessories are endurance tested to the same level as the host MCCB.

2. SAFETY LOCK FOR PLUG-IN VERSIONS

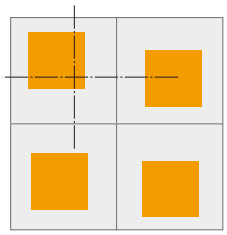
Plug-in MCCB and base *Plug-in connection kit, including safety lock*

The plug-in MCCB is locked to the base when the toggle is ON. It cannot be removed unless the toggle is OFF or TRIPPED. The safety lock prevents a trip occurring as the MCCB is being removed from the base.

3. SYMMETRICAL DOOR CUTOUT PATTERNS



Using TemBreak 2 Operating Handles



Using other MCCB Operating Handles

Door cutout patterns for handles are symmetrical, even when breakers are mounted in opposite directions.

4. MODULAR SIZES

All current ratings up to 630A can be supplied in **2 sizes:** the 250A and 630A sizes.

The compact 125A size offers **the same** features and performance but with reduced dimensions and cost.

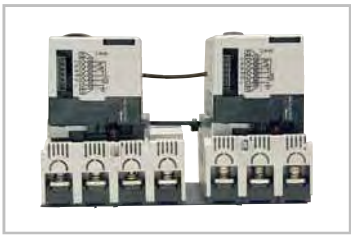
5. ADVANCED L.C.D. DISPLAY, OCR

The XOW-1S OCR comes standard with the backlit LCD display. It can monitor and indicate phase currents, voltages, power, energy, power factor, harmonic currents, and more. Data communications via Modbus, an open network, are supported.

10 REASONS TO USE TEMBREAK 2

6. COMPACT CHANGEOVERS

Changeover Pair with Link Interlock and Motor Operators



Viewed from Below (250A frame)

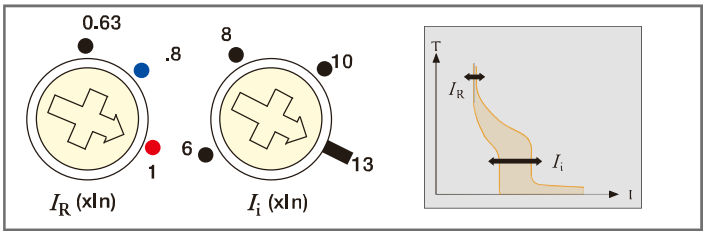
The mechanical interlock is installed on the front of the MCCB, and is compatible with motor operators and handles. An automatic changeover system can be assembled very easily by a switchboard builder or end-user.

7. DIRECT OPENING

Under the heading "Measures to minimise the risk in the event of failure", IEC 60204-1 Safety of Machinery-Electrical Equipment of Machinery includes the following recommendation:

"-the use of switching devices having positive (or direct) opening operation."

8. UNSURPASSED FLEXIBILITY



Overload protection is adjustable between 63% and 100% of the rating.

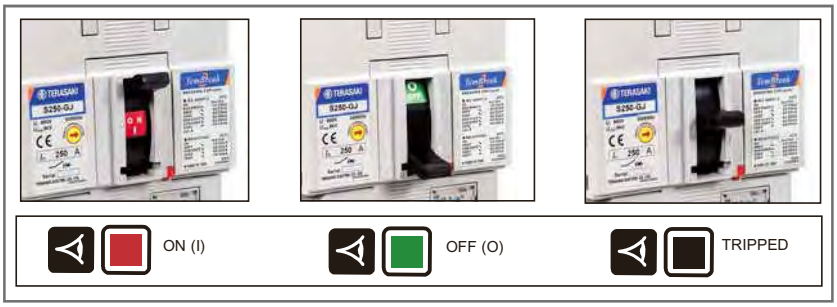
Short-circuit protection is adjustable on all thermal magnetic models.

Short-circuit protection settings are suitable for motor starting on all models, including the compact 125A frame.

9. CUSTOMISED TRIPPING TIMES

If you require a characteristic which is not available as a preset on our electronic protection unit, send us the details and we will program a customised characteristic to suit your application. (Within certain limits - contact us for details).

10. VISUAL SAFETY



Coloured indicators display the ON or OFF status. The indicators are fully covered if the breaker trips, and black is the only visible colour.

WELCOME TO TEMBREAK 2

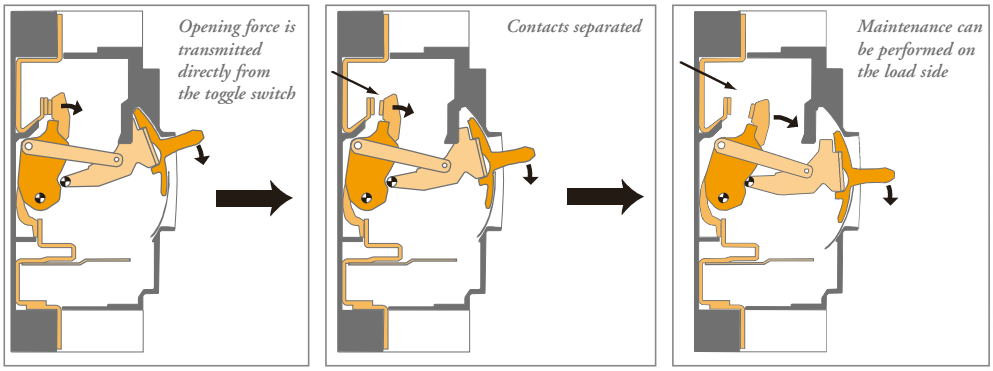
SAFETY PLUS

Terasaki have an innovative approach to product design. Our goal is to develop products which not only meet, but exceed recognised standards.

We use our knowledge of related applications to improve circuit breaker designs. For instance, when developing the Direct Opening Action, we applied ideas from a machinery safety standard to the design of the TemBreak 2 switching mechanism.

This proactive development policy confirms our reputation as Innovators in Protection Technology.

Machine Safety

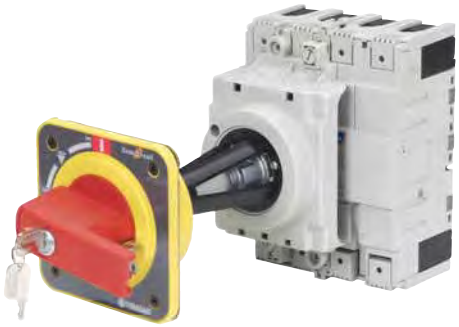


TemBreak 2 MCCBs are marked with IEC symbol indicating Direct Opening Action.

The robust mechanism ensures that the force you apply to the toggle is transmitted directly to the contacts.

Under the heading "Measures to minimise risk in the event of failure", IEC 60204-1 Safety of Machinery - Electrical Equipment of Machines includes the following recommendation:

" - the use of switching devices having positive (or direct) opening operation."



TemBreak 2 MCCBs help you to comply with the world's most stringent safety standards. It is one of the safest switching devices for machinery.

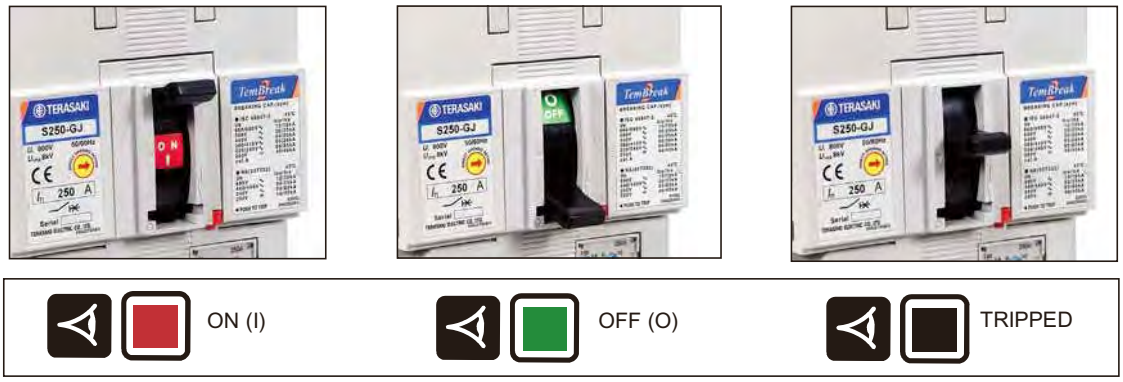
SAFETY PLUS

Visual Safety

You can easily see if a breaker is open, closed or tripped. **SAFETY+** coloured indicators boldly display the ON or OFF status. The indicators are fully covered if a breaker trips, and black is the only visible colour.

This is a ***unique*** safety feature. You can identify faulty circuits at a glance.

The toggle position always matches the position of the main contacts.



Touch Safety

The risk of touching live parts has been minimised by design.
These features reduce the risk of touching live parts:

There are no exposed metal screws on the front face

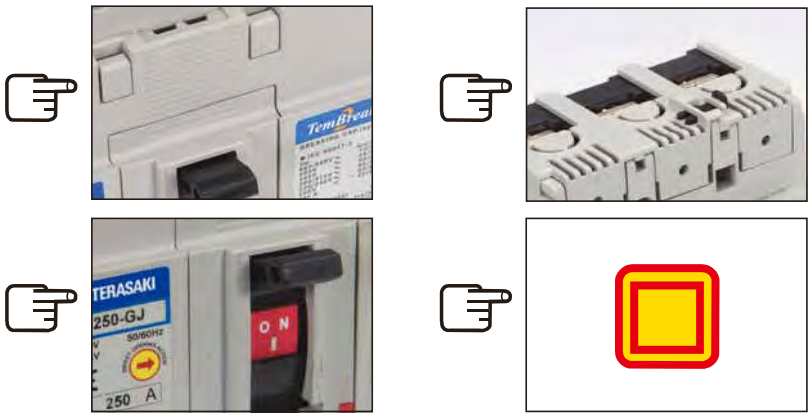
IP20 protection at the terminals

IP30 protection at the toggle

If the toggle is broken by accident or misuse, no live part is exposed

No live parts are exposed when fitting accessories

Double Insulation



WELCOME TO TEMBREAK 2

EXCEEDING STANDARDS

Safety Plus

TemBreak 2 MCCBs exceed the requirements of recognised standards.

International Compliance

The TemBreak 2 MCCB complies with the international standard **IEC 60947-2**

TemBreak 2 Switch Disconnectors comply with **IEC 60947-3**

Accessories comply with **IEC 60947-5-1 or IEC 61058-1**

The entire range conforms to the IEC general rules for switchgear, **IEC 60947-1**

TemBreak 2 MCCBs comply with **JIS C 8201-2-1 Ann.1**

The TemBreak 2 range complies with the EC Low Voltage Directive and all models are CE marked

TemBreak 2 MCCBs carry the IEC symbol indicating Direct Opening Action as defined by **IEC 60947-5-1. IEC 60204-1, Safety of Machinery - Electrical Equipment of Machines** recommends that switches used for machinery have Direct Opening Action to minimise risk in the event of failure

Independent Tests

TemBreak 2 circuit breakers have been tested at independent laboratories as well as in Terasaki's own laboratory in Osaka, Japan. Copies of independent test reports are available on request.

Marine Approvals

TemBreak 2 MCCBs are approved by the leading marine approval organisations.

REDUCING ENVIRONMENTAL IMPACT

Longer Life Cycle

It makes good environmental sense to install a product with a long life expectancy. If you install a TemBreak 2 MCCB, you can expect it to stay in service for at least 30,000 mechanical operations (250A Frame). This is 22,000 more operations than recommended by IEC 60947-2, the international standard for circuit breakers.

If a system must be upgraded in future, we have made the following provisions for recycling:

1

1. The modular design of TemBreak 2 allows component parts and accessories to be easily disassembled and separately disposed of. Moulded parts do not contain any embedded metal parts.
2. Materials are clearly marked to allow future identification for easy recycling.

2

Uses Eco-friendly Materials

The following materials are used in most TemBreak 2 circuit breakers:

Thermoplastic resin not containing PBBs or PBDEs

Lead-free solder

Cadmium-free contacts

Lighter and Smaller

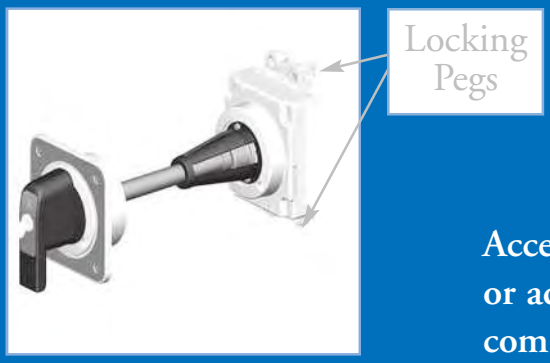
Components with low weight and volume make life easy for users, but high performance from smaller products also means less material used and less waste produced.

ISO 14001

Terasaki operate an Environmental Management System accredited to ISO 14001:1999. This requires us to monitor and measure the environmental performance of our activities, products and services in order to continually improve such performance.

Further information about this standard can be found on the internet at: www.tc207.org

FIELD-INSTALLABLE ACCESSORIES



Accessories can be fitted by the switchboard builder or added by the end-user. All internal accessories are common for TemBreak 2 MCCBs.

Handles and motor operators can be rapidly fitted using the locking pegs. It takes **less than 10 seconds to secure a handle or motor** to the MCCB – a great time saving compared to alternative products.

All accessories are endurance tested to the same level as the host MCCB.

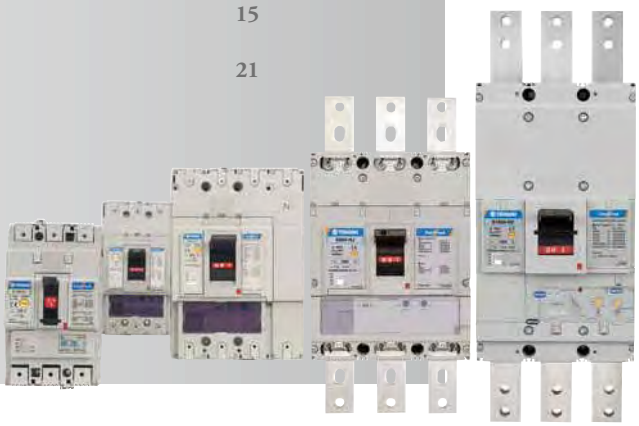
1

RATINGS AND SPECIFICATIONS

TEMBREAK 2

MOULDED CASE CIRCUIT BREAKERS

16A TO 1600A



RATINGS AND SPECIFICATIONS

MCCB ELECTRICAL CHARACTERISTICS TO IEC 60947-2, EN 60947-2, JIS C 8201-2-1 ANN.1, AS/NZS 3947-2, NEMA AB-1

Frame	Quantity	Unit	Condition	125	
Model				E125	S125
Number of Poles				3, 4	1
Type				NJ	NF
Nominal current ratings					
	I_n	(A)	45°C	20,32,50, 63,100,125	16,20,25, 32,40,50, 63, 80, 100,125
Electrical characteristics					
Rated operational voltage	U_e	(V)	AC 50/60 Hz	525	240
			DC	500	-
Rated insulation voltage	U_i	(V)		800	800
Rated impulse withstand voltage	U_{imp}	(kV)		8	8
Ultimate breaking capacity (IEC, JIS, AS/NZS)	I_{cu}	(kA)	690V AC	-	-
			525V AC	8	-
			440V AC	15	-
			400/415V AC	25	-
			220/240V AC	35	25
			250V DC	25	-
Service breaking capacity (IEC, JIS, AS/NZS)	I_{cs}	(kA)	690V AC	-	-
			525V AC	6	-
			440V AC	12	-
			400/415V AC	19	-
			220/240V AC	27	13
			250V DC	19	-
Rated breaking capacity (NEMA)		(kA)	480V AC	8	-
			240VAC	35	25
Protection					
Adjustable thermal, adjustable magnetic				■	
Fixed thermal, fixed magnetic					■
Microprocessor					
Utilisation category				A	A
Installation					
Front connection (FC)				■	■
Extension bar (FB)					
Cable clamp (FW)					
Rear connection (RC)					-
Plug-in (PM)					-
Draw- out (DR)				-	-
DIN rail mounting (DA)					
Dimensions	h	(mm)		155	155
	w	(mm)	3 pole, (1 pole)	90	(30)
			4 pole	120	
	d	(mm)		68	68
Weight	W	(kg)	3 pole, (1 pole)	1.1	(0.45)
			4 pole	1.4	
Operation					
Direct Opening Action				■	■
Toggle operation				■	■
Door mounted (HS, HP) / Breaker mounted handle (HB)					-
Motor operation (MC)					-
Endurance	Electrical	cycles	440V AC		
	Mechanical	cycles			

■ Standard Optional - Not Available

RATINGS AND SPECIFICATIONS

					160				
	S125	S125	H125	L125	S160	S160	S160	H160	L160
	3, 4 NJ	3,4 GJ	3, 4 NJ	3, 4 NJ	1 NF	3, 4 NJ	3, 4 GJ	3, 4 NJ	3, 4 NJ
	20,32,50, 63,100,125	20,32,50, 63,100,125	20,32,50, 63,100,125	20,32,50, 63,100,125	16,20,25,32, 40,50,63,80, 100,125,160	20,32,50,63, 100,125,160	50,63,100, 125,160	160	160
	690 600 800 8	690 600 800 8	690 600 800 8	690 600 800 8	415 125 800 8	690 600 800 8	690 600 800 8	690 600 800 8	690 600 800 8
	6 22 25 36 50 25	6 25 50 65 85 40	20 45 120 125 150 40	25 65 180 200 200 40	- - - - 25 -	7.5 (5*) 25 (18*) 25 (18*) 36 (30*) 65 (42*) 40 (30*)	7.5 25 50 65 85 40	20 45 120 125 150 40	25 65 180 200 200 40
	6 22 25 36/30 50 19	6 22 25 36/33 85 40	15 45 80 85 150 40	20 65 135 150 150 40	- - - - 19 -	7.5 (5*) 25 (18*) 25 (18*) 36 (25*) 65 (35*) 40 (25*)	7.5 25 25 36 85 40	15 45 80 85 150 40	20 65 135 150 150 40
	22 50	25 85	45 150	65 200	- 25	22 (18*) 65 (42*)	25 85	45 150	65 200
	■ A	■ A	■ A	■ A	■ A	■ A	■ A	■ A	■ A
	■ - 155 90 120 68 1.1 1.4	■ - 155 90 120 68 1.1 1.4	■ - - 165 105 140 103 2.4 3.2	■ - - 165 105 140 103 2.4 3.2	■ - - - 165 (35) - 68 (0.5)	■ - - 165 105 140 68 1.5 1.9	■ - - 165 105 140 68 1.5 1.9	■ - - 165 105 140 103 2.5 3.3	■ - - 165 105 140 103 2.5 3.3
	■ ■	■ ■	■ ■	■ ■	■ ■ - -	■ ■	■ ■	■ ■	■ ■
	30,000 30,000				20,000 30,000			20,000 30,000	

*Applies only to 20A and 32A models

RATINGS AND SPECIFICATIONS

MCCB ELECTRICAL CHARACTERISTICS TO IEC 60947-2, EN 60947-2, JIS C 8201-2-1 ANN.1, AS/NZS 3947-2, NEMA AB-1

Frame	Quantity	Unit	Condition	250				
Model				E250	S250	S250	S250	S250
Number of Poles				3, 4	3, 4	3, 4	3, 4	3, 4
Type				NJ	NJ	GJ	NE	GE
Nominal current ratings								
	I_n	(A)	45°C	20,32 50,63 100,125 160,200 250	160 200 250	160 200 250	40, 125, 160 250	40, 125, 160 250
Electrical characteristics								
Rated operational voltage	U_e	(V)	AC 50/60 Hz DC	525 500	690 600	690 600	690 -	690 -
Rated insulation voltage	U_i	(V)		800	800	800	800	800
Rated impulse withstand voltage	U_{imp}	(kV)		8	8	8	8	8
Ultimate breaking capacity (IEC, JIS, AS/NZS)	I_{cu}	(kA)	690V AC 525V AC 440V AC 400/415V AC 220/240V AC 250V DC	- 10 15 25 35 25	7.5 25 25 36 65 40	7.5 25 50 65 85 40	7.5 25 25 36 65 -	7.5 25 50 65 85 -
Service breaking capacity (IEC, JIS, AS/NZS)	I_{cs}	(kA)	690V AC 525V AC 440V AC 400/415V AC 220/240V AC 250V DC	- 7.5 12 19 27 19	7.5 25 25 36 65 40	7.5 25 25 36 85 40	7.5 25 25 36 65 -	7.5 25 25 36 85 -
Rated breaking capacity (NEMA)		(kA)	480V AC 240VAC	10 35	22 65	25 85	25 65	25 85
Rated short-time withstand current	I_{cw}	(kA)	0.3 Seconds	-	-	-	-	-
Protection								
Adjustable thermal, adjustable magnetic				■	■	■		
Fixed thermal, fixed magnetic								
Microprocessor							■	■
Utilisation category				A	A	A	A	A
Installation								
Front connection (FC)				■	■	■	■	■
Extension bar (FB)								
Cable clamp (FW)								
Rear connection (RC)								
Plug-in (PM)								
Draw- out (DR)				-	-	-	-	-
DIN rail mounting (DA)				-	-	-	-	-
Dimensions	h	(mm)		165	165	165	165	165
	w	(mm)	3 pole	105	105	105	105	105
		(mm)	4 pole	140	140	140	140	140
	d	(mm)		68	68	68	103	103
Weight	W	(kg)	3 pole	1.5	1.5	1.5	2.3	2.3
			4 pole	1.9	1.9	1.9	3.1	3.1
Operation								
Direct Opening Action				■	■	■	■	■
Toggle operation				■	■	■	■	■
Door mounted (HS, HP) / Breaker mounted handle (HB)								
Motor operation (MC)								
Endurance	Electrical	cycles	415V AC					
	Mechanical	cycles						

■ Standard Optional - Not Available

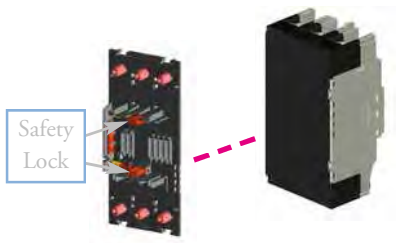
RATINGS AND SPECIFICATIONS

					400									630		
	S250	H250	H250	L250	E400	S400	S400	S400	S400	S400	S400	S400	H400	L400	E630	S630	S630
	3, 4 PE	3, 4 NJ	3, 4 NE	3, 4 NJ	3, 4 NJ	3, 4 CJ	3, 4 NJ	3,4 NE	3, 4 GJ	3, 4 GE	3, 4 PJ	3, 4 PE	3, 4 NE	3, 4 NE	3,4 NE	3, 4 CE	3, 4 GE
	40, 125, 160 250	160, 250**	40, 125, 160 250	160, 250**	250, 400	250, 400	250, 400	250, 400	250, 400	250, 400	250, 400	250, 400	250, 400	250, 400	630	630	630
	690 - 800 8	690 600 800 8	690 - 800 8	690 600 800 8	525 500 800 8	690 600 800 8	690 600 800 8	690 - 800 8	690 600 800 8	690 - 800 8	690 600 800 8	690 - 800 8	690 - 800 8	690 - 800 8	690* - 800 8	690* - 800 8	690* - 800 8
	20 35 50 70 125 -	20 45 120 125 150 40	20 45 120 125 150 -	25 65 180 200 200 40	- 15 22 25 35 25	15 22 30 36 50 40	20 30 45 50 85 40	20 30 45 50 85 -	20 30 65 70 100 40	20 30 65 70 100 -	20 30 80 85 100 40	20 30 80 85 100 -	35 45 120 125 150 -	50 65 180 200 200 -	10* 15 25 36 50 -	20* 30 45 50 85 -	20* 30 65 70 100 -
	15 35 50 70 125 -	15 45 80 85 150 40	15 45 80 85 150 -	20 65 135 150 150 40	- 15 22 25 35 19	15 22 30 36 50 40	15 30 45 50 85 40	15 30 45 50 85 -	15 30 50 50 85 40	15 30 50 50 85 -	15 30 80 85 85 40	15 30 80 85 85 -	35 45 80 85 150 -	50 65 135 150 150 -	10* 15 25 36 50 -	15* 30 45 50 85 -	15* 30 50 50 85 -
	35 125	45 150	45 150	65 200	15 35	22 50	25 85	25 85	30 100	30 100	30 100	30 100	45 150	65 200	15 50	25 85	30 100
	-	-	-	-	-	-	-	5	-	5	-	5	5	5	-	-	-
	■ A	■ A	■ A	■ A	■ A	■ A	■ A	■ B	■ A	■ B	■ A	■ B	■ B	■ B	■ A	■ A	■ A
	■ - - - 165 105 140 103 2.5 3.3	■ † - - 165 105 140 103 2.4 3.2	■ - - - 165 105 140 103 2.5 3.3	■ † - - 165 105 140 103 2.4 3.2	■ - - - 260 140 185 103 4.2 5.6	■ - - - 260 140 185 103 4.2 5.6	■ - - - 260 140 185 103 4.2 5.6	■ - - - 260 140 185 103 4.3 5.7	■ - - - 260 140 185 103 4.2 5.6	■ - - - 260 140 185 103 4.3 5.7	■ - - - 260 40 185 103 4.2 5.6	■ - - - 260 140 185 103 4.3 5.7	■ - - - 260 140 185 140 7.1 9.4	■ - - - 260 140 185 140 7.1 9.4	■ - ‡ - 260 140 185 103 5.0 6.5	■ - ‡ - 260 140 185 103 5.0 6.5	■ - ‡ - 260 140 185 103 5.0 6.5
	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
	10,000 30,000				4,500 15,000										4,500 15,000		

*MCCB cannot be used in IT systems at this voltage.
**Max. rating 225A for Plug-in.
† Refer to Temperature Ratings, Section 6.
‡ Contact us for details.

SAFETY LOCK FOR PLUG-IN VERSIONS

Plug-in MCCB and base



Plug-in connection kit, including safety lock

The plug-in MCCB is locked to the base when the toggle is ON. It cannot be removed unless the toggle is OFF or TRIPPED.
The safety lock prevents a trip occurring as the MCCB is being removed from the base.

2

OPERATING CHARACTERISTICS

TEMBREAK 2

MOULDED CASE CIRCUIT BREAKERS
16A TO 1600A

OPERATING CHARACTERISTICS

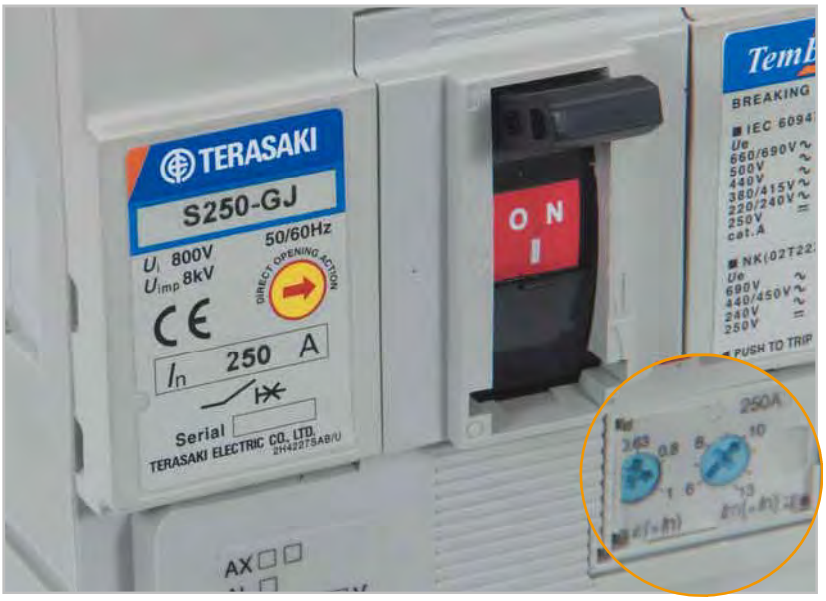
THERMAL MAGNETIC PROTECTION

TemBreak 2 MCCBs from 125A frame to 800A frame are available with thermal magnetic protection units.

Thermal Magnetic trip units are especially suited to the following applications:

Installations where harmonic distortion of current waveforms is likely.
They operate inherently on the root mean square (rms) heating effect of current.

DC circuits. Refer to Section 4, "The Application of MCCBs in DC Systems" for more information.



3 Pole MCCB with Adjustable Thermal and Adjustable Magnetic Characteristics

Single Pole MCCB with Fixed Characteristics

Models with Adjustable Thermal and Adjustable Magnetic Characteristics

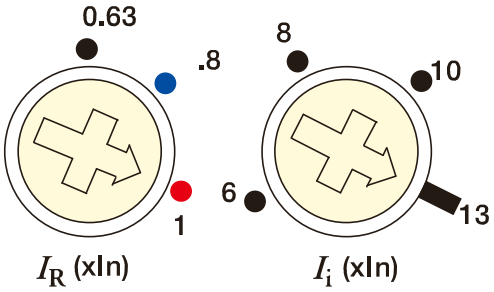
All standard 3 pole and 4 pole TemBreak 2 thermal magnetic models have adjustable thermal and adjustable magnetic characteristics.

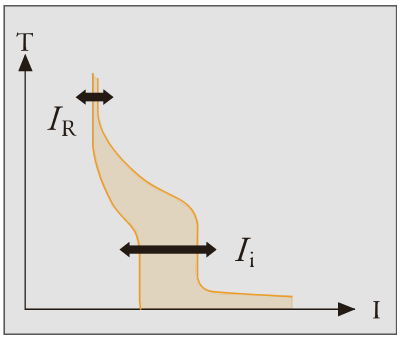
Traditionally, thermal magnetic MCCBs have had adjustable thermal with fixed magnetic characteristics. The fixed magnetic element can limit the application of the MCCB.

An adjustable magnetic characteristic allows short-circuit protection to be matched to the load and supply characteristics, for example motor inrush currents or generator short-circuit currents. Lowering the short-circuit tripping threshold can allow a higher earth-loop impedance in an installation and provide end-of-cable protection with the correct disconnection times.

THERMAL MAGNETIC PROTECTION

Adjustment Dials





1. I_R is the thermal element adjustment dial and is used to set the rated current to match the conductor rating.

   I_R can be set between 0.63 and 1.0 times I_n.

2. I_i is the magnetic element adjustment dial and is used to set the short circuit tripping threshold to suit the application.

Models, Types, Rated Currents and Magnetic trip currents of Thermal Elements

Model	Type	Rated current I_n (A)	Magnetic trip current I_i (A)
S125	-NF	16, 20, 25, 32, 40, 50, 63, 80, 100	13 × I_n
		125	12.4 × I_n
E125	-NJ	20, 32, 50, 63, 100	6 – 12 × I_n
		125	6 – 10 × I_n
S125	-NJ	20, 32, 50, 63, 100	6 – 12 × I_n
		125	6 – 10 × I_n
S125	-GJ	20, 32, 50, 63, 100	6 – 12 × I_n
		125	6 – 10 × I_n
H125	-NJ	20, 32, 50, 63, 100, 125	6 – 12 × I_n
L125	-NJ	20, 32, 50, 63, 100, 125	6 – 12 × I_n
S160	-NF	16, 20, 25, 32, 40, 50, 63, 80, 100, 125, 160	10 × I_n
S160	-NJ	20, 32, 50, 63, 100, 125	6 – 12 × I_n
		160	6 – 13 × I_n
S160	-GJ	50, 63, 100, 125	6 – 12 × I_n
		160	6 – 13 × I_n
H160	-NJ	160	6 – 13 × I_n
L160	-NJ	160	6 – 13 × I_n
E250	-NJ	20, 32, 50, 63, 100, 125	6 – 12 × I_n
		160, 200	6 – 13 × I_n
		250	6 – 10 × I_n
S250	-NJ	160, 200	6 – 13 × I_n
		250	6 – 10 × I_n
S250	-GJ	160, 200	6 – 13 × I_n
		250	6 – 10 × I_n
H250	-NJ	160	6 – 13 × I_n
		250 (225A for Plug-in)	6 – 10 × I_n
L250	-NJ	160	6 – 13 × I_n
		250 (225A for Plug-in)	6 – 10 × I_n
E400	-NJ	250, 400	6 – 12 × I_n
S400	-CJ	250, 400	6 – 12 × I_n
S400	-NJ	250, 400	6 – 12 × I_n
S400	-GJ	250, 400	6 – 12 × I_n
S800	-CJ	630, 800	5 – 10 × I_n
S800	-NJ	630, 800	5 – 10 × I_n
S800	-RJ	630, 800	5 – 10 × I_n

OPERATING CHARACTERISTICS

THERMAL MAGNETIC PROTECTION

Single Pole MCCBs

Single pole models have fixed thermal and fixed magnetic characteristics.

Generator Protection

Generators may need specially modified protection characteristics, based on their short-circuit capability.

If a generator is capable of delivering short-circuit current greater than six times its full load current, a standard TemBreak 2 thermal magnetic MCCB may be used, with I_i set at less than the available short-circuit current. (Note that MCCBs, with fixed magnetic characteristics may not be suitable for this application.)

A thermal magnetic MCCB with low instantaneous protection may be used where the generator short-circuit current is less than six times its full load current. These are modified versions of the standard MCCB.

Four pole MCCBs with low instantaneous protection have protection on the neutral pole as standard. The magnetic characteristic of MCCBs with low instantaneous protection is fixed at the following values:

Model	Magnetic Trip Current
E125	$3xI_n$
S125	$3xI_n$
S160	$3xI_n$
E250	$3xI_n$
S250	$3xI_n$
E400	$3.5xI_n$
S400	$3.5xI_n$

Neutral Pole Protection

Neutral pole protection is available as an optional extra on four pole thermal magnetic MCCBs. The thermal and magnetic elements in the neutral pole are related to those in the phase poles as follows:

	Phase Trip Threshold	Neutral Trip Threshold
Thermal	I_r (adjustable)	I_N (adjustable)= I_n
Magnetic	I_i (adjustable)	I_i (adjustable)

Motor Protection

MCCBs feeding motors are often only required to provide protection from short-circuits. Overload protection is provided by a dedicated thermal or electronic overload relay. Tembreak 2 MCCBs without thermal protection elements are available for this application. Four pole MCCBs with magnetic trip only have protection on the neutral pole as standard.

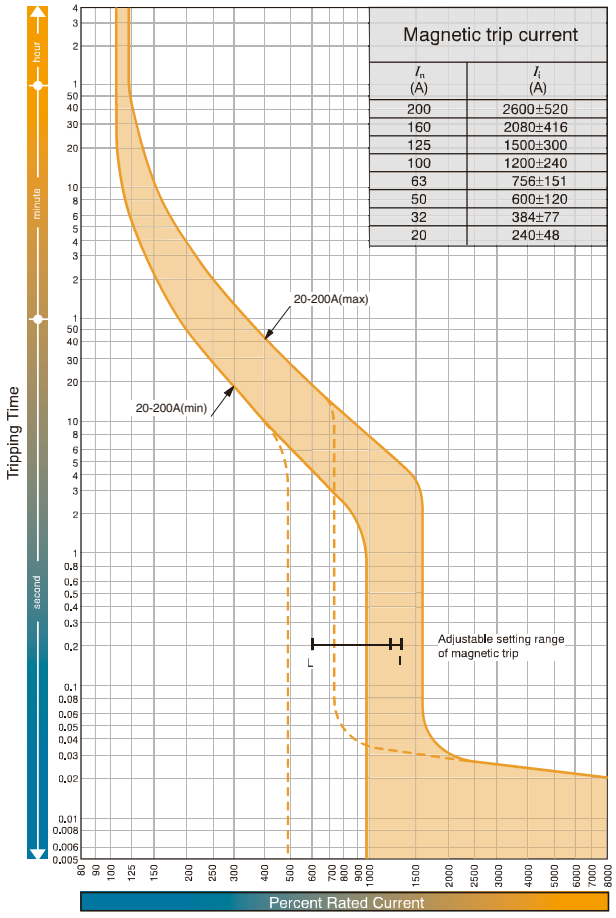
OPERATING CHARACTERISTICS

THERMAL MAGNETIC CHARACTERISTICS

160A and 250A Frames

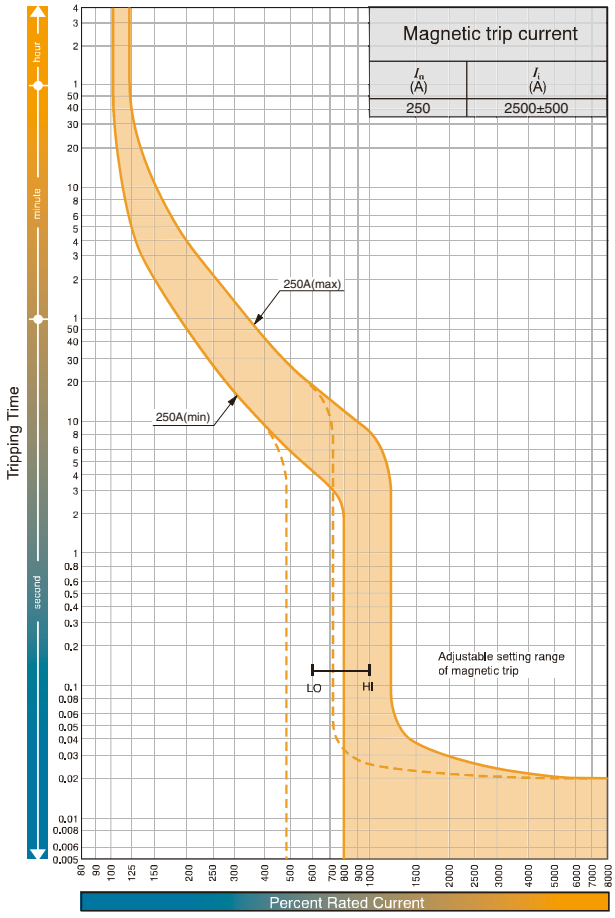
Time/current characteristic curves

S160-NJ, S160-GJ, E250-NJ, S250-NJ, S250-GJ



Time/current characteristic curves

E250-NJ, S250-NJ, S250-GJ



OPERATING CHARACTERISTICS

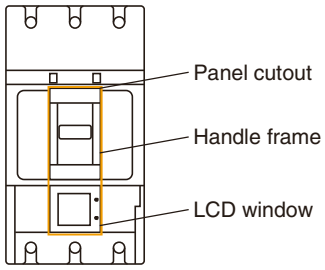
ELECTRONIC PROTECTION (WITH LCD)

Appearance

The TemBreak2 enhanced electronic breaker with integrated VT and CT monitors the current, voltage, instantaneous electrical power, integrated electrical energy and power factor of a circuit and displays their values on the LCD on the front of the breaker. This breaker using the Modbus protocol allows data such as measured values and event/fault logs to be transmitted to an external device.

- The LCD window provides the phase currents, line voltages (and their maximum values), power factor, electrical power and electrical energy. It can also provide the 1st to 19th harmonic currents for each phase.

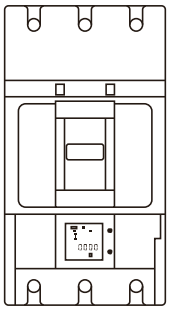
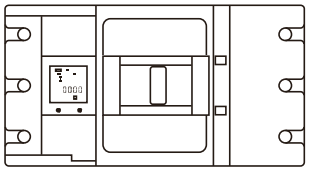
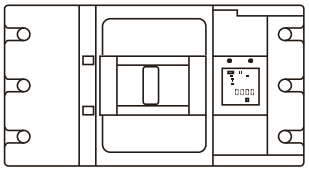
- When a fault occurs, the cause of the fault and the fault current are indicated on the LCD. Data in memory is stored even if the power is lost. You can view event or fault logs after the power is restored.



The LCD window is equal to the handle frame in width; the panel cutout can be made easily.

ELECTRONIC PROTECTION (WITH LCD)

● The breaker is available in three LCD orientations corresponding to the installation orientations of the breaker.

Vertical (move the handle up to ON) (Standard orientation)	Horizontal (move the handle right to ON)	Horizontal (move the handle left to ON)
		

If the breaker is installed in a horizontal orientation, please specify "Horizontal (move the handle right to ON)" or "Horizontal (move the handle left to ON)" when ordering. Otherwise the standard orientation "Vertical (move the handle up to ON)" will apply.

OCR Power Supply for Electronic Protection with LCD

The XOW OCR, protection relays, requires control power.
The OCR power supply is installed on the right side of the breaker as standard. This can also be installed separately to the breaker. Please specify when ordering.

Note ①: When the OCR power supply is installed on the right side of the breaker, the breaker cannot be equipped with a terminal block for connection to the shunt trip device and under voltage trip device.

● Specifications of OCR power supply

Control voltage Note ② (Rated voltage)	100 – 120 VAC or 200 – 240 VAC
Current consumption	2VA

Note ②: The permissible range of the control voltage is 85 to 110% of the rated voltage.
Please specify the rated voltage when ordering.

Dimensions of the OCR power supply can be found in Section 7.

OPERATING CHARACTERISTICS

ELECTRONIC PROTECTION (WITH LCD)

Available types

Type of OCR	Protective function				Alarm function	Display		
	Long time-delay trip Short time-delay trip Instantaneous trip	Ground fault trip	N-phase protection	Phase rotation protection	Pre-trip alarm	LCD window	LCD backlight	
	A	GF	NP	NS	PTA			
XOW-1L-A	●	—	—	—	—	●	—	
XOW-1L-AGN	●	●	●	—	—	●	—	
XOW-1L-AP	●	—	—	—	●	●	—	
XOW-1L-APGNS	●	●	●	●	●	●	—	
XOW-1L-APC	●	—	—	—	●	●	—	
XOW-1L-APGNSC	●	●	●	●	●	●	—	
XOW-1S-A	●	—	—	—	—	●	●	
XOW-1S-AGN	●	●	●	—	—	●	●	
XOW-1S-AP	●	—	—	—	●	●	●	
XOW-1S-APGNS	●	●	●	●	●	●	●	
XOW-1S-APCWH	●	—	—	—	●	●	●	
XOW-1S-APGNSCWH	●	●	●	●	●	●	●	

● : Standard equipment
○ : Optional
— : Not applicable

Measurement/event indication function specifications

Measurement/event (accuracy)		Modbus communication function ○ : Yes —: Non	Note
Load current (±1.5%)	Present value for each phase	○	Ground fault current and negative-phase current can be displayed depending on the specifications.
	Present max value	○	Among L1, L2, L3 phases, the phase having the highest current is subject to measurement and the value of the current is displayed.
Line voltage (±1.0%)	Present value of each line voltage	○	
	Present max value	○	
	Present phase voltage value for each phase	○	Applies to 4-pole breakers only.
Harmonic current (±2.5%)	Present value of 3rd, 5th, 7th, ...19th harmonic current for each phase	—	
Electrical power (±2.5%)	Present value	○	
	Demand value	○	
	Max demand value	○	
Electrical energy (±2.5%)	Electrical energy	○	
Power factor (±5%)	Present value	○	
Trip event log	Fault current (±1.5%)	○	
	Indication of cause	○	
Alarm event log	Cause of alarm, Indication of operated value	○	

Note: Electrical energy is stored every hour and the fault current and cause of fault are stored every time a fault occurs in a flash memory.

OPERATING CHARACTERISTICS

	Measurement/event indication						Communication function	External indicator	Test function	Indication via output contact	Control power supply
	Current	Voltage, electrical power, electrical energy, power factor, demand electrical power	Electrical energy pulse	Harmonic current	Trip event log	Alarm event log					
			W	H			C	I		Y	
	●	—	—	—	●	●	—	—	●	—	Required
	●	—	—	—	●	●	—	—	●	—	Required
	●	—	—	—	●	●	—	—	●	●	Required
	●	—	—	—	●	●	—	—	●	●	Required
	●	—	—	—	●	●	●	—	●	●	Required
	●	—	—	—	●	●	●	—	●	●	Required
	●	●	—	—	●	●	—	—	●	—	Required
	●	●	—	—	●	●	—	—	●	—	Required
	●	●	—	—	●	●	—	—	●	●	Required
	●	●	—	—	●	●	—	—	●	●	Required
	●	●	●	●	●	●	●	○	●	●	Required
	●	●	●	●	●	●	●	○	●	●	Required

Network interface I/O specifications

Item	Modbus line
Communication protocol	RS-485
Communication mode	2-wire, half-duplex
Topology	Multi-drop bus
Transmission rate	19.2 kbps max
Transmission distance	1.2 km max (at 19.2 kbps)
Data format	Modbus-RTU
Max number of nodes	1–31

OPERATING CHARACTERISTICS

ELECTRONIC CHARACTERISTICS (WITH LCD)

Specifications of over-current release

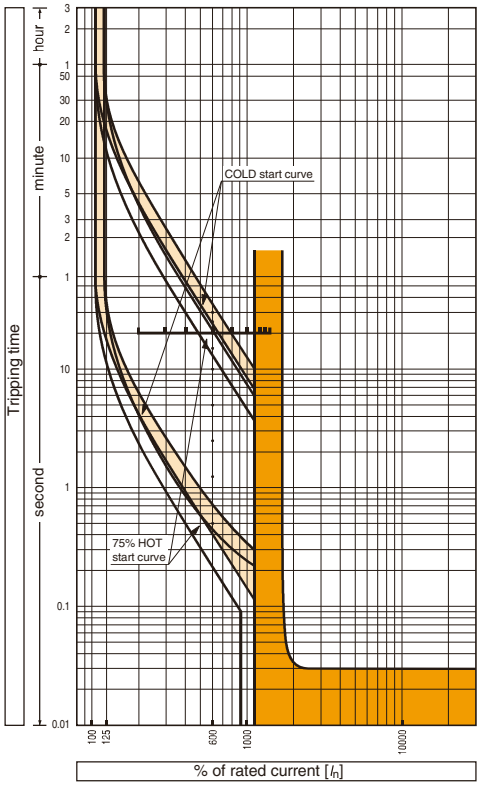
Applicable MCCB type	CT rated primary current I_{CT}
S400-NE, S400-GE, S400-PE,	250A
H400-NE, L400-NE	400A
E630-NE, S630-CE, S630-GE	630A
S800-NE, S800-RE,	630A
H800NE, L800-NE	800A
S1000-SE, S1000-NE	1000A

Protective function		Symbol	Setting range
Rated current (A)		I_n	[I_{CT}] x (0.5-0.63-0.8-1.0)
Long time-delay trip LT	Pick-up current (A)	I_R	[I_n] x (0.8-0.85-0.9-0.95-1.0) Non tripping at not more than [I_R] x 1.05 Tripping at more than [I_R] x 1.05 and not more than [I_R] x 1.2
	Time-delay (s)	t_R	(0.5-1.25-2.5-5-10-15-20-25-30) (sec) at 600% of [I_R] ① Time-delay setting tolerance: ±20%, +0.13s –0s
	COLD/HOT	—	COLD/HOT
Short time-delay trip ST	Pick-up current (A)	I_{sd}	[I_n] x (1-1.5-2-2.5-3-4-6-8-10-NON) ② Current setting tolerance: ±15%
	Time-delay (s)	t_{sd}	I^2t OFF: 0.05-0.1-0.2-0.3s (Definite time characteristic) I^2t ON: 0.05-0.1-0.2-0.3s (Ramp characteristic at less than 1000% of [I_n], Definite time characteristic at 1000% or more of [I_n])
	I^2t ramp characteristic	—	OFF/ON
Instantaneous trip INST	Pick-up current (A)	I_i	[I_n] x (2-3-4-6-8-10-12-13-14-NON) ③④ Current setting tolerance: ±20%
Ground fault trip GF	Pick-up current (A)	I_g	[I_{CT}] x (0.2-0.3-0.4-NON) Current setting tolerance: ±20%
	Time-delay (s)	t_g	I^2t OFF: 0.1-0.2-0.3-0.4-0.8s (Definite time characteristic) Time-delay setting tolerance: +50ms –20ms I^2t ON: 0.1-0.2-0.3-0.4-0.8s (Ramp characteristic at less than 40% of [I_{CT}], Definite time characteristic at 40% or more of [I_{CT}]) Time-delay setting tolerance: ±15%, +50ms –20ms
	I^2t ramp characteristic	—	OFF/ON
	Mode	—	TRIP/OFF ⑤
N-phase protection NP	Pick-up current (A)	I_N	[I_{CT}] x (0.4-0.5-0.63-0.8-1.0-NON) Non tripping at not more than [I_N] x 1.05 Tripping at more than [I_N] x 1.05 and not more than [I_N] x 1.2
	Time-delay (s)	t_N	Tripping at 600% of [I_N] with LT time-delay [t_R].
	COLD/HOT	—	COLD/HOT
Phase rotation protection NS	Pick-up current (A)	I_{NS}	[I_n] x (0.2-0.3-0.4-0.5-0.6-0.7-0.8-0.9-1.0) Current setting tolerance: ±10%
	Time-delay (s)	t_{NS}	(0.4-0.8-1.2-1.6-2.0-2.4-2.8-3.2-3.6-4.0) (sec) at 150% of [I_{NS}] Time-delay setting tolerance: ±20%, +0.13s –0s
	Mode	—	TRIP/OFF ⑤
Pre-trip alarm PTA	Pick-up current (A)	I_P	[I_n] x (0.7-0.8-0.9-1.0) Current setting tolerance: ±10%
	Time-delay (s)	t_P	5-10-15-20-40-60-80-120-160-200s more than [I_P] Time-delay setting tolerance: ±10%, +0.1s –0s
	Mode	—	AL/OFF ⑤

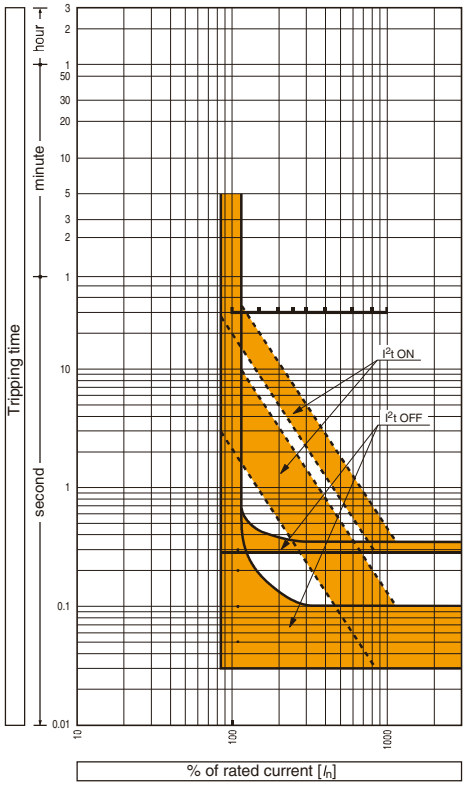
Note ①: For E630, S630, S1000, (0.5-1.25-2.5-5-10-15-16)sec.
②: For E630, S630, S1000, [I_n] x (1-1.5-2-2.5-3-4-6-8-NON).
③: The max. pick-up current is set to 1300% x [I_{CT}] for S400, H400 and L400, 1000% x [I_{CT}] for E630, S630 and S1000, 1200% x [I_{CT}] for S800, H800 and L800.
④: When the short time delay trip function has been set to NON, the instantaneous trip function cannot be set to NON. When the instantaneous trip function has been set to NON, the short time delay trip function cannot be set to NON.
⑤: Selecting "OFF" disables protective functions.
Unless otherwise specified when ordering, the settings will default to those underlined in the table above.

ELECTRONIC CHARACTERISTICS (WITH LCD)

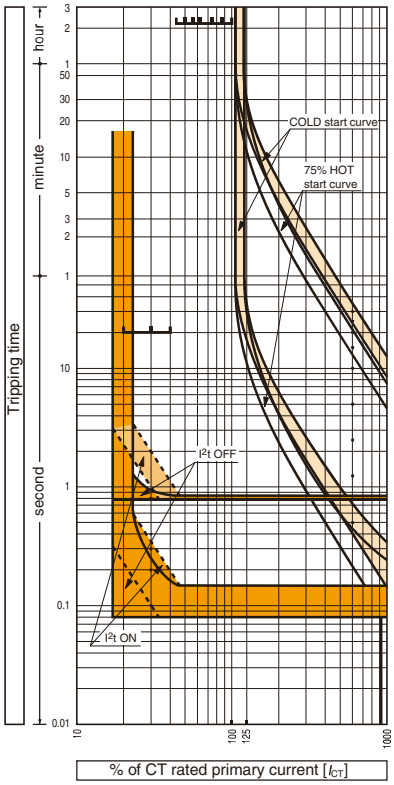
Long time-delay and instantaneous trip



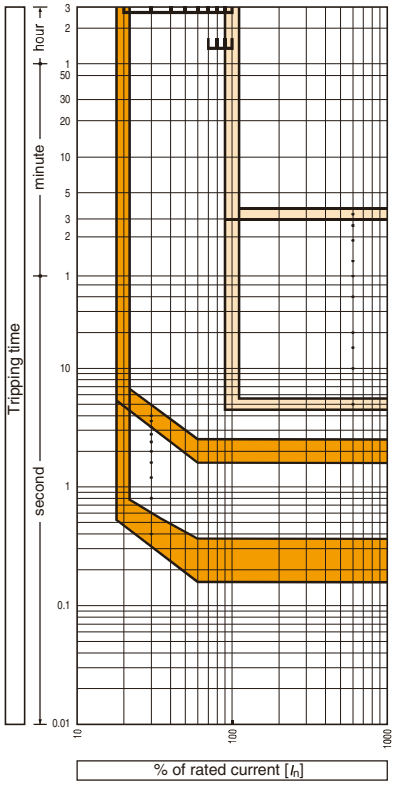
Short time-delay trip



N-phase protection and ground fault trip

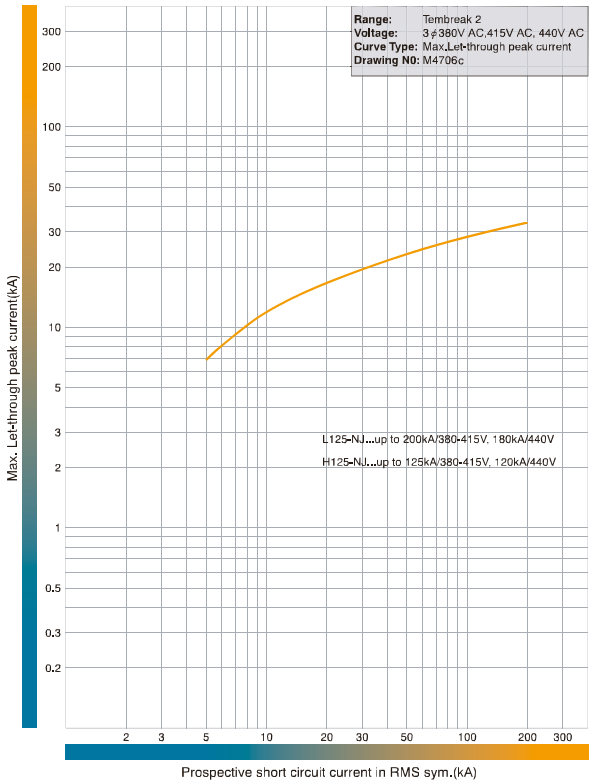


Phase rotation protection and pre-trip alarm

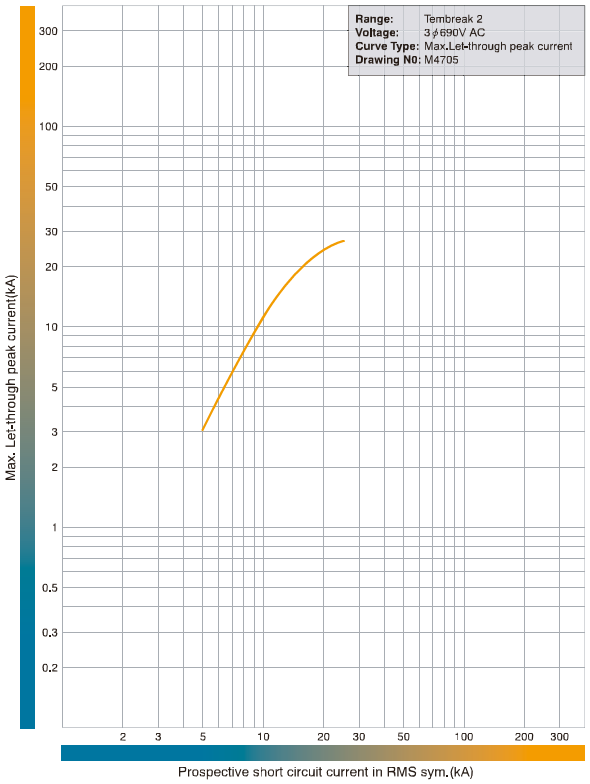


LET-THROUGH PEAK CURRENT CHARACTERISTICS

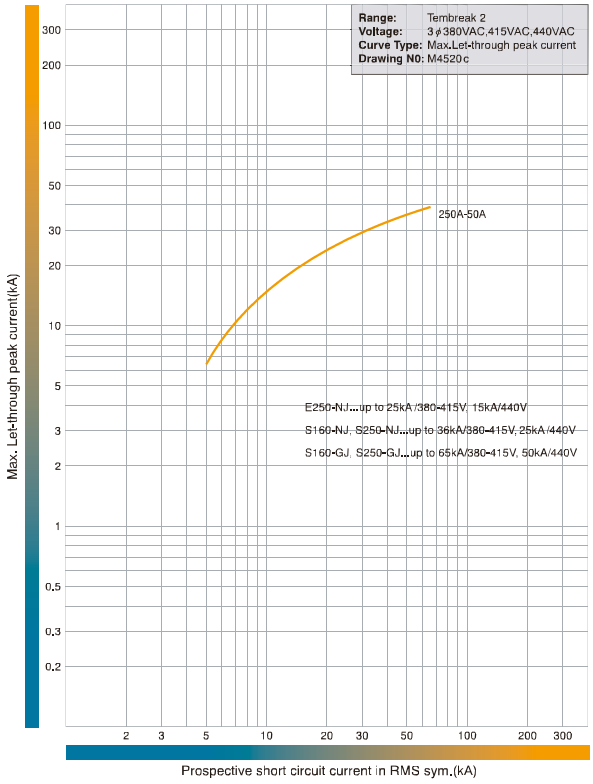
H125-NJ, L125-NJ. 440V AC.



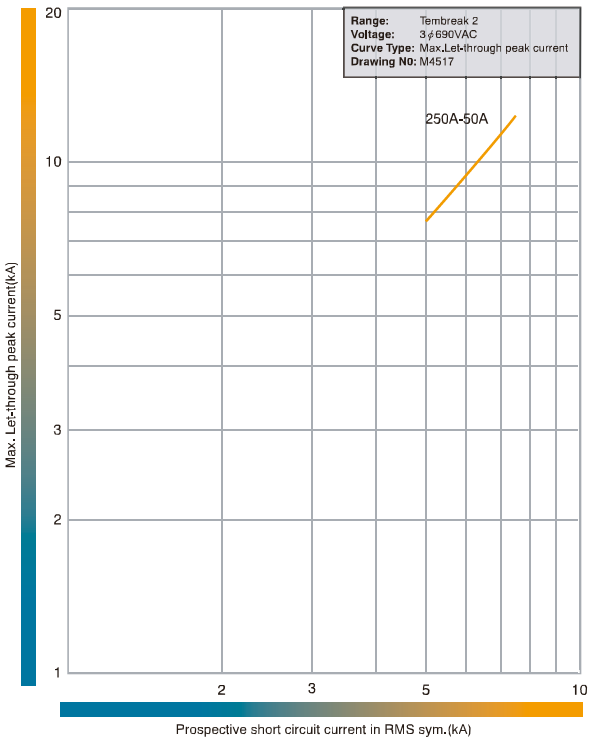
H125-NJ, L125-NJ. 690V AC.



S160-NJ, S160-GJ, E250-NJ, S250-NJ, S250-GJ. 440V AC.



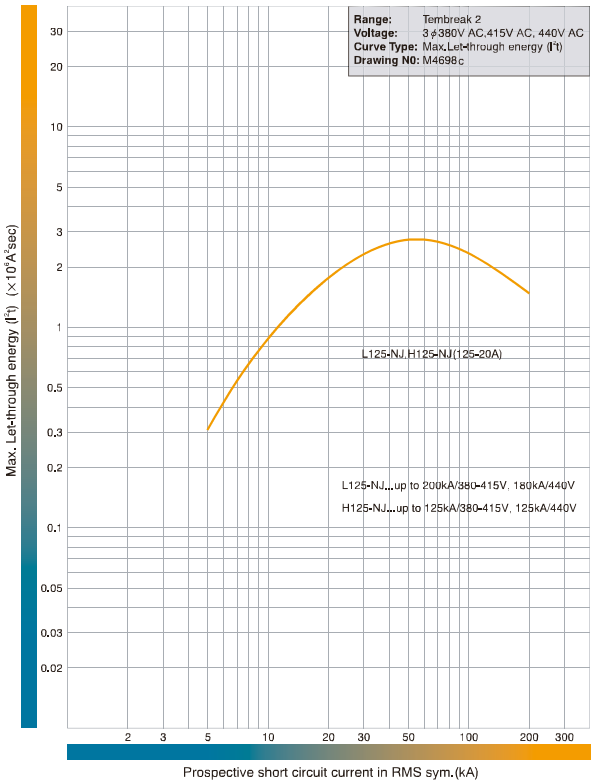
S160-NJ, S160-GJ, S250-NJ, S250-GJ. 690V AC.



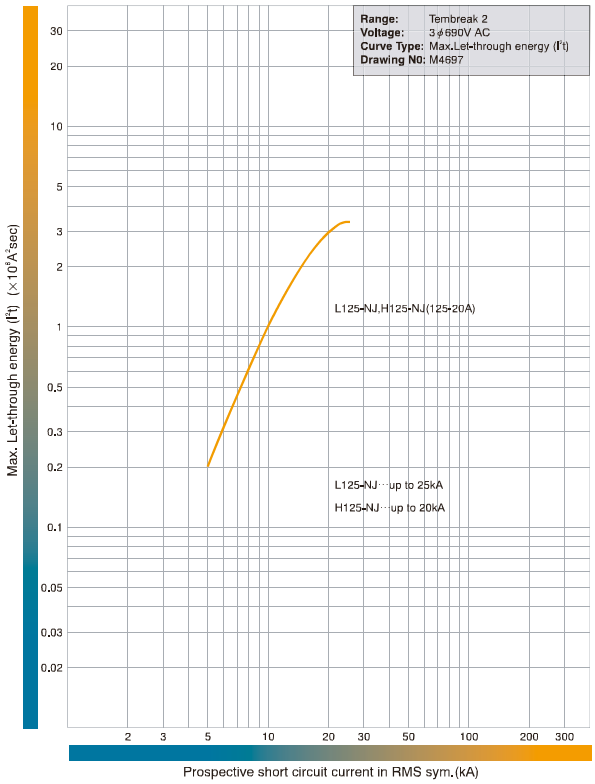
OPERATING CHARACTERISTICS

LET-THROUGH ENERGY CHARACTERISTICS

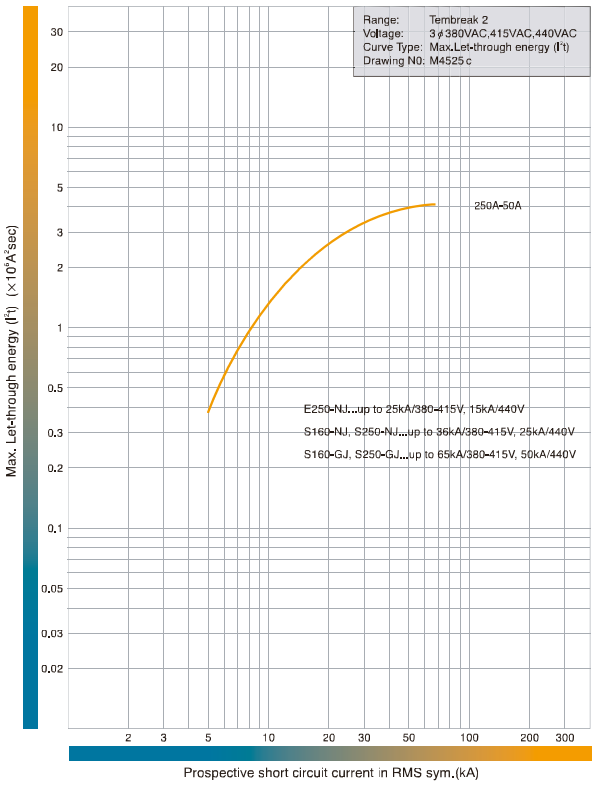
H125-NJ, L125-NJ. 440V AC.



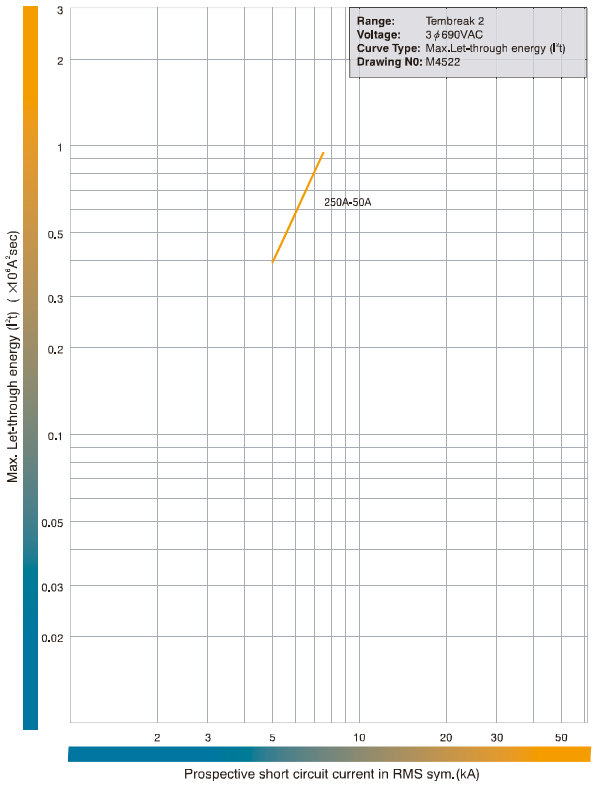
H125-NJ, L125-NJ. 690V AC.



S160-NJ, S160-GJ, E250-NJ, S250-NJ, S250-GJ. 440V AC.

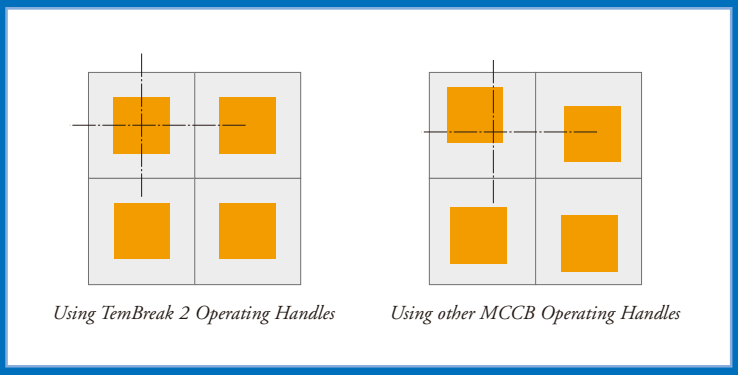


S160-NJ, S160-GJ, S250-NJ, S250-GJ. 690V AC.



SYMMETRICAL DOOR CUTOUT PATTERNS

Door cutout patterns for handles are symmetrical, even when breakers are mounted in opposite directions.



Using TemBreak 2 Operating Handles

Using other MCCB Operating Handles

3

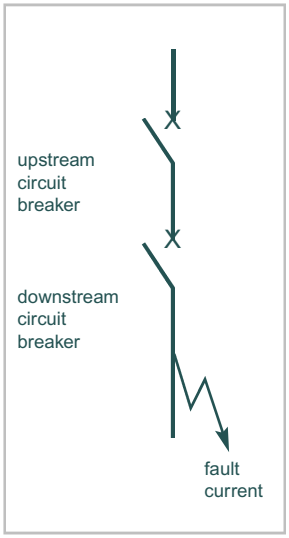
TEMBREAK 2
MOULDED CASE CIRCUIT BREAKERS
16A TO 1600A

APPLICATION DATA

DISCRIMINATION

WHAT IS DISCRIMINATION?

Discrimination, also called selectivity, is the co-ordination of protective devices such that a fault is cleared by the protective device installed immediately upstream of the fault, and by that device alone.



Total discrimination

Discrimination is said to be total if the downstream circuit breaker opens and the upstream circuit breaker remains closed. This ensures maximum availability of the system.

Partial discrimination

Discrimination is partial if the above condition is not fulfiled up to the prospective short-circuit current, but to a lesser value, termed the selectivity limit current (I_s).

Above this value both circuit breakers could open, resulting in loss of selectivity.

HOW TO READ THE DISCRIMINATION TABLES

Boxes containing the letter "T" indicate total discrimination between the relevant upstream and downstream circuit-breakers. Total discrimination applies for all fault levels up to the breaking capacity of the upstream or the downstream circuit breaker, whichever is the lesser.

For the other boxes, discrimination is either partial or there is no discrimination.

If discrimination is partial then the value of the selectivity limit current, I_s, is shown in the box.

Worked Examples

Q (1) A main switchboard requires a 1600A ACB feeding a 400A MCCB. The fault level is 70kA. What combination of protective devices would provide total discrimination?

A (1) A TemPower2 ACB AR216S feeding a TemBreak2 S400-GJ would provide total discrimination up to 70kA. See page 71

Note: Discrimination would be total whether the TemPower 2 ACB had an integral or external protection relay because I_{cw} (I_s) = I_{cs}.

Most other ACBs have I_{cw} (I_s) <I_{cs}.

HOW TO READ THE DISCRIMINATION TABLES

Q (2) A Sub distribution board requires a 630A MCCB feeding a 250A MCCB. The fault level is 65kA. What combination of protective devices would provide total discrimination?

A (2) Using a TemBreak 2 S630-GE MCCB feeding a TemBreak 2 S250-GJ would provide total discrimination up to 65kA. See page 73

Q (3) A final distribution board contains a 125A MCCB incomer feeding a 32A Type B MCB. Is discrimination between these devices possible?

A (3) A TemBreak 2 MCCB type S160-NJ/125A feeding a TD3 DIN type MCB would provide total discrimination. See page 72

Alternatively **ANY OTHER** MCB can be used provided it has energy limiting ability of class 3 in accordance with EN 60898.

APPLICATION DATA

DISCRIMINATION TABLES

Upstream: TemPower 2 ACB with or without Integral Protection Relay. Downstream: TemBreak 2 MCCB.

Upstream ACB

Frame			800A	1250A		1600A			2000A			2500A		3200A		4000A	5000A	6300A	
	Model		AR208S	AR212S	AR212H	AR216S	AR216H	AR316H	AR220S	AR220H	AR320H	AR325S	AR325H	AR332S	AR332H	AR440SB	AR650S	AR663S	AR663H
		Breaking Capacity	65kA	65kA	80kA	65kA	80kA	100kA	65kA	80kA	100A	85kA	100kA	85kA	100kA	100kA	120kA	120kA	135kA
125A	E125NJ	25kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S125NJ	36kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S125GJ	65kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	H125NJ	125kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	L125NJ	200kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
160A/ 250A	S160NJ	36kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S160GJ	65kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	E250NJ	25kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S250NJ	36kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S250GJ	65kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S250PE	70kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	H250NJ	125kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	L250NJ	200KA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
400A/ 630A	E400NJ	25kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S400CJ	36kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S400NJ	50kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S400NE	50kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S400GJ	70kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S400GE	70kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S400PJ	85kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S400PE	85kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	H400NJ	125kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	H400NE	125kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	E630NE	36kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S630CE	50kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S630GE	70kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
800A	S800-CJ	36kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S800-NJ	50kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S800-RJ	70kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S800-NE	50kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S800-RE	70kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	H800-NE	125kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	L800-NE	200kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
1000A	S1000-SE	50kA	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S1000-NE	70kA	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
1250A	S1250-SE	50kA	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S1250-NE	70kA	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S1250-GE	100kA	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
1600A	S1600-SE	50kA	-	-	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S1600-NE	100kA	-	-	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T

Downstream MCCB

Notes: 1. All ACB's have I_i set at NON, MCR ON.
2. Assuming ACB time settings are greater than MCCB.
3. The above table is in accordance with IEC 60947-2, Annex A.
4. External relay can be used - Contact Terasaki for further details.
5. All values shown at 400V AC.

T= Total Selectivity

DISCRIMINATION TABLES

Upstream: TemBreak 2 MCCB (thermal-magnetic)
Downstream: MCB

Upstream MCCB

Downstream MCB	S125NJ (36kA) E125NJ (25kA)						S160NJ (36kA)							S250NJ (36kA) E250NJ (25kA)									S400NJ	
In	20A	32A	50A	63A	100A	125A	20A	32A	50A	63A	100A	125A	160A	20A	32A	50A	63A	100A	125A	160A	200A	250A	250A	400A
6A	260	T	T	T	T	T	260	T	T	T	T	T	T	260	T	T	T	T	T	T	T	T	T	T
10A	260	420	T	T	T	T	260	420	T	T	T	T	T	260	420	T	T	T	T	T	T	T	T	T
16A	260	420	650	T	T	T	260	420	650	T	T	T	T	260	420	650	T	T	T	T	T	T	T	T
20A	260	420	650	1000	T	T	260	420	650	1000	T	T	T	260	420	650	1000	T	T	T	T	T	T	T
25A	260	420	650	1000	T	T	260	420	650	1000	T	T	T	260	420	650	1000	T	T	T	T	T	T	T
32A	260	420	650	1000	1500	T	260	420	650	1000	1500	T	T	260	420	650	1000	1500	T	T	T	T	T	T
40A	260	420	650	1000	1500	2000	260	420	650	1000	1500	2000	T	260	420	650	1000	1500	2000	T	T	T	T	T
50A	260	420	650	1000	1500	2000	260	420	650	1000	1500	2000	3000	260	420	650	1000	1500	2000	3000	T	T	T	T
63A	260	420	650	1000	1500	2000	260	420	650	1000	1500	2000	3000	260	420	650	1000	1500	2000	3000	2600	T	T	T

Notes: 1. MCBs can be of any manufacture provided they are Energy class three as defined in EN 60898.
2. Table based on type B MCBs
3. MCBs can be 6kA or 10kA at 400V
4. The above table is in accordance with IEC 60947-2, Annex A.
5. All values shown at 400V AC.
6. *Is* expressed in A.

T= Total Selectivity

APPLICATION DATA

DISCRIMINATION TABLES

Upstream: TemBreak 2 MCCB (electronic).
Downstream: TemBreak 2 MCCB.

Upstream MCCB

Frame			250A				400A					630A			800A				1000A		1250A			1600A	
	Model		S250-NE	S250-GE	S250-PE	H250-NE	S400-NE	S400-GE	S400-PE	H400-NE	L400-NE	E630-NE	S630-CE	S630-GE	S800-NE	S800-RE	H800-NE	L800-NE	S1000-SE	S1000-NE	S1250-SE	S1250-NE	S1250-GE	S1600-SE	S1600-NE
		Breaking Capacity	36 kA	65 kA	70 kA	125 kA	50 kA	70 kA	85 kA	125 kA	200 kA	36 kA	50 kA	70 kA	50 kA	70 kA	125 kA	200 kA	50 kA	70 kA	50 kA	70 kA	100 kA	50 kA	100 kA
50A	S50-NF	10kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
100A	E100-NF	10kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
125A	E125-NJ	25kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S125-NJ	36kA	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S125-GJ	65kA	T	T	T	T	T	T	T	T	T	T	T	T	T	50	T	T	T	T	T	T	T	T	T
	H125-NJ	125kA	T	T	T	T	T	T	T	T	T	T	T	T	T	50	T	T	T	T	T	T	70	T	85
160A/ 250A	S160-NJ	36kA	-	-	-	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S160-GJ	65kA	-	-	-	-	T	T	T	T	T	T	T	T	36	36	T	T	T	50	T	T	T	T	T
	H160-NJ	125kA	-	-	-	-	-	-	-	T	T	T	T	T	T	50	T	T	T	T	T	T	70	T	85
	E250-NJ	25kA	-	-	-	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S250-NJ	36kA	-	-	-	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S250-GJ	65kA	-	-	-	-	T	T	T	T	T	T	T	T	36	36	T	T	T	50	T	T	T	T	T
	S250-NE	36kA	-	-	-	-	-	-	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	S250-GE	65kA	-	-	-	-	-	-	-	T	T	T	T	T	36	36	T	T	T	50	T	T	T	T	T
	H250-NJ	125kA	-	-	-	-	-	-	-	T	T	T	T	T	T	50	T	T	T	T	T	T	70	T	85
	S250-PE	70kA	-	-	-	-	-	-	-	T	T	T	T	T	36	36	T	T	T	50	T	T	70	T	T
	H250-NE	125kA	-	-	-	-	-	-	-	T	T	T	T	T	36	36	T	T	T	50	T	T	70	T	85
400A/ 630A	E400-NJ	25kA	-	-	-	-	-	-	-	-	-	10	10	10	T	T	T	T	T	T	T	T	T	T	T
	S400-CJ	36kA	-	-	-	-	-	-	-	-	-	10	10	10	25	25	25	25	30	30	T	T	T	T	T
	S400-NJ	50kA	-	-	-	-	-	-	-	-	-	10	10	10	25	25	25	25	30	30	36	36	36	T	T
	S400-NE	50kA	-	-	-	-	-	-	-	-	-	10	10	10	25	25	25	25	30	30	36	36	36	T	T
	S400-GJ	70kA	-	-	-	-	-	-	-	-	-	10	10	10	25	25	25	25	30	30	36	36	36	T	50
	S400-GE	70kA	-	-	-	-	-	-	-	-	-	10	10	10	25	25	25	25	30	30	36	36	36	T	50
	S400-PJ	85kA	-	-	-	-	-	-	-	-	-	10	10	10	25	25	25	25	30	30	36	36	36	T	50
	S400-PE	85kA	-	-	-	-	-	-	-	-	-	10	10	10	25	25	25	25	30	30	36	36	36	T	50
	H400-NE	125kA	-	-	-	-	-	-	-	-	-	10	10	10	36	36	25	25	T	50	T	T	70	T	70
	E630-NE	36kA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T	T	T	T	T
	S630-CE	50kA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36	36	36	T	T
	S630-GE	70kA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36	36	36	T	50
800A	S800-CJ	36kA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	20
	S800-NJ	50kA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	20
	S800-RJ	70kA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	20
	S800-NE	50kA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	20
	S800-RE	70kA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	20

Downstream MCCB

Notes: 1. All pick-up current and time delay settings are to be set at maximum for upstream MCCBs.
2. The above table is in accordance with IEC 60947-2, Annex A.
3. All values shown at 400V AC.
4. Is expressed in kA.

T= Total Selectivity

WHAT IS CASCADING?

Cascading is a technique where the current limiting capability of upstream circuit breakers is used to permit the installation of lower rated and therefore lower cost circuit breakers downstream.

The upstream TemBreak 2 circuit breaker acts as a resistance against short-circuit currents. With this assistance, downstream circuit breakers with breaking capacities lower than the prospective short-circuit at their point of installation can interrupt the reduced short-circuit current.

Since the current is limited downstream of the limiting circuit breaker, cascading applies to all switchgear in the downstream circuit. It is not restricted to two consecutive devices.

Cascading is recognised by the following standards related to electrical installations:

IEC 60364

BS 7671

AS/NZS 3000

The Advantages

Installation of a single limiting circuit-breaker results in considerable simplifications and savings for the entire downstream installation:

Simplification of selection of devices using the cascading tables

Savings on downstream devices. Cascading allows circuit-breakers with lower ratings to be used.

In addition the application of cascading will reduce both electrodynamic and thermal stress within the installation.

APPLICATION DATA

HOW TO READ THE CASCADE TABLES

The value shown in the table is the increased breaking capacity, expressed in kA, that can be achieved if the downstream MCCB is backed up by the appropriate upstream MCCB.

Worked Examples:

Q (1) A 36kA panelboard is required with a 400A incomer and 125A outgoing MCCBs. Can cascading be applied?

A (1) A cost effective solution would be to use an S400-CJ incomer rated at 36kA and E125-NJ MCCBs rated at 25kA downstream.

The upstream S400-CJ MCCB would back up the downstream E125-NJ to 36kA. If this was an 8 Way panelboard you have managed to save cost by installing eight 25kA MCCBs rather than eight 36kA MCCBs.

Q (2) If the same 8 way panelboard was to be used in an 80kA installation, what MCCBs could be used?

A (2) You could still use the E125-NJ provided it was backed up by an L400-NE. The Current limiting capacity of the 400A MCCB would back up the E125A from 25kA to 85kA.

CASCADE TABLES

Upstream: TemBreak 2 MCCB.
Downstream: Din type MCB.

Upstream MCCB

Downstream MCB	Model	E125NJ (25kA)	S125NJ (36kA)	S125GJ (65kA)	S160NJ (36kA)	S160GJ (65kA)	E250NJ (25kA)	S250NJ (36kA)	S250GJ (65kA)
	In	125A	125A	125A	160A	160A	250A	250A	250A
TD3 M06 (6kA)	6A	14	14	14	12	12	12	12	12
	10A	14	14	14	12	12	12	12	12
	16A	14	14	14	12	12	12	12	12
	20A	14	14	14	12	12	12	12	12
	25A	14	14	14	12	12	12	12	12
	32A	14	14	14	12	12	12	12	12
	40A	12	12	12	10	10	10	10	10
	50A	12	12	12	10	10	10	10	10
	63A	12	12	12	10	10	10	10	10

Notes: 1. All values shown at 400V AC.
2. Cascade fault level limit is expressed in kA.

Upstream MCCB

Downstream MCB	Model	E125NJ (25kA)	S125NJ (36kA)	S125GJ (65kA)	S160NJ (36kA)	S160GJ (65kA)	E250NJ (25kA)	S250NJ (36kA)	S250GJ (65kA)
	In	125A	125A	125A	160A	160A	250A	250A	250A
TD3 M10 (10kA)	6A	25	30	30	25	25	25	25	25
	10A	25	30	30	25	25	25	25	25
	16A	25	30	30	25	25	25	25	25
	20A	25	30	30	25	25	25	25	25
	25A	25	30	30	25	25	25	25	25
	32A	25	30	30	25	25	25	25	25
	40A	25	30	30	23	23	23	20	23
	50A	25	30	30	23	23	23	23	23
	63A	25	30	30	23	23	23	23	23

Notes: 1. All values shown at 400V AC.
2. Cascade fault level limit is expressed in kA.

APPLICATION DATA

CASCADE TABLES

Upstream: TemBreak 2 MCCB.
Downstream: TemBreak 2 MCCB.

Upstream MCCB

Downstream MCCB																		
Frame			125A					160A/250A										
	Model		E125NJ	S125NJ	S125GJ	H125NJ	L125NJ	S160NJ	S160GJ	H160NJ	L160NJ	E250NJ	S250NJ	S250GJ	S250PE	H250NJ H250NE	L250NJ
		Breaking Capacity	25kA	36kA	65kA	125kA	200kA	36kA	65kA	125kA	200kA	25kA	36kA	65kA	70kA	125kA	200kA
50A	S50NF	10kA	25	25	25	25	25	15	15	25	25	15	15	15	15	25	25
	E100NF	10kA	25	25	25	25	25	15	15	25	25	15	15	15	15	25	25
125A	E125NJ	25kA	-	36	50	65	85	36	50	65	85	-	36	50	50	65	85
	S125NJ	36kA	-	-	65	85	125	-	65	85	125	-	-	65	65	85	125
	S125GJ	65kA	-	-	-	125	150	-	-	125	150	-	-	-	70	125	150
	H125NJ	125kA	-	-	-	-	200	-	-	-	200	-	-	-	-	-	200
160A/ 250A	S160NJ	36kA	-	-	-	-	-	-	65	85	125	-	-	65	65	85	125
	S160GJ	65kA	-	-	-	-	-	-	-	125	150	-	-	-	70	125	150
	H160NJ	125kA	-	-	-	-	-	-	-	-	200	-	-	-	-	-	200
	E250NJ	25kA	-	-	-	-	-	-	-	-	-	-	36	50	50	65	85
	S250NJ	36kA	-	-	-	-	-	-	-	-	-	-	-	65	65	85	125
	S250GJ	65kA	-	-	-	-	-	-	-	-	-	-	-	-	70	125	150
	S250PE	70kA	-	-	-	-	-	-	-	-	-	-	-	-	-	125	150
	H250NJ	125kA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200

Notes: 1. All values shown at 400V AC.
2. Cascade fault level limit is expressed in kA.

Upstream MCCB

Downstream MCCB																							
Frame			400A						630A			800A/1000A						1250A/1600A					
	Model		S400CJ	S400NJ S400NE	S400GJ S400GE	S400PJ S400PE	H400NE	L400NE	E630NE	S630CE	S630GE	S800CJ	S800NJ S800NE	S800RJ S800RE	H800NE	L800NE	S1000SE	S1000NE	S1250SE	S1250NE	S1250GE	S1600SE	S1600NE
		Breaking Capacity	36kA	50kA	70kA	85kA	125kA	200kA	36kA	50kA	70kA	36kA	50kA	70kA	125kA	200kA	50kA	70kA	50kA	70kA	85kA	50kA	85kA
125A	E125NJ	25kA	36	36	50	50	65	85	36	36	50	30	36	36	-	-	-	-	-	-	-	-	-
	S125NJ	36kA	-	50	65	65	85	125	-	50	65	-	50	50	-	-	-	-	-	-	-	-	-
	S125GJ	65kA	-	-	70	85	125	150	-	-	70	-	-	70	-	-	-	-	-	-	-	-	-
	H125NJ	125kA	-	-	-	-	-	200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
160A/ 250A	S160NJ	36kA	-	50	65	65	85	125	-	50	65	-	50	70	50	50	50	70	-	-	-	-	-
	S160GJ	65kA	-	-	70	85	125	150	-	-	70	-	-	70	70	70	-	70	-	-	-	-	-
	H160NJ	125kA	-	-	-	-	-	200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	E250NJ	25kA	36	36	50	50	65	85	36	36	50	30	36	50	36	36	36	50	-	-	-	-	-
	S250NJ	36kA	-	50	65	65	85	125	-	50	65	-	50	70	50	50	50	70	-	-	-	-	-
	S250GJ	65kA	-	-	70	85	125	150	-	-	70	-	-	70	70	70	-	70	-	-	-	-	-
	S250PE	70kA	-	-	-	-	125	150	-	-	-	-	-	-	85	85	-	-	-	-	-	-	-
	H250NJ	125kA	-	-	-	-	-	200	-	-	-	-	-	-	-	150	-	-	-	-	-	-	-
400A	E400NJ	25kA	36	36	50	50	65	85	36	36	50	30	36	50	36	36	36	36	36	36	36	36	36
	S400CJ	36kA	-	50	65	65	70	100	-	50	65	-	50	70	50	50	50	50	50	50	50	50	50
	S400NJ	50kA	-	-	70	70	85	125	-	-	70	-	-	70	70	70	-	70	-	70	70	-	70
	S400GJ	70kA	-	-	-	85	125	150	-	-	-	-	-	-	85	85	-	-	-	-	-	-	85
	S400PJ	85kA	-	-	-	-	125	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: 1. All values shown at 400V AC.
2. Cascade fault level limit is expressed in kA.

The Application of MCCBs in DC Systems

Terasaki's MCCBs provide an excellent range of protection for DC installations. We offer MCCBs of up to 1000A with DC overload protection and up to 2500A with DC short-circuit protection.

Protection Method

Current transformers require alternating current to generate magnetic flux thereby inducing current to flow in the secondary winding. Any device which relies on current transformers for measurement or detection of current is therefore unsuitable for protection of DC systems. Most electronic MCCBs fall into this category.

The most common method of detecting DC overloads is by the use of a thermal element. Short-circuit protection in DC circuits is provided by electromagnetic tripping elements.

Tripping Characteristics

The time-current characteristics of a thermal element, such as those published in Section 3, are unaffected by the frequency of current applied. They hold good for both AC and DC currents.

A magnetic element operates on the instantaneous value of the current waveform. This means that in practice in an AC circuit, it will operate at the peak value of the sinusoidal waveform. Tripping characteristics are published in AC root mean square (rms) Amperes (A). This means that the value of AC instantaneous current, I_P, which will operate the element is equal to the rms current multiplied by $\sqrt{2}$. Similarly, the value of DC instantaneous current which will operate the element is equal to the AC rms current multiplied by $\sqrt{2}$.

DC operating current of magnetic element = $\sqrt{2} \times$ AC rms operating current of magnetic element.

Time Constant

Time constants associated with DC circuits prevent the voltage of the circuit from reacting immediately when a load current is suddenly interrupted.

The time constant, τ, of a circuit indicates how quickly voltage across capacitors and current through inductors react to transient conditions.

The time constant of a capacitive circuit is the product of capacitance and resistance:
$\tau = RC$ (s).
The time constant of an inductive circuit is given by:
$\tau = L/R$ (s).

APPLICATION DATA

The Application of MCCBs in DC Systems

Time Constant

Transient voltages and currents, including those produced by switching, do not approximate their steady state values until 5 time constants have elapsed.

Fault currents occurring in circuits with high time constants are extremely difficult to interrupt due to the lagging voltage. All DC breaking capacities in this section are shown with the assumption that the time constant of the circuit is restricted to the values shown below.

Fault Level	τ
Near the rated current, I_n, of the circuit breaker	<2.0ms
<2.5 x I_n	<2.5ms
<10kA	<7ms
>10kA	<15ms

Breaking Capacity

The short-circuit ratings of MCCBs suitable for DC installations are shown in the table below. In some cases, two or more poles must be connected in series to achieve the given rating, this is also indicated in the table.
Please refer to catalogue I73E for further details.

DC Breaking Capacity, Icu (kA), Protection and Reference								
Voltage	250V DC	350V DC	500V DC		600V DC		Protection	
Poles in Series	2	3	3	4	3	4	Overload	Short Circuit
E125-NJ	25	–	–	–	–	–	Thermal, adjustable	Magnetic, adjustable
S125-ND	–	10	–	7.5	–	5	Thermal, adjustable	Magnetic, fixed
S125-GJ	40	–	–	–	–	–	Thermal, adjustable	Magnetic, adjustable
S160-ND	–	10	–	7.5	–	5	Thermal, adjustable	Magnetic, fixed
E250-NJ	25	–	–	–	–	–	Thermal, adjustable	Magnetic, adjustable
S250-ND	–	10	–	7.5	–	5	Thermal, adjustable	Magnetic, fixed
E400-NJ	25	–	–	–	–	–	Thermal, adjustable	Magnetic, adjustable
S400-CJ	–	–	–	–	–	–	Thermal, adjustable	Magnetic, adjustable
S400-ND	–	20	15	–	15	–	Thermal, adjustable	Magnetic, fixed
S800-CJ	50	–	–	–	–	–	Thermal, adjustable	Magnetic, adjustable
S800-ND	–	30	20	–	20	–	Thermal, adjustable	Magnetic, fixed
XS1000ND	50	30	20	20	20	20	Thermal, fixed	Magnetic, adjustable
XS1250ND	50	50	50	50	20	20	–	Magnetic, adjustable
XS1600ND	50	50	50	50	20	20	–	Magnetic, adjustable
XS2000ND	50	50	50	50	20	20	–	Magnetic, adjustable
XS2500ND	50	50	50	50	20	20	–	Magnetic, adjustable

TEMBREAK 2

MOULDED CASE CIRCUIT BREAKERS 16A TO 1600A

ELECTRICAL CONTROL USING INTERNALLY MOUNTED ACCESSORIES

Electrical control accessories for TemBreak 2 are designed with the installer in mind. Status and alarm contacts, remote tripping coils and undervoltage protection coils are of modular design and convenient to use.

(1) (2) (3) (4) (5) (6)

1) Heavy-duty auxiliary switch
2) Heavy-duty alarm switch
3) General-purpose auxiliary switch
4) General-purpose alarm switch
5) Shunt trip
6) Undervoltage trip

Every accessory fits every MCCB and Switch-Disconnector in the range.

All accessories are endurance tested to the same level as MCCBs.

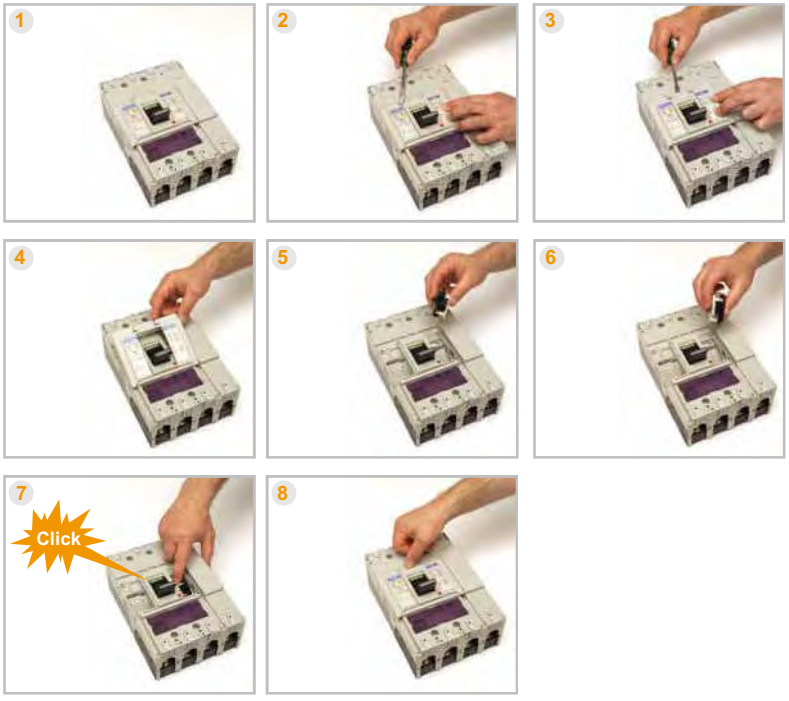
TemBreak 2 internal accessories are easily **field-installable.**

All accessories are individually packaged and are supplied with fitting instructions.

Control wiring is terminated on the accessory screw terminal. Alternatively a terminal block which clips to the side of the MCCB is available.

Installing Accessories in a 4 pole S400 model

The internal accessories can be easily installed in the field without special tools or product training.



Easy field-Installation of Accessories

Internal accessory can be simply plugged into position

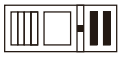
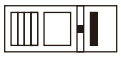
No tools are required for this, except a screwdriver to lift the MCCB front cover clips.

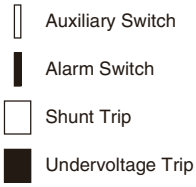
Accessories fit with a firm click when installed correctly.

Colour coding of accessories helps identification and installation

ELECTRICAL CONTROL USING INTERNALLY MOUNTED ACCESSORIES

Valid Maximum Accessory Combinations

Frame size (A)	125	160 and 250	400 and 630	800 and 1000	1250 and 1600
E	E125	E250	E400 E630		
S	S125	S160 S250	S400 S630	S800 S1000	S1250 S1600
H		H125 H160 H250	H400	H800	
L		L125 L160 L250	L400	L800	
General Purpose Auxiliary Switch General Purpose Alarm Switch Shunt Trip					
General Purpose Auxiliary Switch General Purpose Alarm Switch Undervoltage Trip					
Heavy Duty Auxiliary Switch Heavy Duty Alarm Switch Shunt Trip					
Heavy Duty Auxiliary Switch Heavy Duty Alarm Switch Undervoltage Trip					



General purpose and heavy duty status indication switches cannot be mixed in the same MCCB.

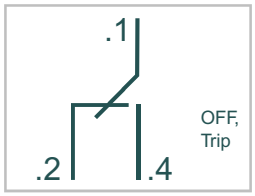
It is not possible to install a shunt trip and an undervoltage trip in an MCCB as they occupy the same location. Undervoltage trips can provide remote tripping if necessary by wiring a normally closed contact or pushbutton in series with the protected supply.

Undervoltage trips with time delays require an external time delay controller which clips to the side of the MCCB.

ELECTRICAL CONTROL USING INTERNALLY MOUNTED ACCESSORIES

Status Indication Switches

General Purpose Auxiliary Switch



Terminal Designations and Function of General Purpose Auxiliary Switch

General Purpose Auxiliary Switch (AX)

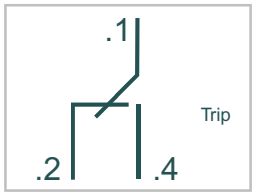
An auxiliary switch electrically indicates the ON or OFF status of the MCCB. The general purpose type is a changeover switch with 3 terminals.

A microcurrent version is available for switching currents as low as 1mA.

Auxiliary switches are colour coded grey. The cable capacity of the terminals is 0.5 to 1.25mm^2.

The general purpose auxiliary switch meets the requirements of IEC 61058-1.

General Purpose Alarm Switch



Terminal Designations and Function of General Purpose Alarm Switch

General Purpose Alarm Switch (AL)

An alarm switch electrically indicates the TRIP status of the MCCB. The general purpose type is a changeover switch with 3 terminals.

A microcurrent version is available for switching currents as low as 1mA.

Alarm switches are colour coded grey and black. The cable capacity of the terminals is 0.5 to 1.25mm^2.

The general purpose alarm switch meets the requirements of IEC 61058-1.

General purpose auxiliaries and alarm switch ratings

Volts (V)	AC Amperes (A)		Volts (V)	DC Amperes (A)		Minimum Load
	Resistive Load	Inductive Load		Resistive Load	Inductive Load	
440	-	-	250	-	-	100mA at
240	3	2	125	0.4	0.05	15V DC.
110	3	2	30	3	2	

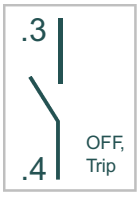
Microcurrent versions

DC Volts (V)	DC Amperes (A) Resistive Load	Minimum Load
30	0.1	1mA at 5V DC and 30V DC.

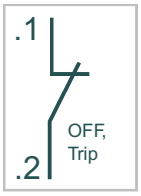
ELECTRICAL CONTROL USING INTERNALLY MOUNTED ACCESSORIES

Status Indication Switches

Heavy Duty Auxiliary Switch

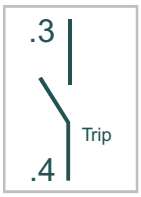


Terminal Designations and Function of Heavy Duty Auxiliary Switch, a contact

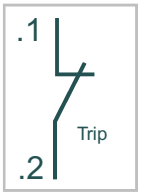


Terminal Designations and Function of Heavy Duty Auxiliary Switch, b contact

Heavy Duty Alarm Switch



Terminal Designations and Function of Heavy Duty Alarm Switch, a contact



Terminal Designations and Function of Heavy Duty Alarm Switch, b contact

Ratings of Heavy Duty Auxiliary and Alarm Switches					
AC			DC		
Volts (V)	Amperes (A)		Volts (V)	Amperes (A)	
	Resistive Load	Inductive Load		Resistive Load	Inductive Load
500	1	1	-		
440	3	3	250	0.5	0.5
240	4	4	125	1	1
110	5	5	48	3	2.5
48	6	6	24	6	2.5

Heavy Duty Auxiliary Switch (AX)

The heavy duty auxiliary switch has an impulse withstand voltage (Uimp) of 6kV and is suitable for isolating safety circuits. The auxiliary switch electrically indicates the ON or OFF status of the MCCB. The heavy duty type is a bridge switch with two terminals. It is available in either normally open or normally closed configurations.

Heavy duty auxiliary switches are colour coded grey. The cable capacity of the terminals is 1.25 to 2.5mm^2.

The heavy duty auxiliary switch meets the requirements of IEC 60947-5-1.

It has direct opening action, recommended by IEC 60204-1 Safety of Machinery - Electrical Equipment for Machines.

Heavy Duty Alarm Switch (AL)

The heavy duty alarm switch has an impulse withstand voltage (Uimp) of 6kV and is suitable for isolating control circuits. The alarm switch electrically indicates the TRIP status of the MCCB. The heavy duty type is a bridge switch with two terminals. It is available in either normally open or normally closed configurations.

Heavy duty auxiliary switches are colour coded grey and black. The cable capacity of the terminals is 1.25 to 2.5mm^2.

The heavy duty alarm switch meets the requirements of IEC 60947-5-1.

It has direct opening action, recommended by IEC 60204-1 Safety of Machinery - Electrical Equipment for Machines.

ACCESSORIES

ELECTRICAL CONTROL USING INTERNALLY MOUNTED ACCESSORIES

Remote Tripping Devices

Shunt Trip (SHT)

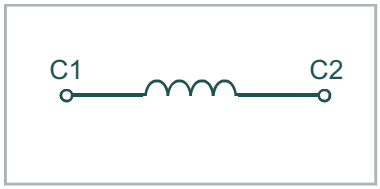
A shunt trip allows an MCCB to be tripped remotely on the application of the rated coil voltage across the shunt trip terminals. TemBreak 2 shunt trips have **continuously rated coils** and are suitable for use in electrical interlocking applications.

The MCCB contacts and toggle will move to the tripped position when the shunt trip is operated.

The permissible voltage range is 85% to 110% for AC or 75% to 125% for DC.

The cable capacity of the terminals is 0.5 to 1.25mm². Shunt trips are colour coded grey.

Shunt Trips



Terminal Designations of Shunt Trips

Ratings of Shunt Trips							
Rated Voltage	Voltage AC			Voltage DC			
	100-120	200-240	380-450	24	48	100-120	200-240
Excitation Current (A)	0.014	0.014	0.0065	0.03	0.03	0.011	0.011

Under Voltage Trip (UVT)

An undervoltage trip will trip the breaker automatically when the voltage applied to the terminals of the undervoltage coil drops to between 70% and 35% of its voltage rating. The undervoltage trip prevents the circuit breaker being closed unless a voltage corresponding to at least 85% of its voltage rating is applied across the terminals of the undervoltage coil.

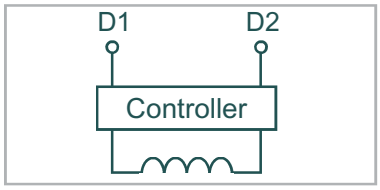
The MCCB contacts and toggle will move to the tripped position when the under-voltage trip operates.

Undervoltage trips with AC operating voltages are available with 500ms time delays. Time-delay units are fitted to the outside of MCCBs.

The cable capacity of the terminals is 0.5 to 1.25mm². Undervoltage trips are colour coded grey and black.

A UVT controller is required for time delay UVT only.

Undervoltage Trips



Terminal Designations of Undervoltage Trips

Ratings of Undervoltage Trips										
		Power supply capacity (VA)						Excitation current (mA)		
MCCB Model	Rated Voltage	Voltage AC						Voltage DC		
		100-120		200-240		380-450		24	100-120	200-240
E125, S125, H125, L125, S160, H160, L160, E250, S250, H250, L250, E400, S400, H400, L400, E630, S630		1.4		2.8		2.3		23	10	10
MCCB Model	Rated Voltage	Voltage AC						Voltage DC		
		100-110	115-120	200-220	230-240	380-415	440-450	24	100-120	200-240
S800, H800, L800, S1000, S1250, S1600		1.5	1.6	2.4	2.9	2.1	2.3	29	13	11

TERMINATION OF CONTROL WIRING

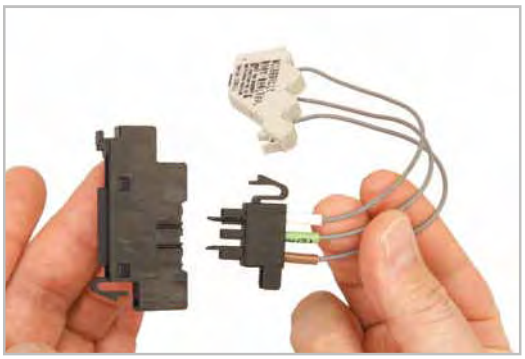
Terminal blocks are for optional use with all types of internally mounted accessory.

Terminal Block for Plug-in MCCBs

The terminal block for a plug-in MCCB consists of:

- a male section pre-fitted with 3 cables with which clips easily to the back of the MCCB
- a female section with 3 user terminals which clips easily into the plug-in base.

Up to 4 terminal blocks can be installed on a 125A, 160A or 250A frame MCCB. Up to 5 terminal blocks can be installed on a 400A to 800A frame MCCB.



Terminal Block for Plug-in MCCBs

Terminal Block for Front-Connected and Rear-Connected MCCBs (TF)

A terminal block facilitates convenient and accessible control wiring to internally mounted accessories especially the accessories with lead wire.
It allows the use of control wiring cables with larger cross-sectional area than permitted by the internal accessories themselves.

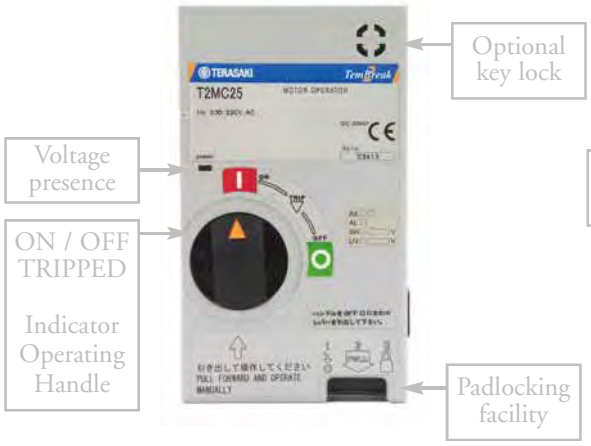
This terminal block can be clipped to either side of the MCCB. If mounted on the left incoming wiring will be fed vertically up to the terminals. If mounted on the right, the incoming wiring will be fed vertically down to the terminals.

The maximum incoming cable size to the terminal block is 2.0mm^2. 11terminals or 6 terminals can be specified. See page 153.

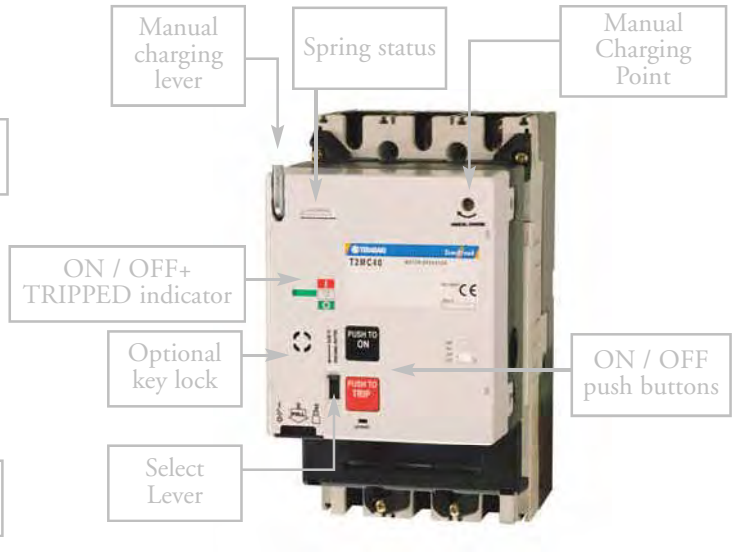
Terminal Block for Front-Connected and Rear-Connected MCCBs

ELECTRICAL CONTROL USING MOTORISED OPERATION

Overview – Motor Operators (MC)



Motor Operator for 125A and 250A Frame MCCB's



Motor Operator for 400A and 630A Frame MCCB's

Motor operators provide the possibility of opening and closing an MCCB on application of electrical control signals. TemBreak 2 motor operators are extremely reliable, having been designed to endure the same switching duty as the host MCCB.

Easy field-installation.

Fast operation (≤100ms).

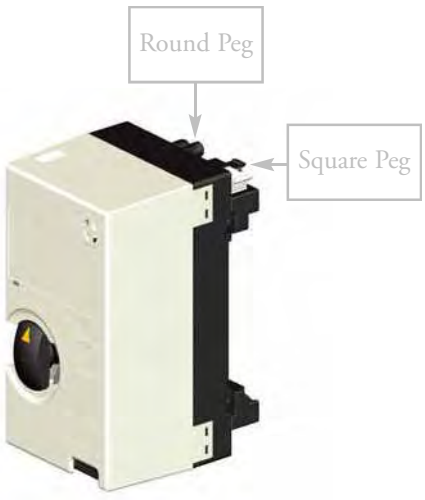
Positive contact indication.

Padlocking facility as standard (Maximum 3, hasp diameter 8mm).

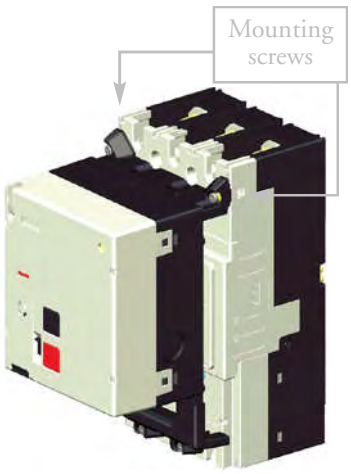
Optional keylock.

Versions available with automatic reset function.

Voltage presence indication.



Motor Operator for 125A and 250A frame MCCB's



Motor Operator for 400A and 630A frame MCCB's

Motor operators for 125A and 250A frame are mounted on the front of the breaker. They can be rapidly fitted by locating the round pegs and square pegs on the motor into corresponding round and square holes on the breaker. It takes less than 10 seconds to secure the motor to the MCCB.Two levers securely lock the motor into position. No tools are needed to fit the motor operator.

400A frame to 1000A frame motor operators are held in place with mounting screws. They can be installed easily in the field.

ELECTRICAL CONTROL USING MOTORISED OPERATION

Indication of ON, OFF or TRIPPED Status

The handle of 125A and 250A frame motor operators has dual functions:

1. Indication of ON, OFF or TRIPPED status as shown in the photographs below;
2. Manual operation when handle is pulled out. The supply to electrical control circuits inside the motor operator is cut when the handle is pulled out.

MCCB on

MCCB off

MCCB tripped

Motor operators for 400A to 1000A frame MCCBs incorporate a mechanical flag which indicates the ON, OFF and TRIPPED status of the MCCB. They can be manually charged using the lever provided.

Ratings and Specifications

Type of Motor Operators		T2MC12	T2MC25	T2MC40	T2MC80
Applicable MCCB		E125	E250	E400	S800, S1000
		S125	S160, S250	S400	H800
			H125, H160, H250	E630	L800
			L125, L160, L250	S630	
Rated operating voltage	100-110 V AC	■		■	■
	200-220 V AC	■		■	■
	230-240 V AC	■		■	■
	24 V DC	■		■	■
	48 V DC	■		■	■
	100-110 V DC	■		■	■
	200-220 V DC	■		NA	NA
Operating current/ Starting current Peak value (A)	100-110 V AC	4.5/8		ON ---/2.3 OFF, RESET 1.4/3.7	ON ---/2.2 OFF, RESET 1.7/3.5
	200-220 V AC	4/8		ON ---/2.3 OFF, RESET 1.1/3.5	ON ---/2.2 OFF, RESET 1.3/3.5
	230-240 V AC	3.5/7		ON ---/2.3 OFF, RESET 1.1/3.5	ON ---/2.2 OFF, RESET 1.3/3.5
	24 V DC	18/26		ON ---/7.2 OFF, RESET 3.9/8.1	ON ---/12 OFF, RESET 6.0/11.5
	48 V DC	12/18		ON ---/7.2 OFF/RESET 2.0/5.1	ON ---/7 OFF, RESET 3.2/6.5
	100-110 V DC	2.2/6		ON ---/2.4 OFF/RESET 1.2/3.8	ON ---/2.2 OFF, RESET 1.3/3.5
	200-220 V DC	2.2/5.5		—	—
Operating method		Direct drive		Spring charging	Spring charging
Operating time (s)	ON	0.1		0.1	0.1
	OFF	0.1		1.5	1.5
	RESET	0.1		1.5	1.5
Operating switch rating		100V, 0.1 A, Opening voltage 44V, current 4mA		100V, 0.1 A, Opening voltage 48V, current 1mA	
Power supply required		300 VA minimum		300VA minimum	300VA minimum
Dielectric properties (1 min)		1500 V AC (1000V AC for 24V DC and 48V DC motors)			
Weight		1.4 kg		3.5kg	3.5kg

■= Available

Note: Operating times shown in the above table apply only when the rated operational voltage is supplied to the motor operator. The voltage supplied to the motor operator must be within the range of 85% and 110% of the rated operating voltage.

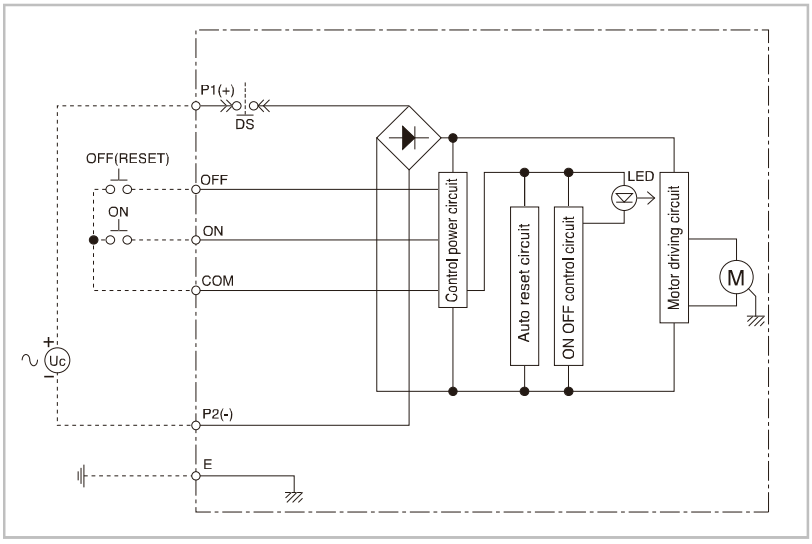
ELECTRICAL CONTROL USING MOTORISED OPERATION

Motor Operator Control Circuits

MCCB and Motor Operator Showing Control Wiring Socket

Control Wiring Plug

The Control circuits for Motor Operators are connected using a simple plug and socket system.



Control circuit for Motor Operators

Operation

The motor operator incorporates a self-hold circuit for the closing and opening signals. Therefore a momentary (over 50msec.) open or close signal will ensure a complete operation.

When the breaker trips, the breaker is reset by applying a signal to the OFF terminals of the motor.

When a UVT is used with a motor operator, design the control circuit so that the UVT is energised **before** a reset or close signal is sent to the motor operator. A 40ms time delay in the reset and close signals is sufficient to allow the UVT to energise.

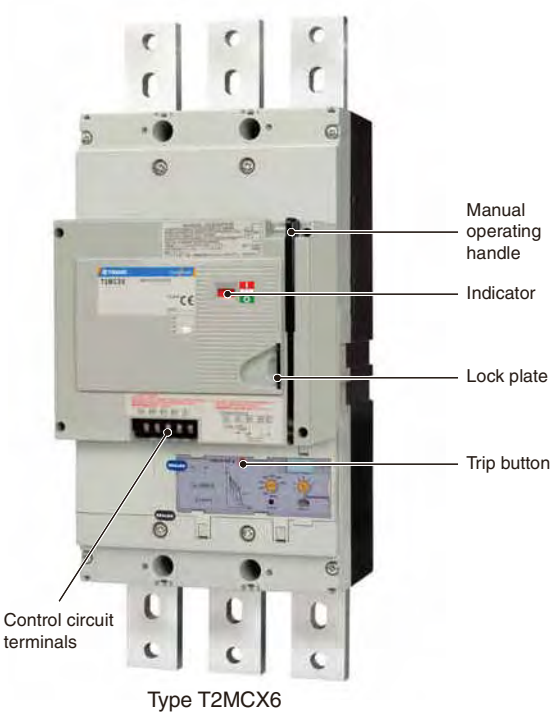
When a shunt trip is used with a motor operator, design the control circuit so that the shunt trip is de-energised before a reset or close signal is sent to the motor operator.

When a mechanical interlock is used with motor operators, design the control circuit to provide electrical interlocking between the motor operators. The electrical interlocking should prevent a close signal being sent to a motor operator unless the other motor operator and circuit breaker are in the OFF position.

Auto- reset

Two types of motor operator are available: motor operators without auto-reset and motor operators with auto-reset. The correct type of motor operator should be selected for the application. MCCB auxiliary and alarm switches do not have to be used in the control circuits for motor operators whether they have auto-reset or not, saving cost and space.

ELECTRICAL CONTROL USING MOTORISED OPERATION



Type T2MCX6

Positive contact indication

Colour coding indicates the true position of the contacts clearly: ON (red), OFF (green), TRIP (white).

Easy maintenance

Breaker mounting, removal, and even setting changes can be done without removing the motor operator.

Manual ON/OFF operation with one stroke

Fast closing operation

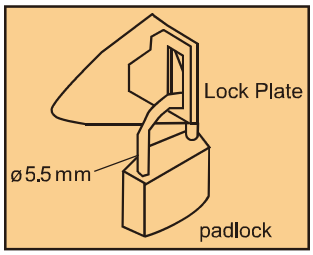
Closing in 60ms or less. The closing time remains constant over repeated operations.

Ratings and Specifications

Type of Motor Operators			T2MCX6
Applicable MCCB			S1250
			S1600
Rated Operating Voltage (V)	AC	100-115V 50/60Hz	■
		200-230V 50/60Hz	■
	DC	100-110V	■
		24V	■
Lock in “OFF” position (standard)			■
Manual Trip Button			✻
Steady-state r.m.s. Amp/inrush Amp (A)	AC100-115V	ON①	–/3.1
		OFF, RESET①	1.8/6.0
	AC200-230V	ON②	–/1.2
		OFF, RESET②	1.0/3.2
	DC100-110V	ON③	–/0.8
		OFF, RESET③	1.1/4.2
	DC24V	ON	–/4.5
		OFF, RESET	4.0/12.0
Type of operation			Spring Charged
Operating Time(s)	ON (Maximium values)		0.06
	OFF, RESET④		3
Control Switch Ratings			250V, 5A
Power Source Capacity (VA)			300VA
Dielectric withstand voltage The value in brackets fot 24V DC			AC1500V (AC500V)
Weight (kg)			6.4

■= Available

✻ Trip button on breaker to be used (accessible with motor fitted)



The breaker can be padlocked in the “OFF” position by pulling out the lock plate, and locking it with a padlock.
When the breaker is “ON”, the lock plate cannot be pulled out.
Up to three locks can be used.
Padlocks not supplied.

NOTE
① : Maximum values at AC115V, 50Hz
② : Maximum values at AC230V, 50Hz
③ : Maximum values at DC110V
④ : Maximum values at the rated operating voltages

ACCESSORIES

ELECTRICAL CONTROL USING MOTORISED OPERATION

Motorised operation

ON CONTROL
When the ON switch is closed, the latch release coil (LRC) is excited and the closing spring is released. The breaker quickly closes and goes into ON status. When the closing spring is released, the limit switch (LS) is opened and the LRC is de-excited.

OFF CONTROL
When the off switch is closed, self-hold control relay (Y) is activated and motor (M) operates to charge the closing spring. The breaker changes to OFF status.

RESET CONTROL
When the breaker is in TRIP status, closing the OFF switch activates self-hold control relay (Y) and starts motor (M). Motor (M) charges the closing spring and resets the breaker.

Manual operation

ON, OFF (RESET)
The breaker can be opened (OFF or RESET) and closed (ON) alternately by pulling the operating lever down in one full stroke. ON/OFF operation of the breaker is possible without charging or releasing the closing spring.

Emergency Trip
Opening the breaker (OFF) using the motor operator takes up to 3 seconds. If a remote emergency OFF function is necessary, incorporate the shunt trip device (SHT) or the undervoltage trip device (UVT) into the breaker.

PRECAUTIONS REGARDING USAGE

- If using the UVT option, be sure to reset the UVT before closing the breaker.
- The motor operator must be supplied with voltage within the following range:
  DC: 75-110% of rated voltage
  AC: 85-110% of rated voltage
  Operation at low voltage may burn out the motor.

Anti-pumping function

When the breaker is turned ON and the closing spring is released, self-hold control relay X is activate. Xa-contact is held closed, and Xb-contact is opened. While the ON switch is closed, latch release coil (LRC) will not be excited even if the OFF switch is closed or an automatic reset circuit is being used. Pumping is thus prevented.

Automatic charge/discharge function

If the breaker is closed manually (ON) while the power source is on, the handle switch (HS) induces automatic release of the closing spring. Likewise, if the breaker is opened manually (OFF), the springs are automatically charged. If the breaker is opened or closed while the power source is off, later when the power source is turned on, the closing spring will automatically be charged or discharged to match the ON/OFF status of the breaker. This automatic charge/discharge function is necessary to prepare the closing mechanism for the next ON/OFF operation. The sound of the charging or discharging of the spring should not be mistaken for a malfunction.

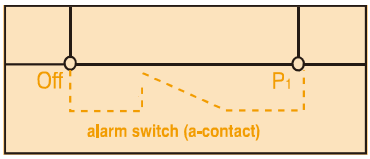
Automatic reset

An alarm switch (a-contact) fitted in the breaker, can be used to induce recharging of the closing spring and automatically reset the MCCB. Connect the automatic reset circuit as shown below.

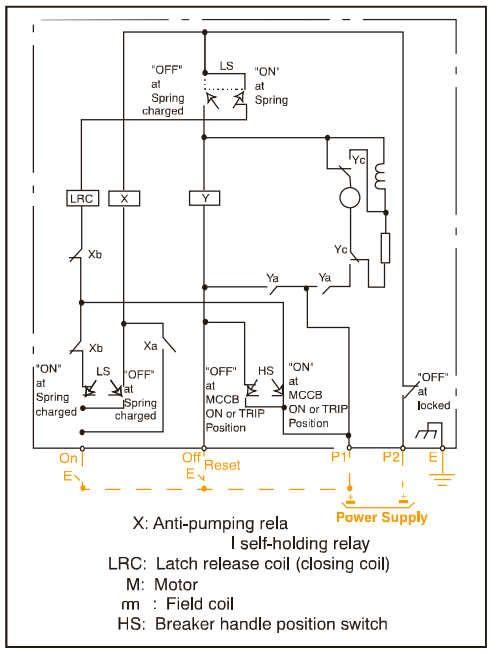
If the alarm switch is used, a pulse signal will be produced in the automatic reset circuit when the alarm is activated. Be sure to use a self-hold circuit to avoid possible problems caused by this pulse signal.

It is recommended that a time delay of approximately 3 minutes is introduced to the automatic reset circuit for thermal magnetic MCCB's. In the event of an overload trip this will prevent the motor operator repeatedly driving the MCCB between the tripped and reset positions while the thermal element is hot.

If an alarm signal is also required for external control, use a 2 alarm switch combination.



Control circuit AC and DC



X: Anti-pumping rela
I self-holding relay
LRC: Latch release coil (closing coil)
M: Motor
m : Field coil
HS: Breaker handle position switch

Note: Customer wiring shown in orange

OPERATING HANDLES & LOCKING DEVICES

TemBreak 2 external operating handles are extremely reliable, having been designed to endure the same switching duty as the host MCCB.

It is easy to fit the operating unit to the MCCBs up to 250A frame. Fitting involves three easy steps:

1. Align breaker toggle with operating mechanism
2. Push external operating handle into position (the handle's round pegs locate securely in the breaker's round holes and the external operating handle's* square pegs in the breaker's square holes).
3. Twist locking screws through 45 degrees.*

Safety Features

Door interlock mechanism with override facility included as standard

IP55 as standard (HS), IP54 as standard (HP), IP3X as standard (HB)

IP65 optional (HS, HP), IP5X optional (HB)

Locks OFF with up to 3 padlocks (8mm hasps)

Optional Key fitting facility is available for Castell FS1 (HS)
Contact us for the details of mounting dimension.

Optional keylock in OFF postion (HP, HB)

Available Gray handle with Black base or Red handle with Yellow base (HS)

Available in black or red and yellow (HP, HB)

A trip test can be performed with the external operating handle fitted to the MCCB

Orientation

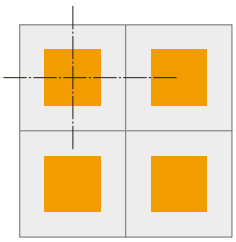
To switch the breaker from OFF to ON the external operating handle is rotated through 90 degrees in a clockwise direction.

MCCB ON

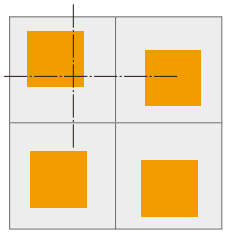
MCCB ON

The ON (I) and OFF (O) indication of the external operating handle can be re-oriented in steps of 90 degrees with respect to the operating mechanism. This allows the indication position to remain the same whether the breaker is mounted vertically (right side up or upside down) or horizontally (on its left side or on its right side). The hole cut-out dimensions for a panel or door will remain unchanged if the external operating handle is re-oriented. The external operating handle's axis of rotation is on the intersection of the centre lines of a 3P MCCB. This means that the positioning of the door cutouts is symmetrical for breakers mounted horizontally on either side of a vertical busbar system.

Cubicle Door Cutouts



Using TemBreak 2 Operating Handles



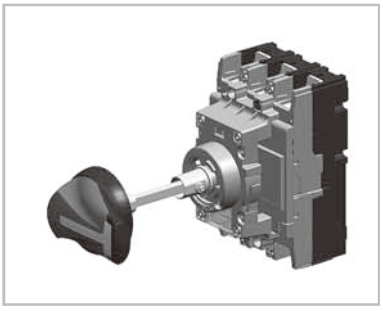
Using other MCCB Operating Handles

*external operating handles for 400A and 1600A Frame models are secured with four screws.

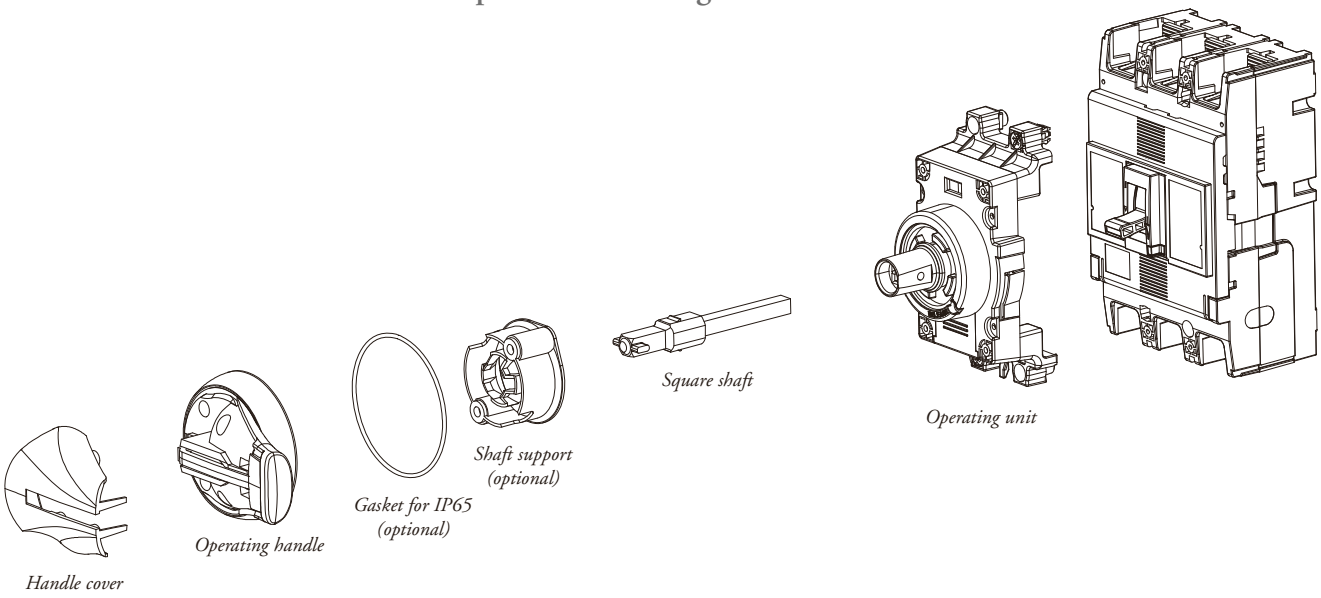
ACCESSORIES

OPERATING HANDLES & LOCKING DEVICES

Door Mounted Handle (HS) standard type



The door mounted handles allow breakers installed in control centers or switchboards to be manually operated from outside and complies with IEC 60204-1.
It consists of an operating mechanism that is mounted on the breaker, an operating handle that is mounted on the door, and a shaft that transmits the turning force from the handle to the operating unit.
The shaft can be cut to the required length.
The shaft support makes easy to insert to the operating handle when the panel door is being closed.



Door interlock mechanism

The external operating handle keeps the panel door locked when in the 'ON' position. There is OFF open type only.

OFF open type

The handle is turned to the OFF position to open the panel door.

Door interlock release button

The release button enables the panel door to be opened with the handle in the 'ON' position.
To release: push the release button on the side of the operating handle with a flat-bladed screwdriver.

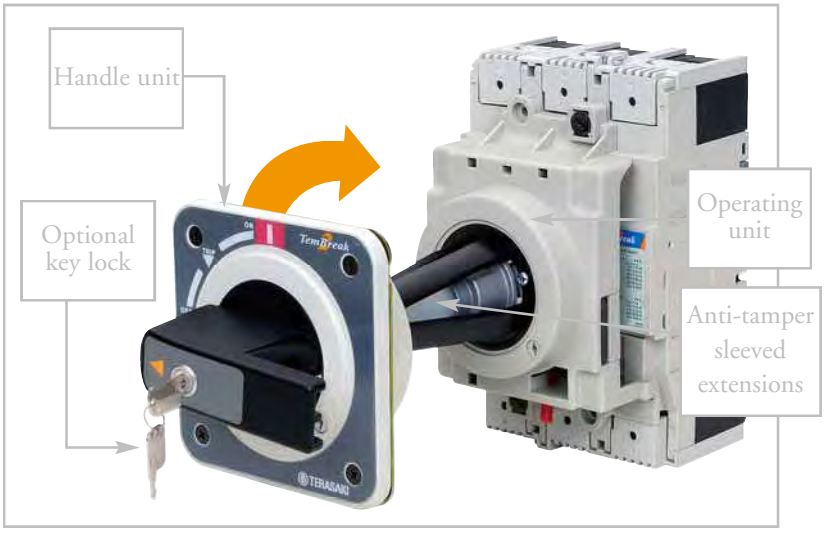
Toggle lock mechanism

Padlock (Standard)

This mechanism allows the breaker to be padlocked in the OFF position.
Padlocks are not supplied.
Up to three padlocks can be installed.

OPERATING HANDLES & LOCKING DEVICES

Door Mounted Handle (HP) ordinal type



Door Mounted Handle with Optional Keylock

The door mounted handle is used to operate a circuit breaker mounted inside a cubicle from outside the door. It consists of an operating mechanism that is mounted on the breaker, an operating handle that is mounted on the door, and a shaft that transmits the turning force from the handle to the operating unit. The shaft can be cut to the required length.

Breaker Mounted Handle (HB)

Breaker Mounted Handle Padlocked in the OFF Position

This external operating handle is used to operate a circuit breaker mounted just behind a compartment door with the door closed. The operating unit and the handle itself are mounted directly onto the circuit breaker. The handle protrudes through a cutout in the door. A moulded door flange is supplied with the external operating handle which covers the cutout from the front.

Padlocking and keylocking is possible in the OFF position.

Locking Devices

Toggle locking devices allow MCCBs to be locked ON or OFF using up to three padlocks. Locking devices for 125A, 160A and 250A frame models accept padlocks with 5mm hasp diameter. Locking devices for 400A to 1600A frame models accept padlocks with 8mm hasp diameter.

S250 Locked OFF

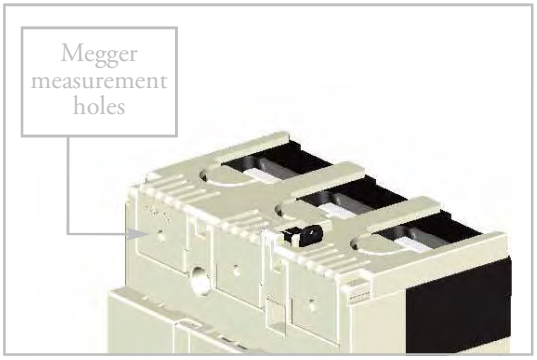
S400 Locked OFF

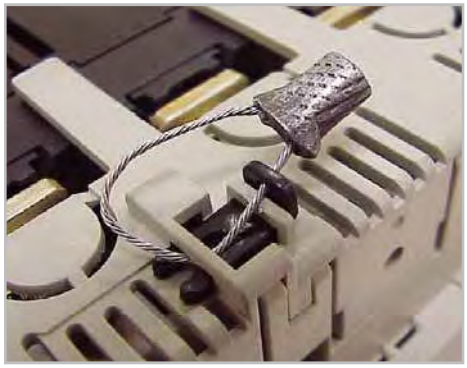
Fittings for Castell and Fortress locks are available. They are suitable for use on door mounted handles (HP) for MCCBs.

INSULATION ACCESSORIES

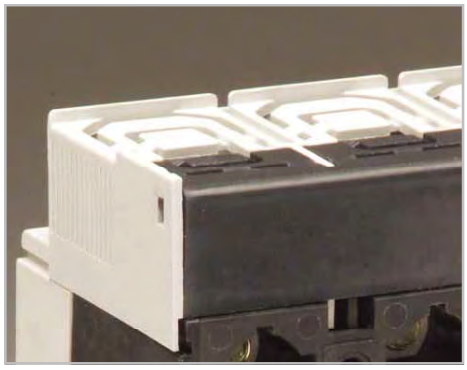
Terminal Covers

Terminal covers are used to prevent direct contact with live MCCB terminations. They also provide additional insulation to reduce the possibility of a short circuit between phases or to earth when large conductors are used.





Terminal Cover Lock with Lead Seal



Earth Barrier Fitted to Rear of Terminal Cover

General features

Terminal covers for 125A to 630A frame models require no tools for installation

Terminal covers for 125A to 630A frame models have an IP20 ingress protection rating

Terminal covers are ordered individually. Two terminal covers are required to cover both the line and load terminals of an MCCB. Each cover can either be fitted to the top or bottom of the MCCB

Terminal covers have a megger measurement hole of 4mm diameter on each phase.

Options

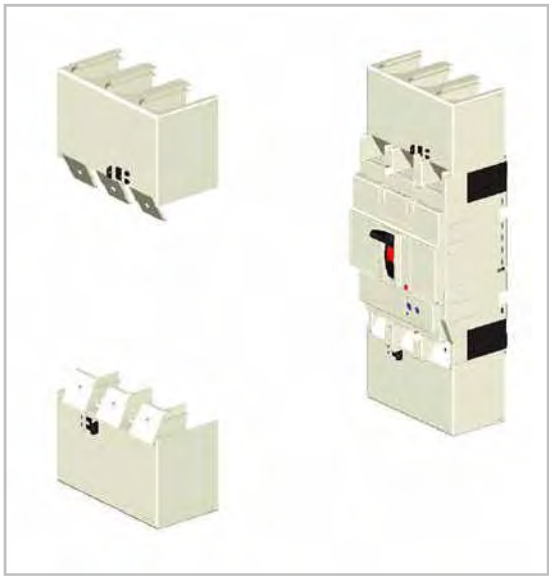
A terminal cover for 125A to 630A frame models lock allows an anti-tampering seal to be added.

An earth barrier for 125A and 250A frame models can be added to terminal covers for front connection. The earth barrier provides insulation at the rear of the terminations.

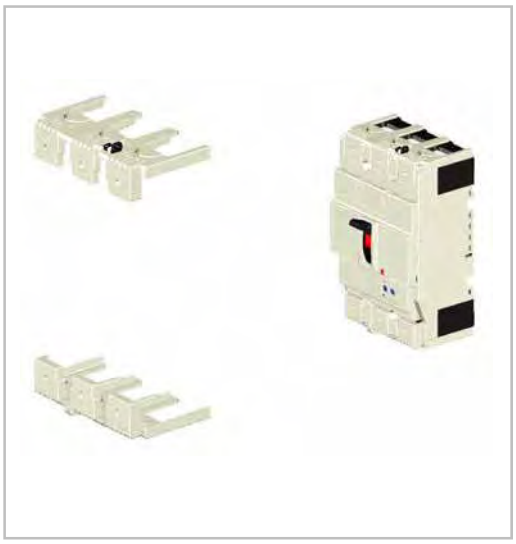
INSULATION ACCESSORIES

Terminal Covers for Front Connection (CF)

Terminal covers for front connection are suitable for covering the exposed live parts of conductors terminated on the MCCB.



Terminal Covers for Front Connection



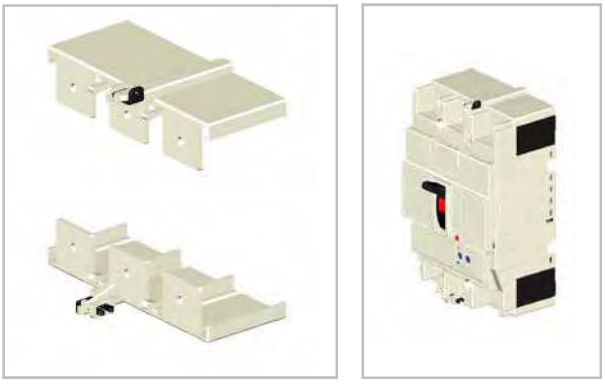
Flush Terminal Covers

Flush Terminal Covers (CS)

Flush terminal covers are available for 125A to 630A frame models and are useful for increasing the ingress protection rating at the terminals without increasing the overall length. They can be used with busbar and for direct entry of stranded cable (with cable clamp terminals (FW), refer to Section 6, Installation).
Flush terminal covers are identical to rear terminal covers for 400A and 630A frame models.
The user can remove a section of the rear terminal cover using a tool to allow entry of the conductor.

Terminal covers for Rear Connection (CR)

Terminal covers for rear connection are available for 125A to 1000A frame models and may be used on MCCBs fitted with rear connections (RC) or plug-in connections (PM). They prevent access to the terminals from the front and top.



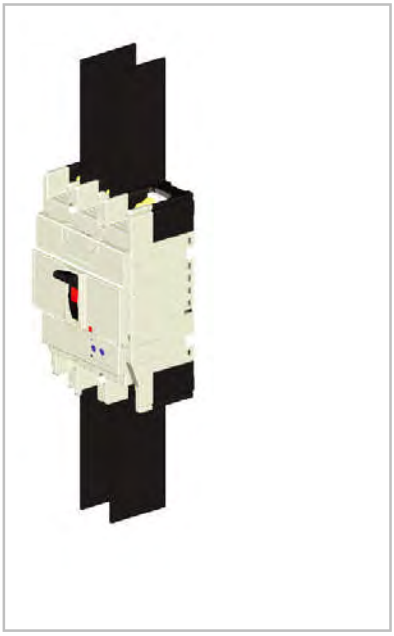
Terminal Covers for Rear Connection

INSULATION ACCESSORIES

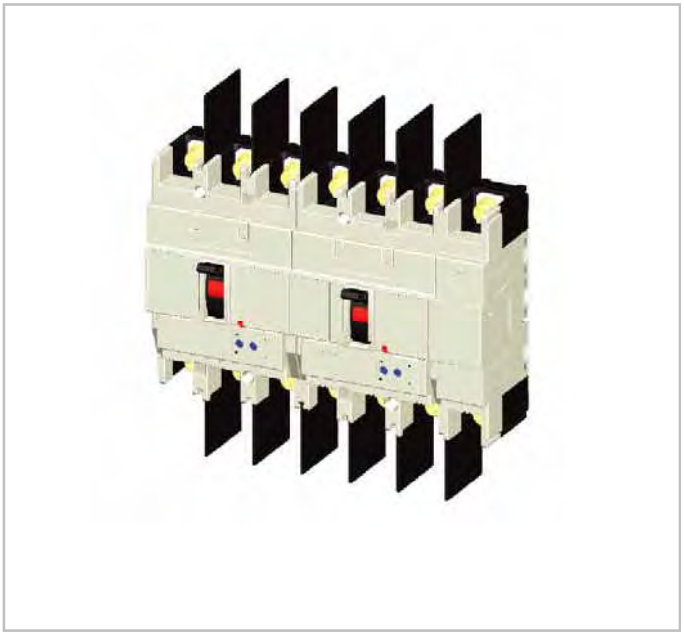
Interpole Barriers (BA)

Interpole barriers provide maximum insulation between phases at the terminals of the MCCB. They cannot be fitted at the same time as any of the terminal covers. Interpole barriers for use on one end of the MCCB are supplied as standard. Additional interpole barriers can be ordered individually. All interpole barriers can easily be fitted to either end of an MCCB.

MCCB moulds have been designed to accept an additional interpole barrier between two adjacent MCCBs.



MCCB Fitted with Interpole Barriers on Both Ends



Interpole Barriers between Adjacent MCCBs

TEMBREAK 2

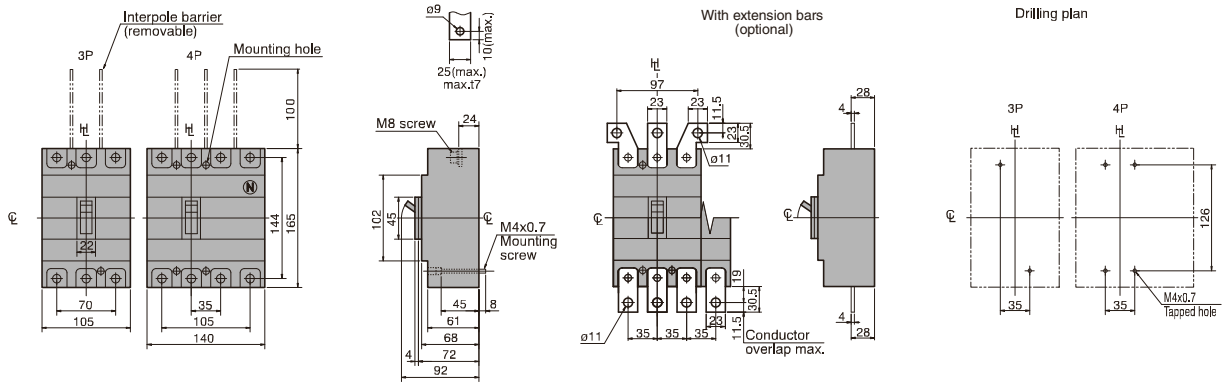
MOULDED CASE CIRCUIT BREAKERS 16A TO 1600A

DIMENSIONS

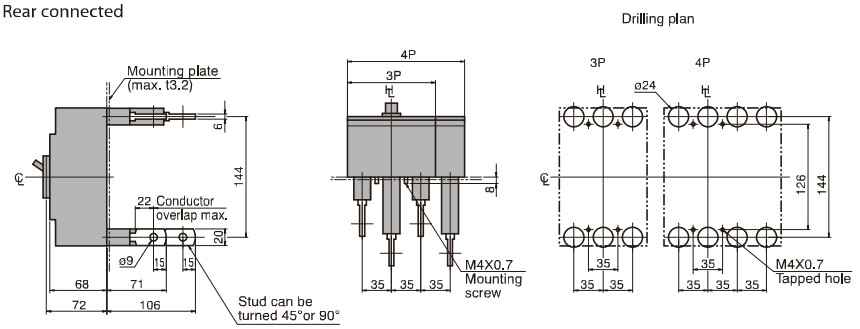
S160-NJ, S160-GJ, E250-NJ, S250-NJ, S250-GJ, S250-NN

ASL: Arrangement Standard Line
H : Handle Frame Centre Line

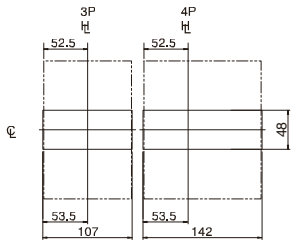
Front connected



Rear connected

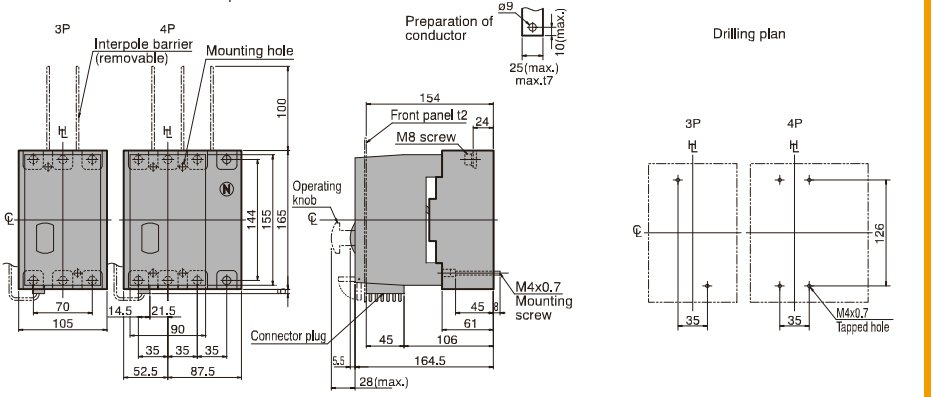


Panel cutout (Front view)

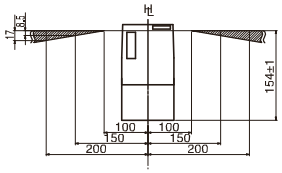


Panel cutout dimensions shown give an allowance of 1.0mm or more around the handle escutcheon.

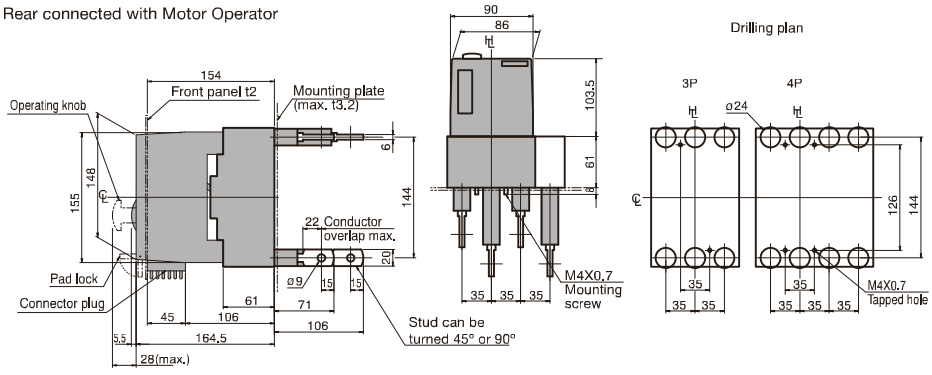
Front connected with Motor Operator



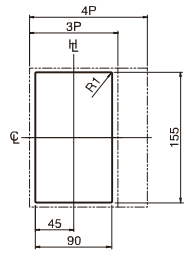
Panel hinge position (hatching area) bottom view



Rear connected with Motor Operator



Panel cutout (Front view)



Panel cutout dimensions shown give an allowance of 1.5mm around the handle escutcheon.

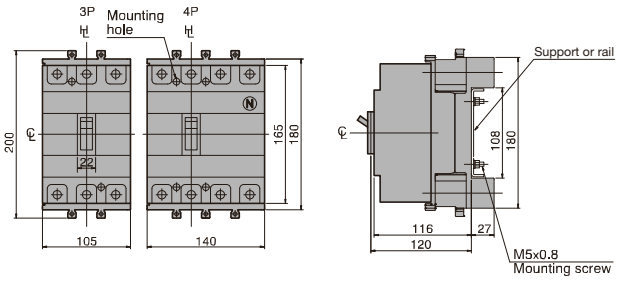
SECTION 7

DIMENSIONS

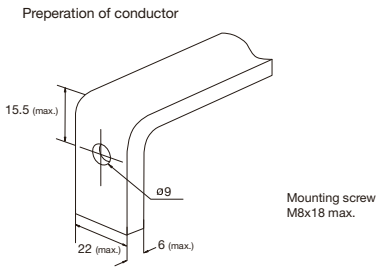
S160-NJ, S160-GJ, E250-NJ, S250-NJ, S250-GJ, S250-NN
Plug-in Versions

ASL: Arrangement Standard Line
⊬ : Handle Frame Centre Line

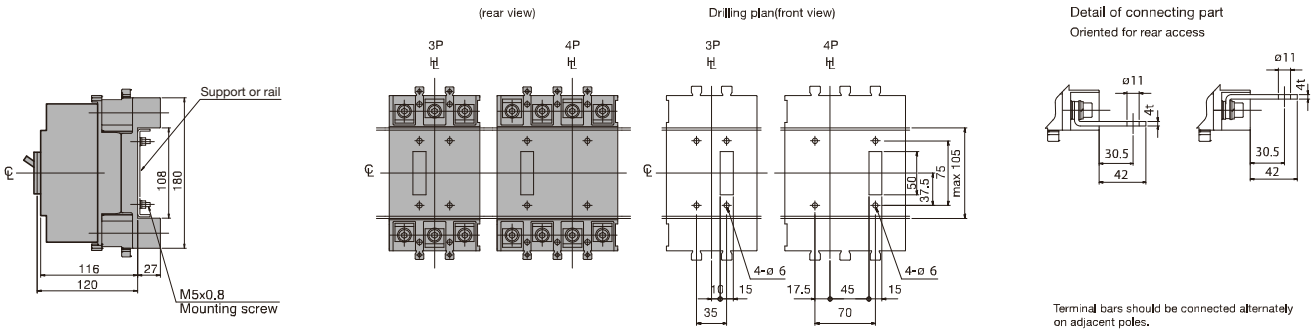
Outline Dimensions



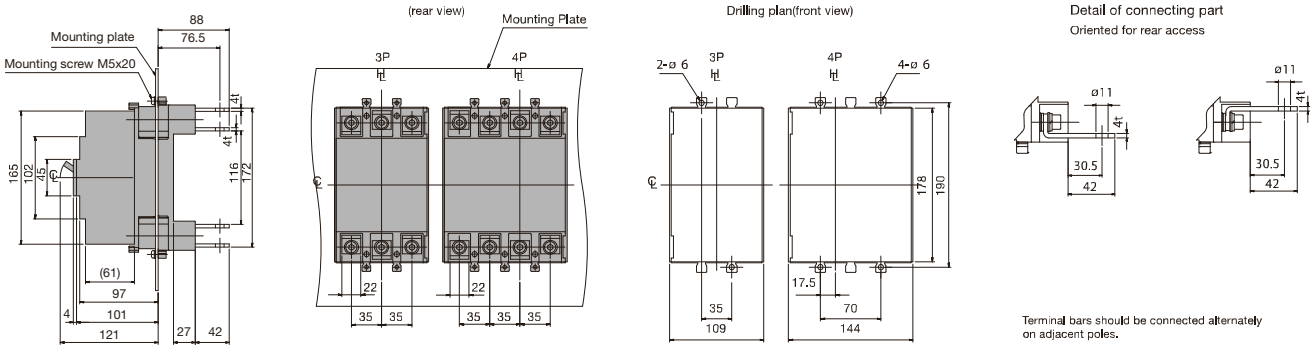
Termination of Busbar



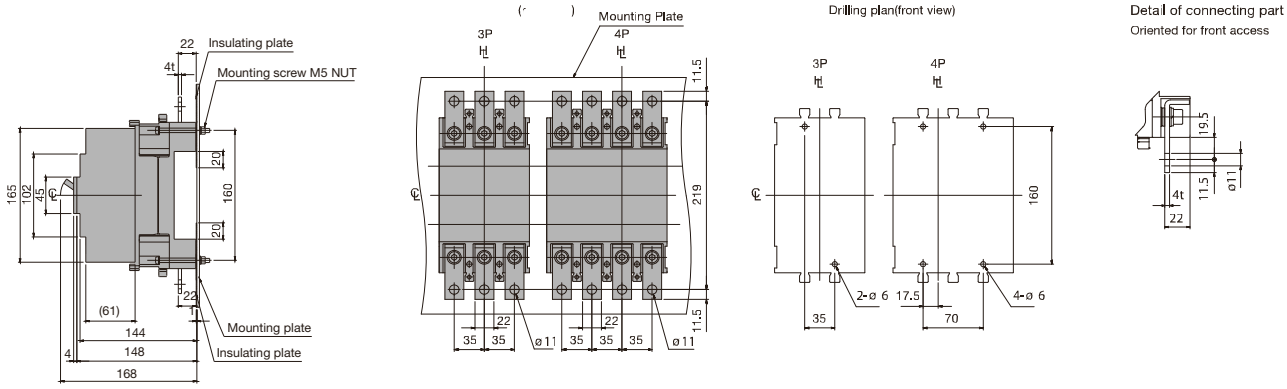
Mounting on a support or rails (shown with optional connection bars oriented for rear access)



Mounting through the backplate (shown with optional connection bars oriented for rear access)



Mounting on the backplate (optional connection bars must be oriented for front access)

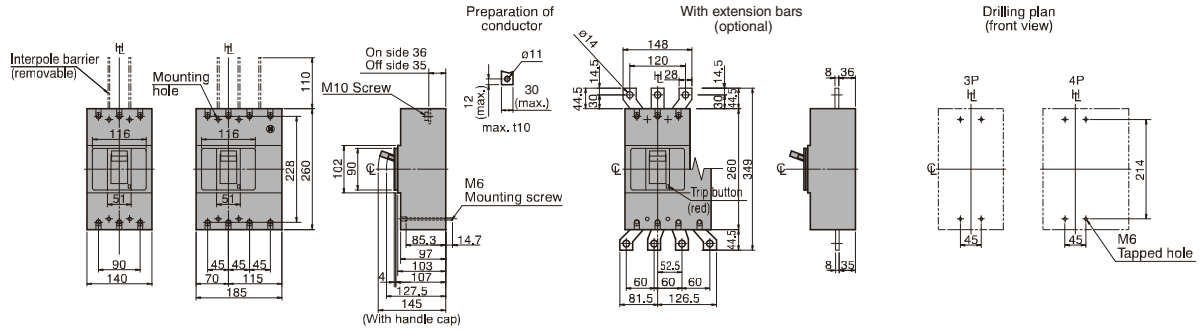


DIMENSIONS

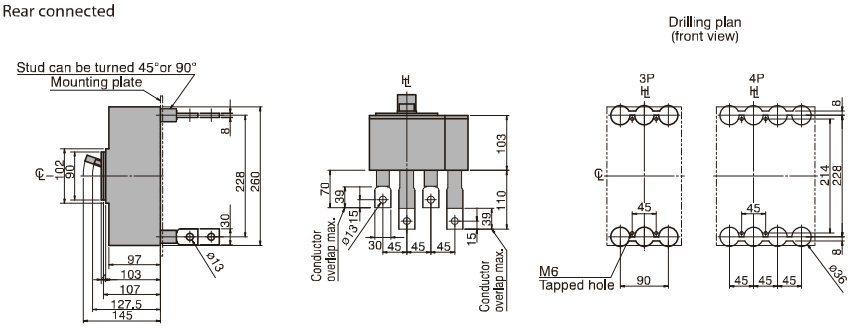
E400-NJ, S400-CJ, S400-NJ, S400-NE, S400-GJ, S400-GE, S400-PJ, S400-PE, S400-NN

ASL: Arrangement Standard Line
Ht : Handle Frame Centre Line

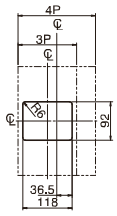
Front connected



Rear connected

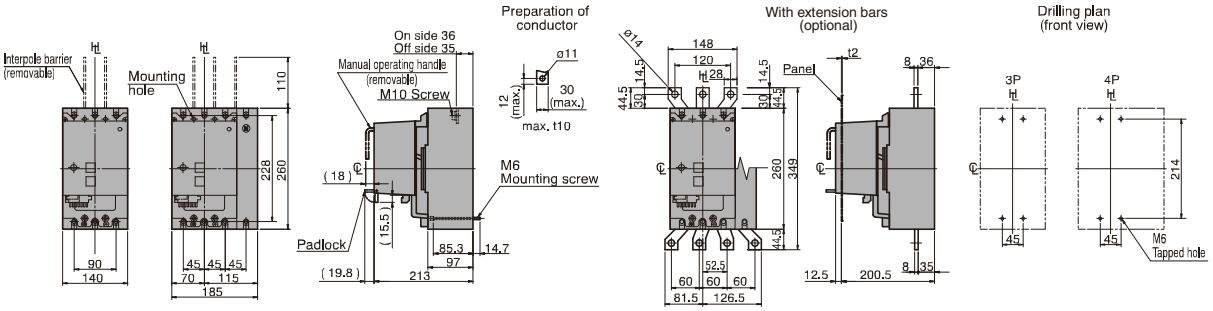


Panel cutout (front view)

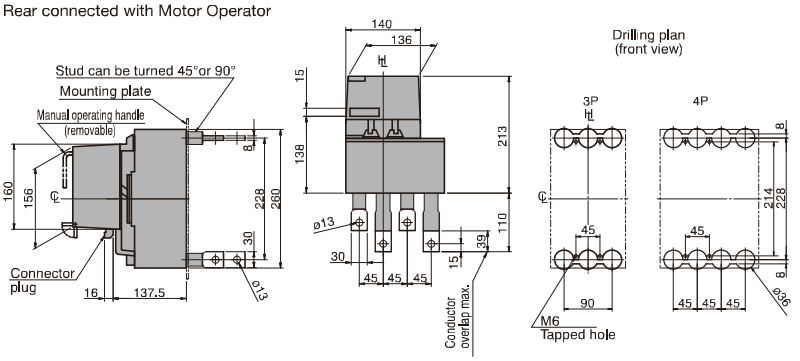


Panel cutout dimensions shown give an allowance of 1.0mm around the handle escutcheon.

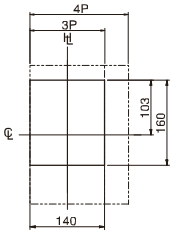
Front connected with Motor Operator



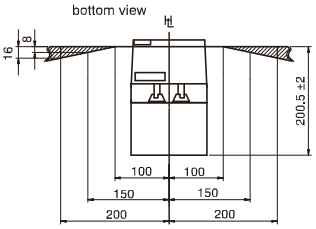
Rear connected with Motor Operator



Panel cutout (front view)



Panel hinge position (hatching area)
bottom view



Panel cutout dimensions shown give an allowance of 1.5mm around motor operator

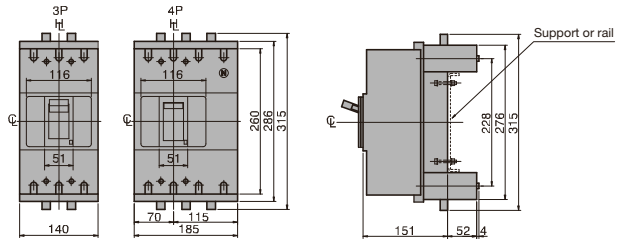
SECTION 7

DIMENSIONS

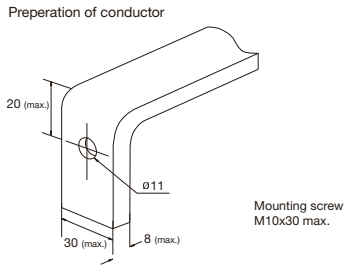
E400-NJ, S400-CJ, S400-NJ, S400-NE, S400-GJ, S400-GE, S400-PJ, S400-PE, S400-NN Plug-in Versions

ASL: Arrangement Standard Line
HL : Handle Frame Centre Line

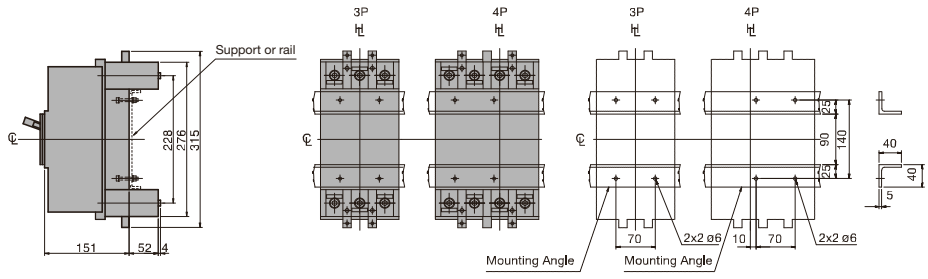
Outline Dimensions



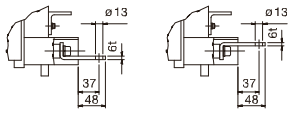
Termination of Busbar



Mounting on a support or rails (shown with optional connection bars oriented for rear access)

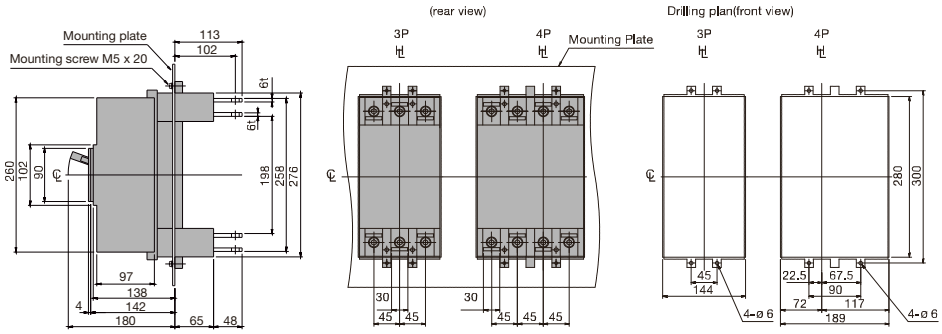


Detail of connecting part
Oriented for rear access

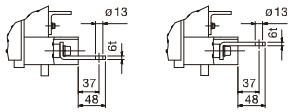


Terminal bars should be connected alternately on adjacent poles.

Mounting through the backplate (shown with optional connection bars oriented for rear access)

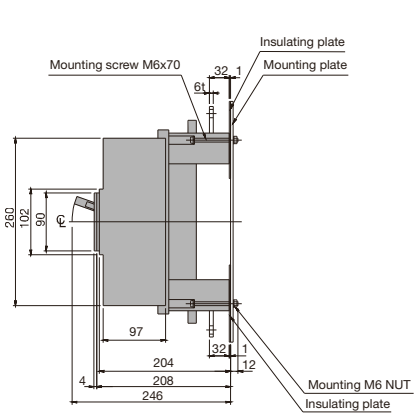


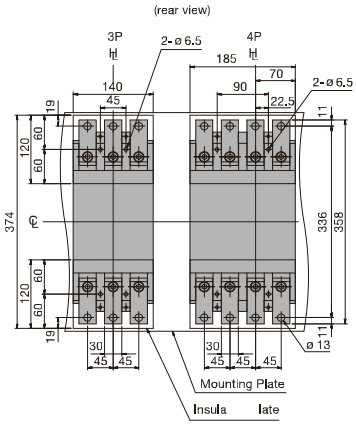
Detail of connecting part
Oriented for rear access

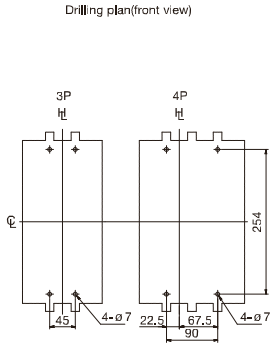


Terminal bars should be connected alternately on adjacent poles.

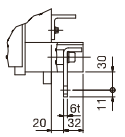
Mounting on the backplate (optional connection bars must be oriented for front access)







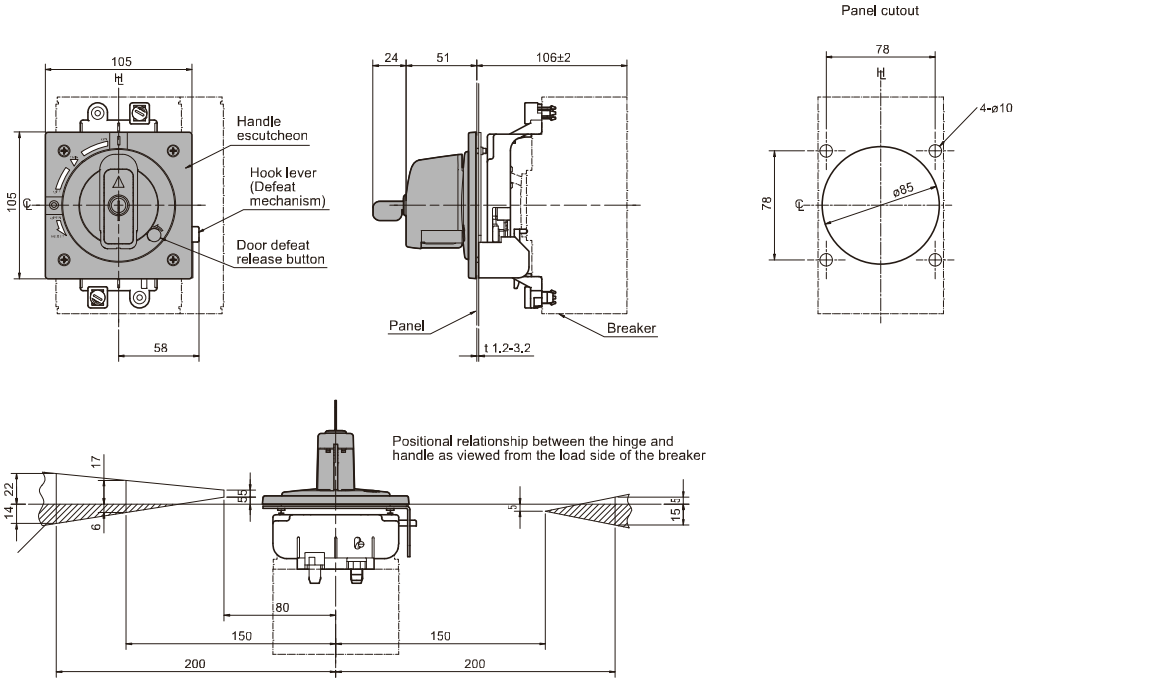
Detail of connecting part
Oriented for front access



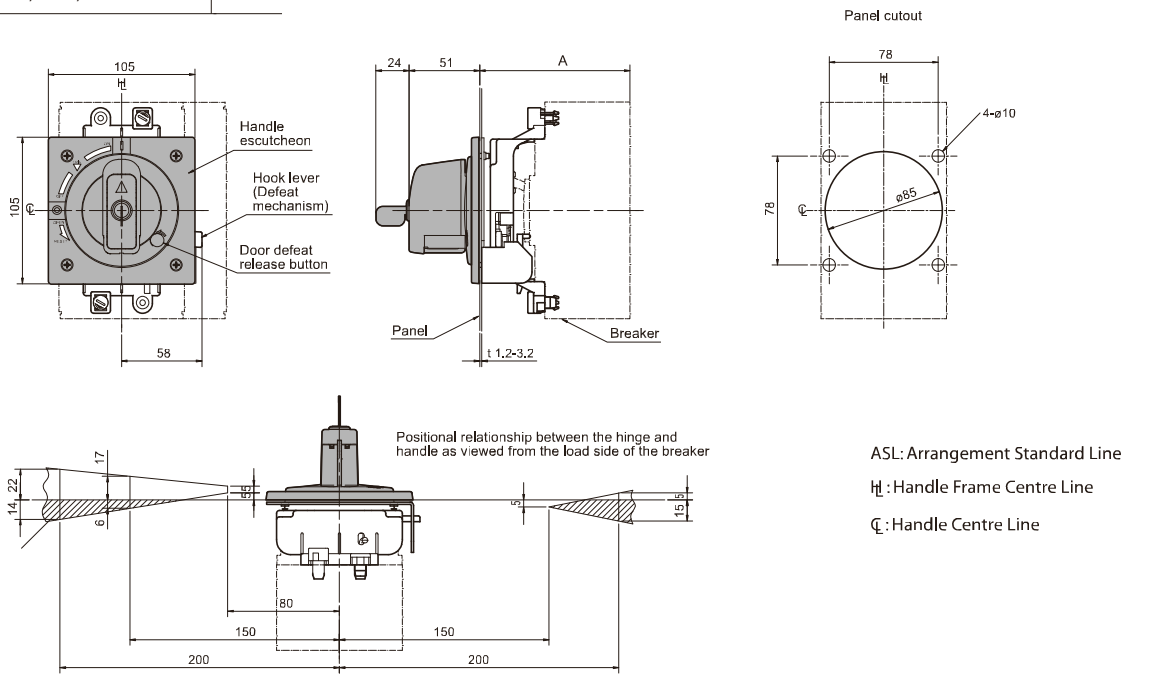
DIMENSIONS

Breaker Mounted Handle

Applicable MCCB
E125, S125



Applicable MCCB	A
S160-NJ, E250-NJ, S250-NJ, S250-GJ, S250-NN	106±2
H125, L125, H160, L160, S250-NE, S250-GE, S250-PE, H250, L250	141±2



ASL: Arrangement Standard Line

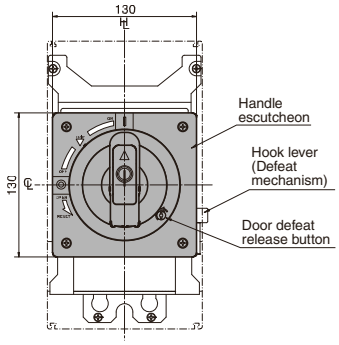
HL : Handle Frame Centre Line

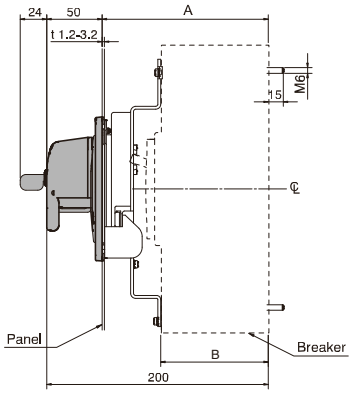
℄ : Handle Centre Line

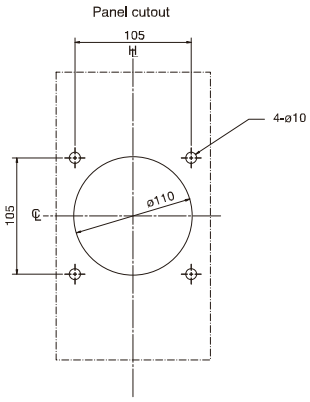
DIMENSIONS

Breaker Mounted Handle

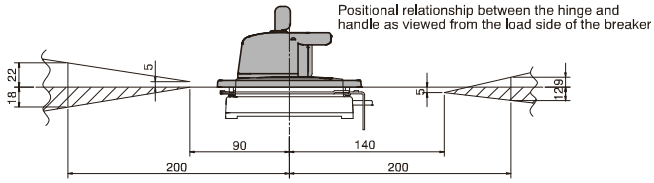
Applicable MCCB	A	B
E400 S400 E630 S630	150±2	97
H400 L400	187±2	134



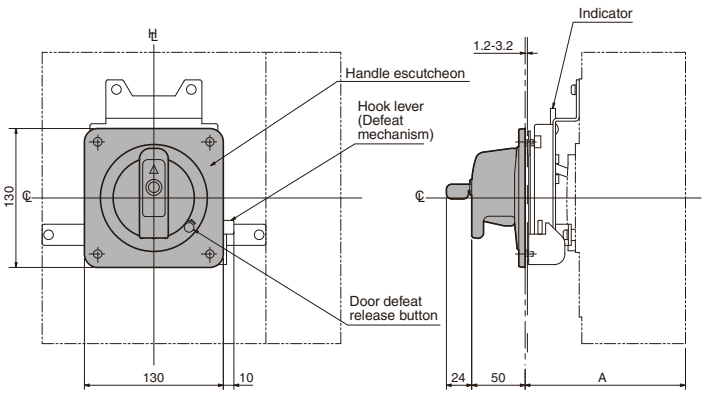


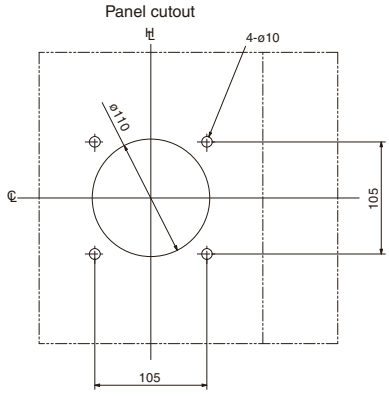


ASL: Arrangement Standard Line
⊬ : Handle Frame Centre Line
℄ : Handle Centre Line

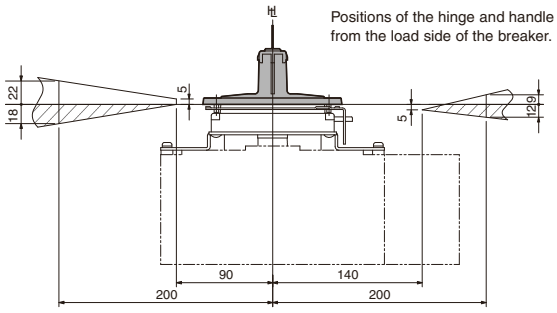


Applicable MCCB	A
S800 S1000	150±2
H800 L800	187±2





ASL: Arrangement Standard Line
⊬ : Handle Frame Centre Line
℄ : Handle Centre Line



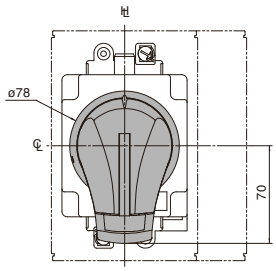
SECTION 7

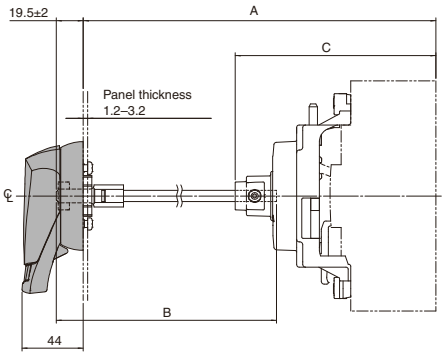
Door Mounted Handle standard type

Applicable MCCB	A*1	B	C
S160-NJ, E250-NJ, S250-NJ, S250-GJ S250-NN	453 max.	358	144
H125, L125, H160, L160, S250-NE, S250-GE, S250-PE, H250, L250	488 max.	358	179

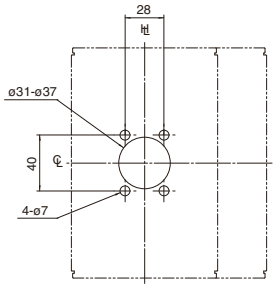
*1: Max. means the maximum length fot A without cutting the shaft.
+ The shaft can be cut to the required length.

A: Distance from the panel surface to the breaker mounting surface
B: Length of the square shaft used

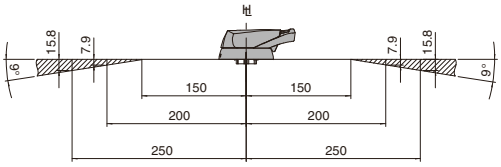




Panel cutout

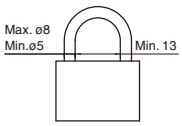


Positional relationship between the hinge and handle as viewed from the load side of the breaker. The hinge must be inside the hatched area.



ASL: Arrangement Standard Line
H: Handle Frame Centre Line
C: Handle Centre Line

Padlock dimensions (mm)



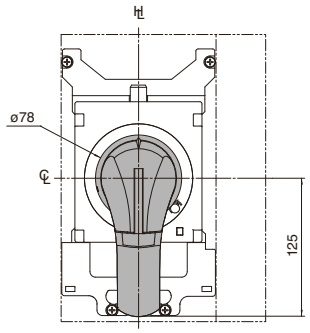
DIMENSIONS

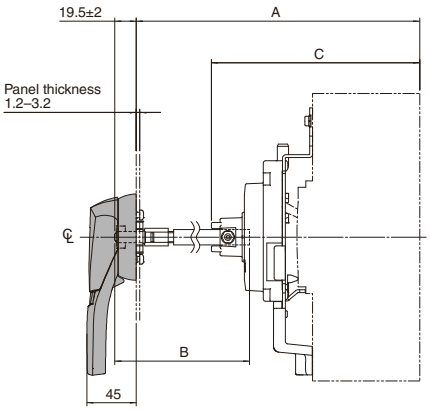
Door Mounted Handle standard type

Applicable MCCB	A*1	B	C
E400 E630	220 min.	86	188.5
S400 S630	456 max.	322	188.5
H400	257 min.	86	225.5
L400	493 max.	322	225.5

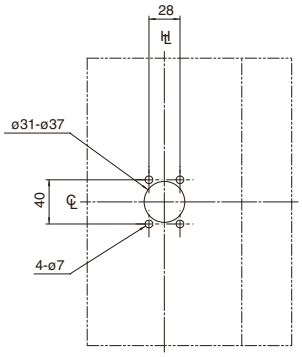
*1: Min. means the minimum length for A by cutting the shaft.
Max. means the maximum length fot A without cutting the shaft.
+ The shaft can be cut to the required length.

A: Distance from the panel surface to the breaker mounting surface
B: Length of the square shaft used

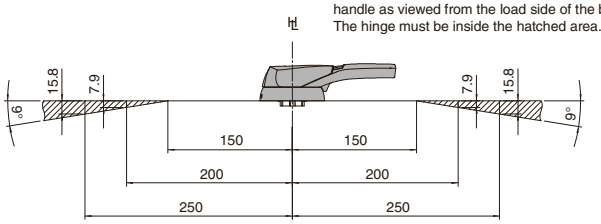




Panel cutout

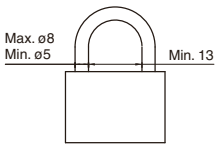


Positional relationship between the hinge and handle as viewed from the load side of the breaker. The hinge must be inside the hatched area.



ASL: Arrangement Standard Line
: Handle Frame Centre Line
: Handle Centre Line

Padlock dimensions (mm)

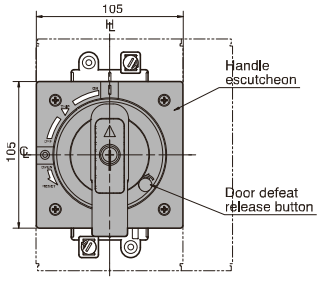


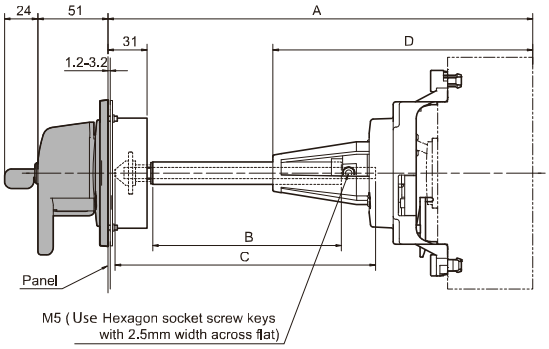
DIMENSIONS

Door Mounted Handle ordinal type

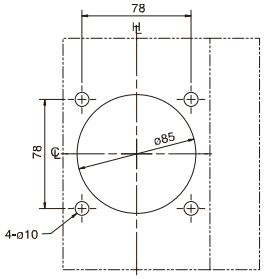
Applicable MCCB	A*1	B	C	D	Shaft support
S160-NJ, E250-NJ, S250-NJ, S250-GJ S250-NN	543 max.	370	421	186	With +
H125, L125, H160, L160, S250-NE, S250-GE, S250-PE, H250, L250	578 max.	370	421	221	With +

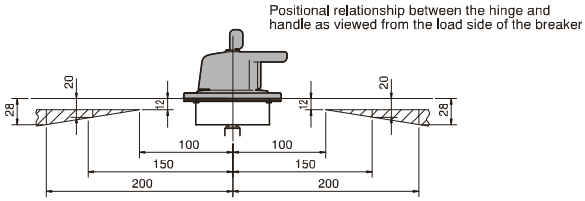
*1: Max. means the maximum length fot A without cutting the shaft.
+ The shaft can be cut to the required length. If it is necessary to cut the shaft so short that it does not protrude beyond the shaft support, the shaft support may be removed.





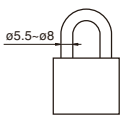
Panel cutout





ASL: Arrangement Standard Line
: Handle Frame Centre Line
℄: Handle Centre Line

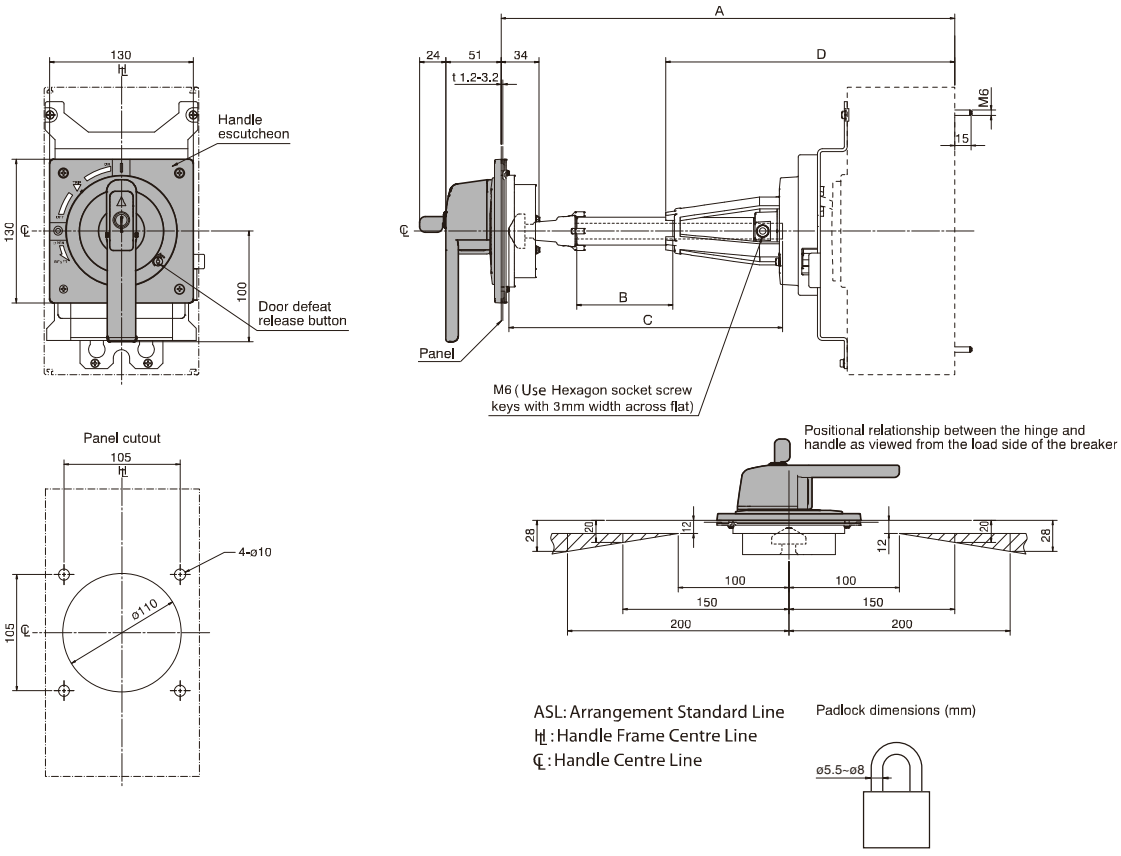
Padlock dimensions (mm)



Door Mounted Handle ordinal type

Applicable MCCB	A*1	B	C	D	Shaft support
E400 E630	270 min.	12	107.5	—	Without
S400 S630	610 max.	280	447.5	261	With +
H400	307 min.	12	107.5	—	Without
L400	647 max.	280	447.5	298	With +

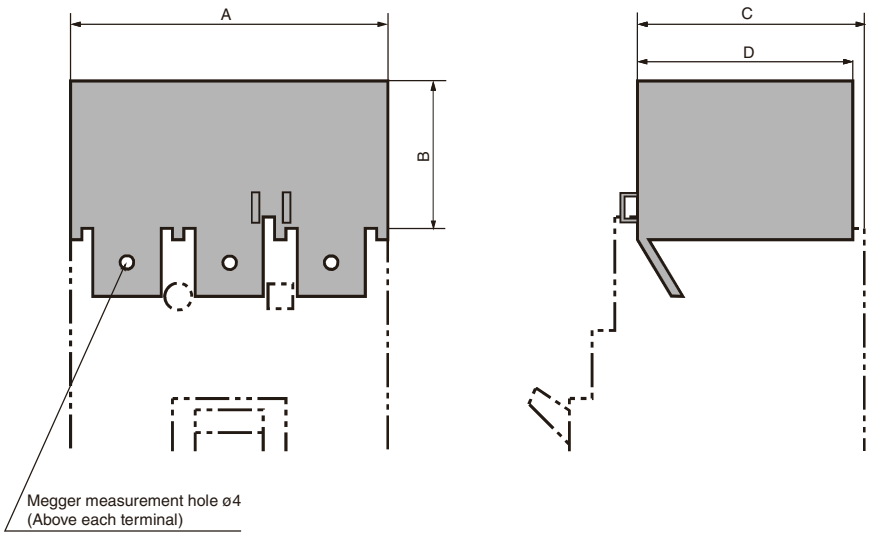
*1: Min. means the minimum length for A by cutting the shaft.
Max. means the maximum length for A without cutting the shaft.
+ The shaft can be cut to the required length. If it is necessary to cut the shaft so short that it does not protrude beyond the shaft support, the shaft support may be removed.



DIMENSIONS

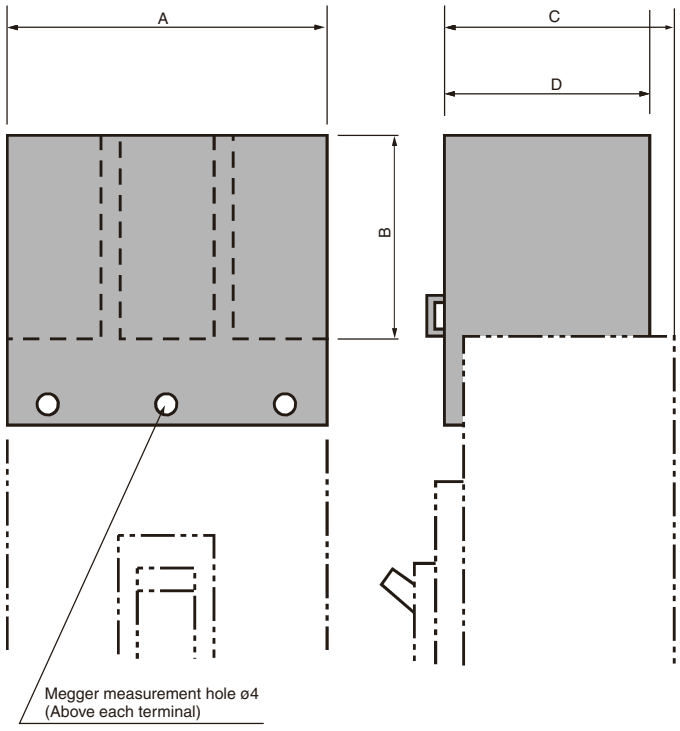
Terminal Covers

Terminal covers for Front connected MCCB's (CF)



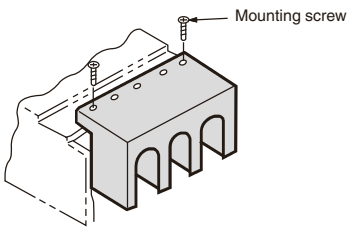
Plug-in mounted version

This version can be mounted simply by being plugged in the breaker body.



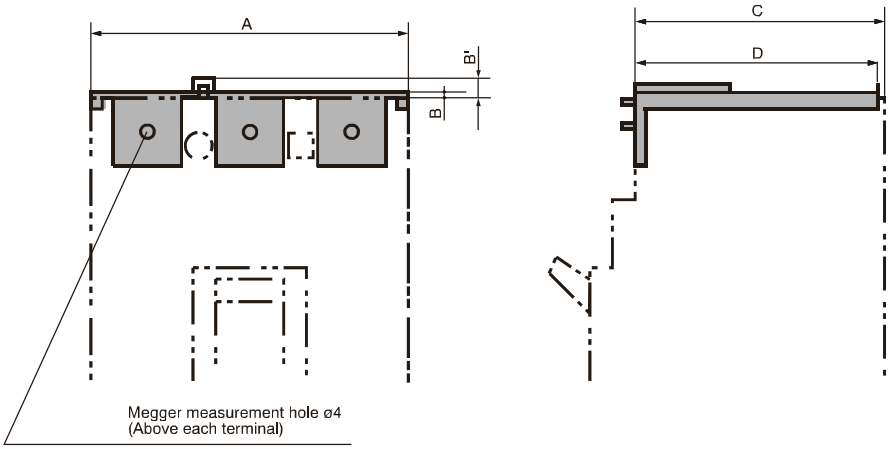
Screw-mounted version

The terminal covers for 630 to 800AF are mounted to the breakers using tapping screws. The terminal cover for 1250AF is mounted to insert nuts of the breaker cover using screws. The insert nuts do not come standard with the breaker. Please be sure to state "with terminal cover (CF)" when ordering the breaker.



Terminal Covers

Terminal covers for Cable clamp terminal type MCCB's (CS)



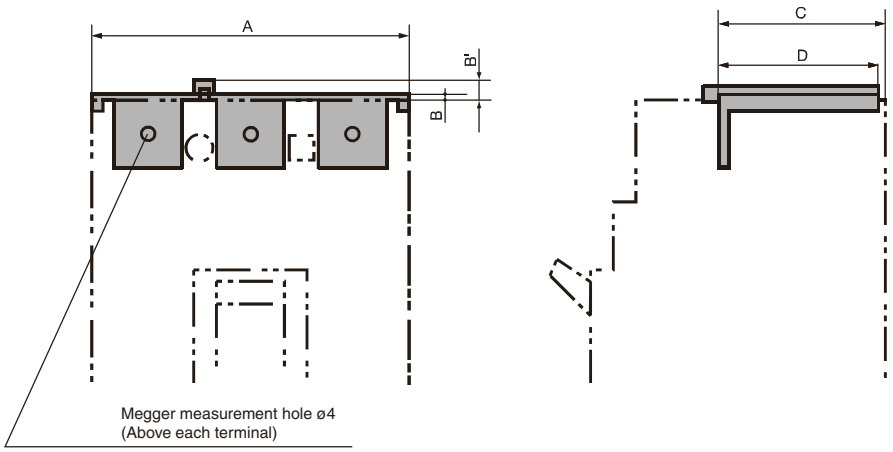
MCCB type	Connection	A			B			B'	C			D			Mounting version	
		1P	3P	4P	1P	3P	4P	3P, 4P	1P	3P	4P	1P	3P	4P	Plug-in mounted	Screw-mounted
E125,S125	Front conn.	30	90	120	40	40	40	o	48	48	48	46	46	46	○	—
	Cable clamp	30	90	120	2.5	2.5	2.5	6	62.5	61	61	60	59.5	59.5	○	—
S160,-NJ, S160NN E250-NJ, S250-NJ, S250-GJ, S250-NN	Front conn. (1)	35	105	140	55	55	55	o	54	54	54	52	52	52	○	—
	Cable clamp	35	105	140	2.5	2.5	2.5	6	63	61	61	49.5	59.5	59.5	○	—
H125, L125, H160, L160, S250-NE, S250-GE, S250-PE H250, L250	Front conn. (1)	o	105	140	o	55	55	o	o	89	89	o	87	87	○	—
	Cable clamp	o	105	140	o	2.5	2.5	4.5	o	96	96	o	59.5	59.5	○	—
E400, S400 E630, S630	Front conn. Wide type	o	180	240	o	110	114	o	o	97	98	o	96	98	○	—
	Front conn. Straight type	o	140	185	o	85	85	o	o	97	97	o	94.5	94.5	○	—
	Cable clamp	o	140	185	o	3	3	4.5	o	97	97	o	93	93	○	—
H400, L400	Front conn. Wide type	o	180	240	o	110	114	o	o	134	135	o	96	98	○	—
	Front conn. Straight type	o	140	185	o	85	85	o	o	134	134	o	94.5	94.5	○	—
	Cable clamp	—	140	185	o	3	3	4.5	o	134	134	o	93	93	○	—
S800, S1000	Front conn. (3)	—	215	285	—	130	130	—	—	99.5 (102)	99.5 (102)	—	99 (101.5)	99 (101.5)	—	○
H800, L800	Front conn. (2) (3)	—	215	285	—	130	130	—	—	99.5 (139)	99.5 (139)	—	99 (101.5)	99 (101.5)	—	○
S1250	Front conn. (3)	—	215	285	—	130	130	—	—	115	115	—	99 (102.5)	99 (102.5)	—	○

Notes:
(1) Not applicable when extension bars (FB) are fitted.
(2) There will be an approx. 40 mm gap between the bottom of the terminal cover and the breaker mounting surface.
(3) Values in parentheses indicate the distance to the head of terminal cover mounting screws.

DIMENSIONS

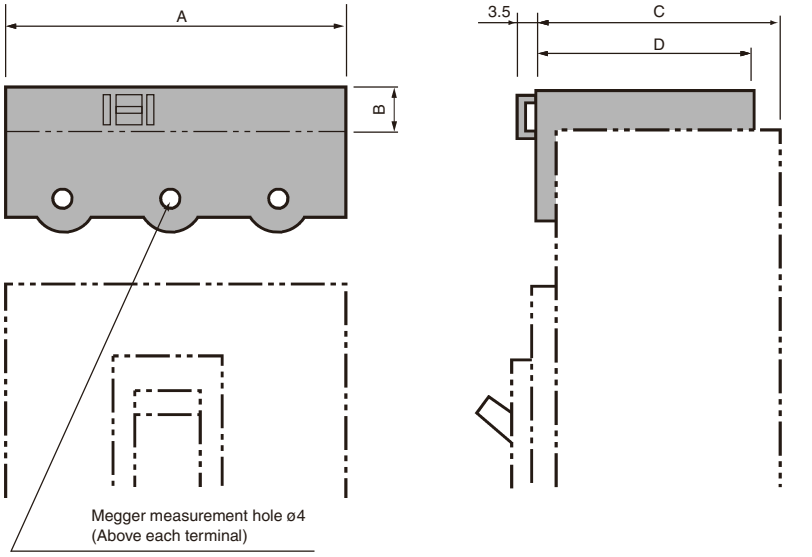
Terminal Covers

Terminal covers for Rear connected and Plug-in MCCB's (CR)



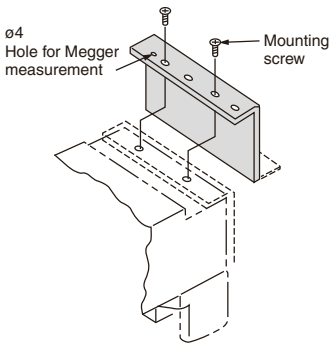
Plug-in mounted version

This version can be mounted simply by being plugged in the breaker body.



Screw-mounted version

The terminal covers for 630 to 800AF are mounted to the breakers using tapping screws.

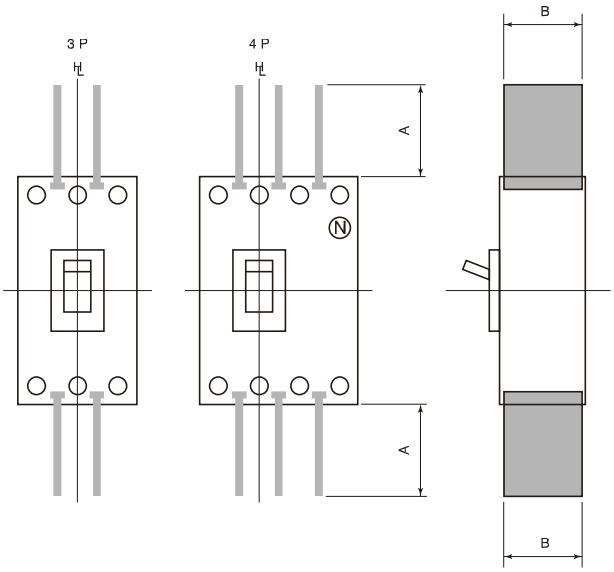


MCCB type	A		B		B'	C		D		Mounting version	
	3 poles	4 poles	3 poles	4 poles		3 poles	4 poles	3 poles	4 poles	Plug-in mounted	Screw-mounted
E125, S125	90	120	2	2	6	41.5	41.5	40.5	40.5	○	—
S160, E250, S250-NJ, S250-GJ, S250-NN	105	140	2	2	6	42.5	42.5	39.5	39.5	○	—
H125, L125, H160, L160, S250-NE, S250-GE, S250-PE, H250, L250	105	140	2	2	6	77.5	77.5	39.5	39.5	○	—
E400, S400, E630, S630	140	185	3	3	5	97	97	93	93	○	—
H400, L400, (1)	140	185	3	3	5	134	134	93	93	○	—
S800, S1000 (2)	206	280	14	18	—	101 (103.5)	99 (101.5)	100.5 (103)	98 (100.5)	—	○
H800, L800 (2)	206	280	14	18	—	138 (140.5)	136 (138.5)	137.5 (140)	135 (137.5)	—	○

Notes:
(1): There will be an approx. 40 mm gap between the bottom of the terminal cover and the breaker mounting surface.
(2): Values in parentheses indicate the distance to the head of terminal cover mounting screws.

Interpole Barriers

Terminal Interpole Barriers (BA)



MCCB type	A	B
E125, S125	47	53
S160, E250, S250-NJ, S250-GJ, S250-NN	100	53
H125, L125, H160, L160, S250-NE, S250-GE, S250-PE, H250, L250	100	88
E400, S400, E630, S630	110	95
H400, L400	110	95
S800, H800, L800, S1000	110	95

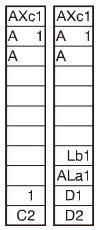
ASL: Arrangement Standard Line
HL: Handle Frame Centre Line
CL: Handle Centre Line

DIMENSIONS

Terminal Blocks for Front-Connected and Rear-Connected MCCBs

11 terminals

Left terminal designations
Example



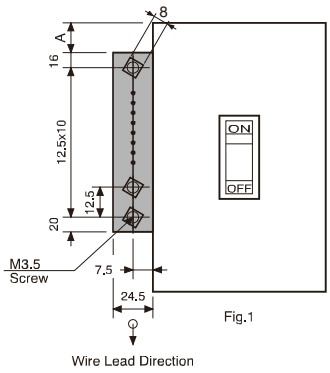


Fig.1

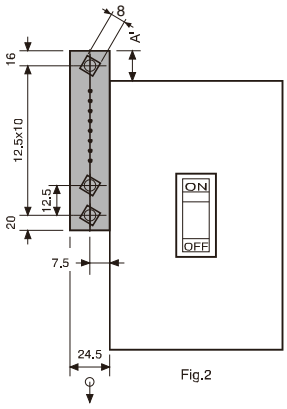
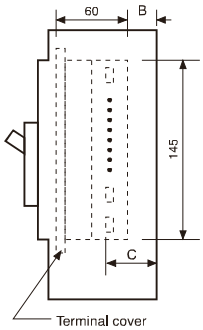


Fig.2



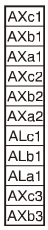
MCCB type	A	A'	B	C	Fig
E125, S125	—	3	0.5	40	2
S160, E250, S250-NJ, S250-GJ, S250-NN	2	—	0.5	40	1
H125, L125, H160, L160, S250-NE, S250-GE, S250-PE, H250, L250	2	—	35.5	75	1

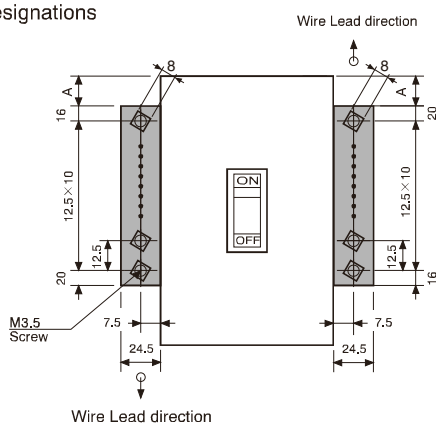
Comments:
1. The tightening torque for the M3.5 terminal screws is 0.9 to 1.2 N·m.
2. Connection wire size is 2.5mm² (max).

---

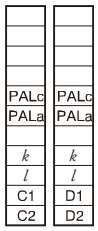
11 terminals

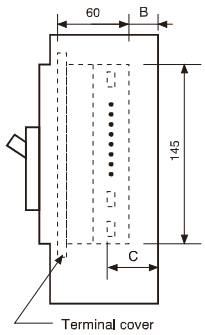
Left terminal designations





Right terminal designations





MCCB type	A	B	C
E400, S400, E630, S630	39.5	30.5	70
H400, L400	39.5	67.5	107
S800, S1000	31	30.5	70
H800, L800	31	67.5	107

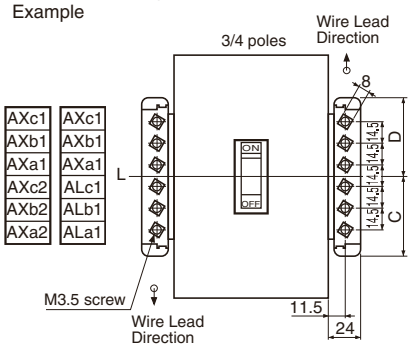
Comments:
1. The tightening torque for the M3.5 terminal screws is 0.9 to 1.2 N·m.
2. Connection wire size is 2.5mm² (max).
3. When you specify Ground Fault Trip on electronic MCCBs with 3 poles the terminal block is automatically fitted to connect with the external neutral CT for 3 phases 4 wires system.

DIMENSIONS

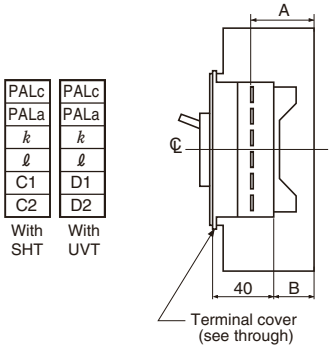
Terminal Blocks for Front-Connected and Rear-Connected MCCBs

6 terminals

Left terminal designations
Example



Right terminal designations
Example

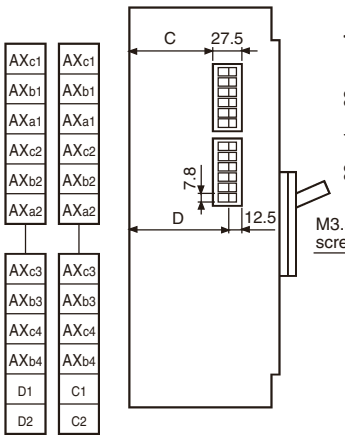


MCCB Type	A	B	C	D
E125, S125	42.5	27	53	53
S160, E250, S250-NJ, S250-GJ, S250-NN	42.5	27	53	53
H125, L125, H160, L160, S250-NE, S250-GE, S250-PE, H250, L250	77.5	62	53	53
E400, S400, E630, S630	72.5	57	43	63
H400, L400	109.5	94	43	63
S800, S1000	72.5	57	23.5	82.5
H800, L800	109.5	94	23.5	82.5

Comments:
1. The tightening torque for the M3.5 terminal screws is 0.9 to 1.2 N·m.
2. Connection wire size is 1.25mm² (max).

6 terminals

Left terminal designations
Example



Right terminal designations
Example

MCCB Type	A	B	C	D
S1250	51	114 (124)	57	72
S1600	51	114 (124)	77	92

Comments:
1. Values in parentheses applies to 4-pole breakers.
2. Tightening torque of M3.5 terminal screws: 0.9 – 1.2 N·m.
3. Connection wire size: 2.0mm² max x 2.

SECTION 7

DIMENSIONS

Slide Interlocks

ASL : Arrangement Standard Line ℍ : Handle Frame Centre Line ℄ : Handle Centre Line

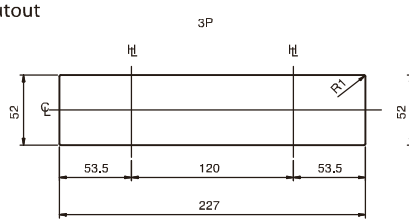
Mechanical Interlocks slide type (MS)

For 125A, 160A, 250A frame size

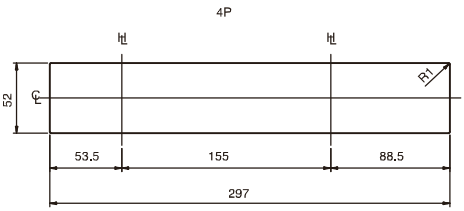
MCCB Type	Poles	Conn.	Parts No.	A
S160, E250, S250-NJ, S250GJ, S250-NN	3	FC, RC	T2MS253SF	91.7
	4	FC, RC	T2MS254SF	
H125, L125, H160, L160, S250-NE, S250-GE, S250-PE, H250, L250	3	FC, RC	T2MS253LF	126.7
	4	FC, RC	T2MS254LF	

Panel Cutout

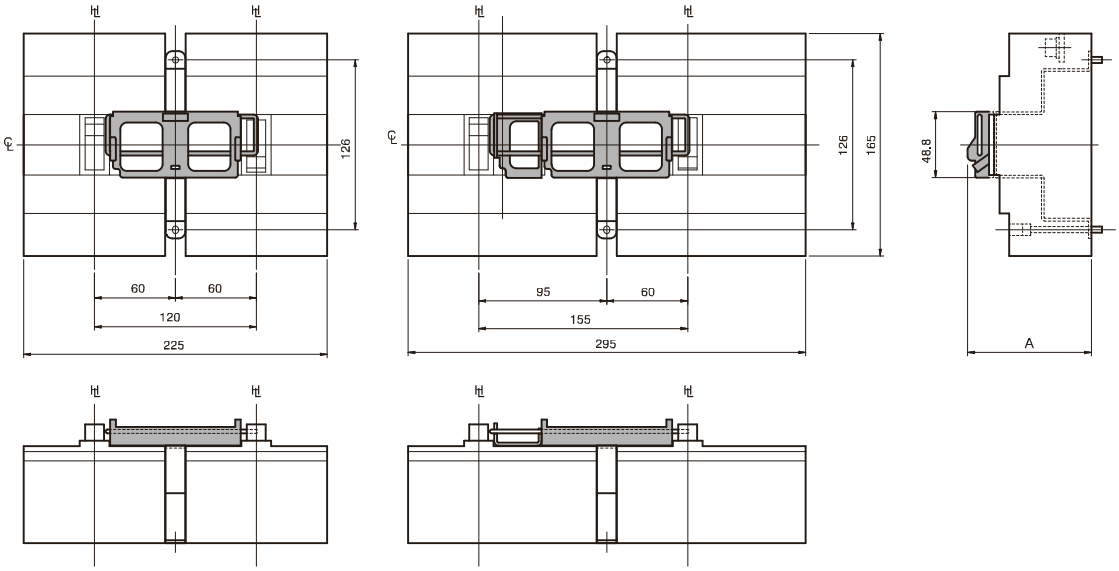
T2MS253SF/T2MS253LF



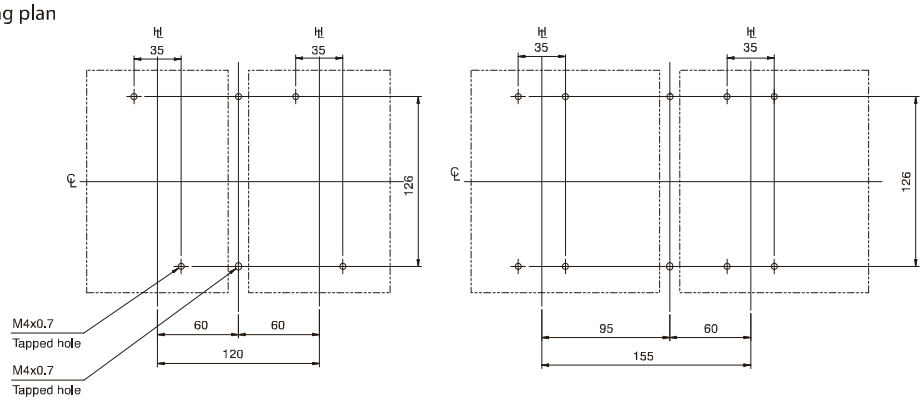
T2MS254SF/T2MS254LF



Panel cutout dimensions shown give an allowance of 1.0 mm around the handle escutcheon.



Drilling plan



DIMENSIONS

Slide Interlocks

ASL : Arrangement Standard Line ℍ : Handle Frame Centre Line ℄ : Handle Centre Line

Mechanical Interlocks slide type (MS)

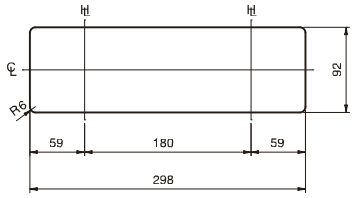
For 400A, 630A frame size

MCCB Type	Poles	Conn.	Parts No.	A
E400, S400, E630, S630	3	FC, RC	T2MS403SF	135.5
	4	FC, RC	T2MS404SF	
H400, L400	3	FC, RC	T2MS403LF	172.5
	4	FC, RC	T2MS404LF	

Panel Cutout

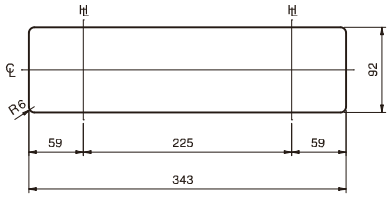
T2MS403SF/T2MS403LF

3P

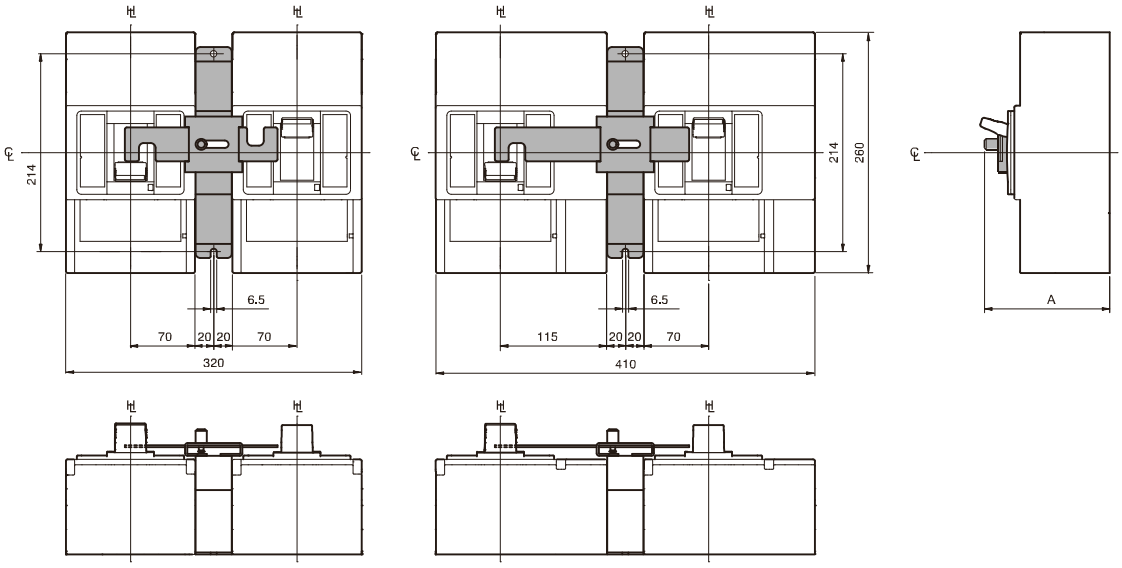


T2MS404SF/T2MS404LF

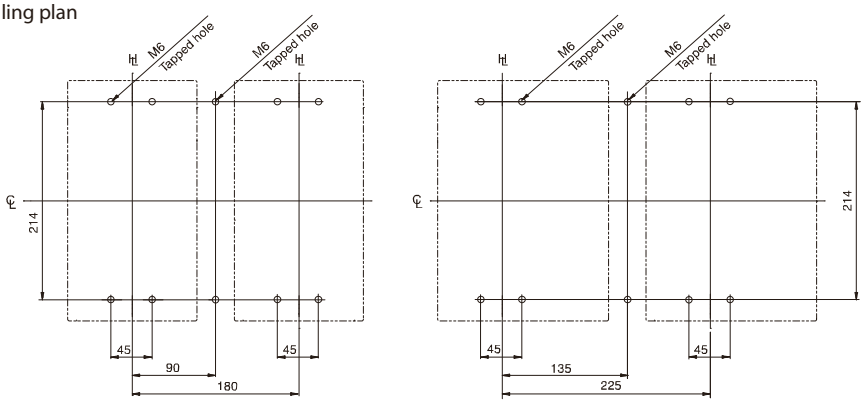
4P



Panel cutout dimensions shown give an allowance of 1.0 mm around the handle escutcheon.



Drilling plan



SECTION 7

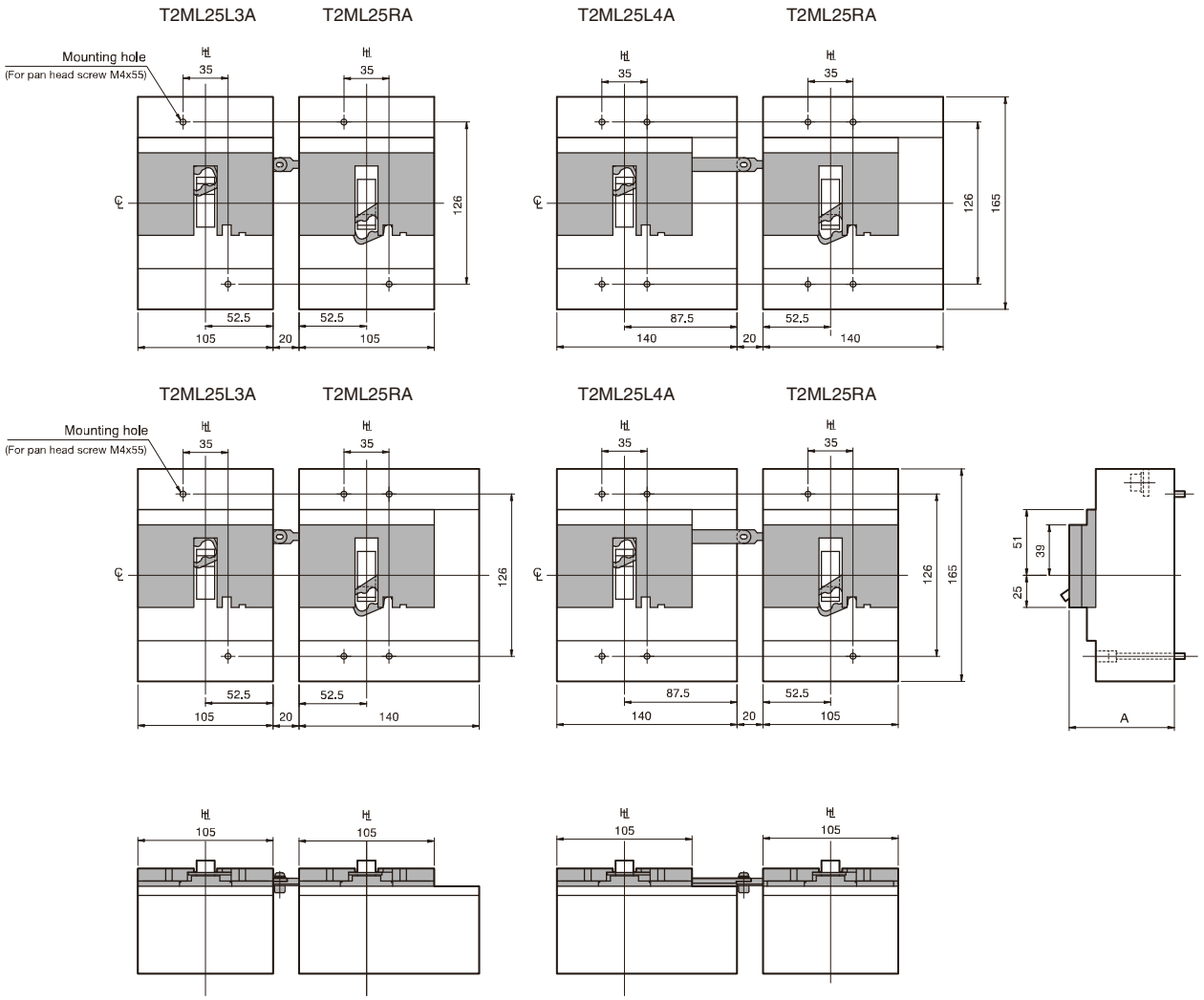
Link Interlocks

ASL : Arrangement Standard Line ℍ : Handle Frame Centre Line ℄ : Handle Centre Line

Mechanical Interlocks link type (ML)

For 125A, 160A, 250A frame size

MCCB Type	Poles	Position	Parts No.	A
S160, E250, S250-NJ, S250-GJ, S250-NN	3	Right	T2ML25RA	81.7
	4			
	3	Left	T2ML25L3A	
	4		T2ML25L4A	
H125, L125, H160, L160, S250-NE, S250-GE, S250-PE, H250, L250	3	Right	T2ML25RA	116.7
	4			
	3	Left	T2ML25L3A	
	4		T2ML25L4A	



SECTION 7

DIMENSIONS

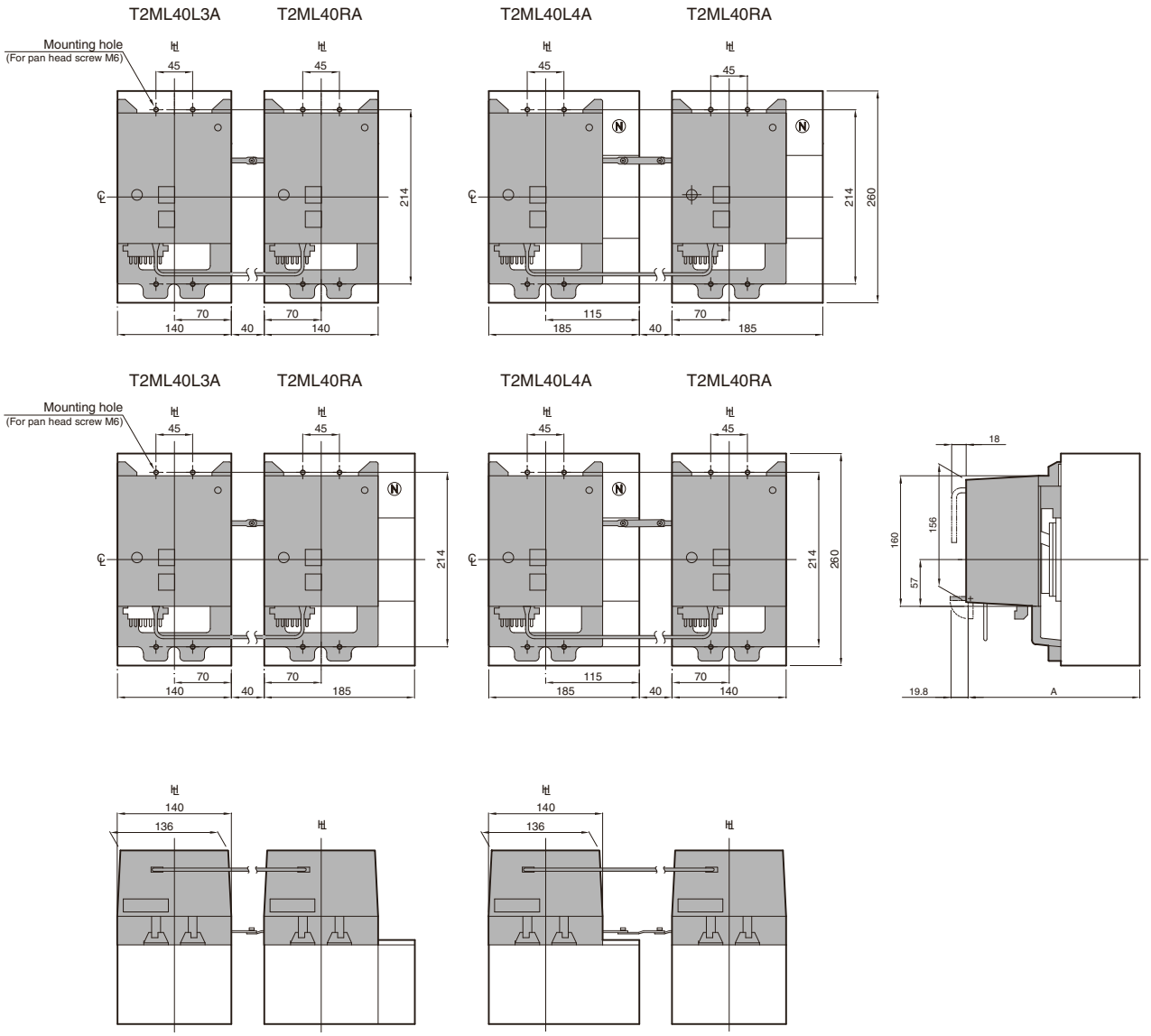
Link Interlocks with motor operators

ASL : Arrangement Standard Line ℍ : Handle Frame Centre Line ℄ : Handle Centre Line

Mechanical Interlocks link type (ML)

For 400A, 630A frame size

MCCB Type	Poles	Position	Parts No.	A
E400, S400 E630, S630	3	Right	T2ML40RA	213
	4			
	3	Left	T2ML40L3A	
	4		T2ML40L4A	
H400, L400	3	Right	T2ML40RA	250
	4			
	3	Left	T2ML40L3A	
	4		T2ML40L4A	



For 400A and 630A frame, the link mechanical interlocks can not be used without motor operators. Please specify also the motor operators when ordering. Furthermore, please request the additional labels for the breakers to TERASAKI and put the labels on the side of the breakers.

DIMENSIONS

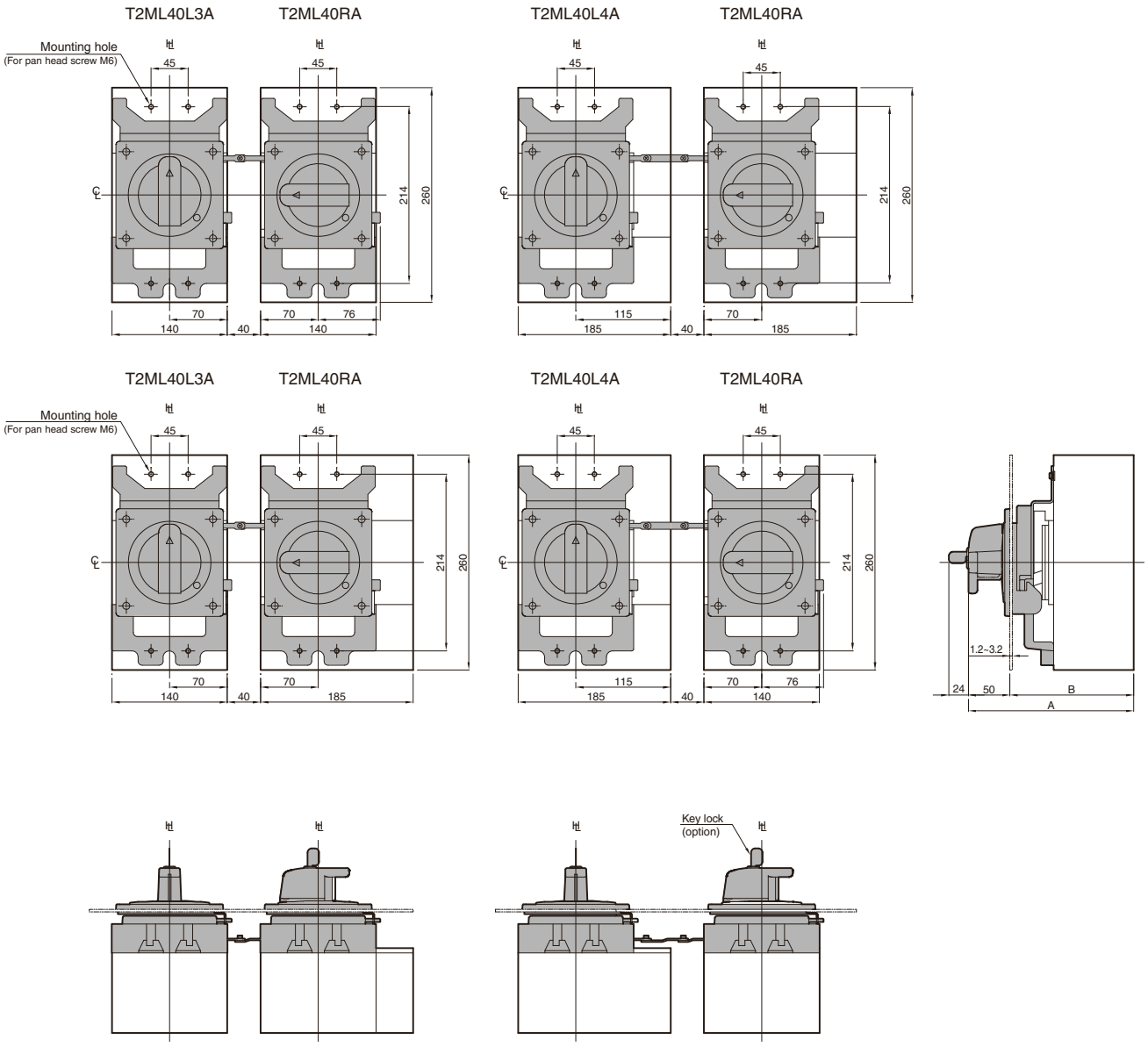
Link Interlocks with breaker mounted handles

ASL : Arrangement Standard Line ℍ : Handle Frame Centre Line ℄ : Handle Centre Line

Mechanical Interlocks link type (ML)

For 400A, 630A frame size

MCCB Type	Poles	Position	Parts No.	A	B
E400, S400 E630, S630	3	Right	T2ML40RA	200	150±2
	4				
	3	Left	T2ML40L3A		
	4		T2ML40L4A		
H400, L400	3	Right	T2ML40RA	237	187±2
	4				
	3	Left	T2ML40L3A		
	4		T2ML40L4A		



For 400A and 630A frame, the link mechanical interlocks can not be used without breaker mounted handles. Please specify also the breaker mounted handles when ordering. Furthermore, please request the additional labels for the breakers to TERASAKI and put the labels on the side of the breakers.

SECTION 7

DIMENSIONS

Wire Interlocks

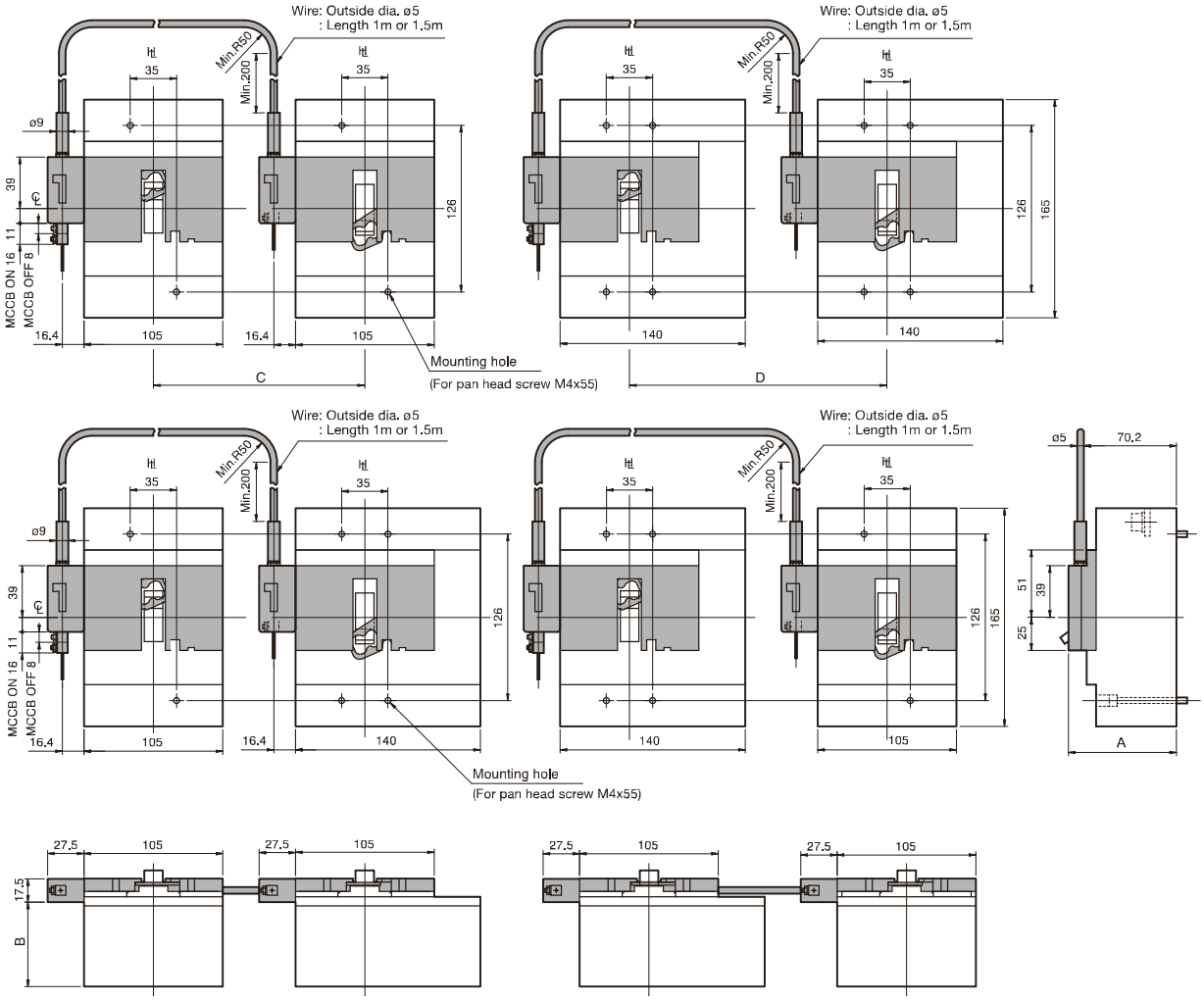
ASL : Arrangement Standard Line ℍ : Handle Frame Centre Line ℄ : Handle Centre Line

Mechanical Interlocks wire type (MW)

For 125A, 160A, 250A frame size

MCCB Type	Parts No.	A	B
S160, E250, S250-NJ S250-GJ, S250-NN	T2MW25CA	81.7	64
H125, L125, H160, L160, S250-NE, S250-GE, S250-PE, H250, L250	T2MW25CA	116.7	99

Cable length	Parts No.	B	C
1.0m	T2MW00SA	155min. – 480max.	180min. – 480max.
1.5m	T2MW00LA	155min. – 980max.	180min. – 980max.



SECTION 7

DIMENSIONS

Wire Interlocks with motor operators

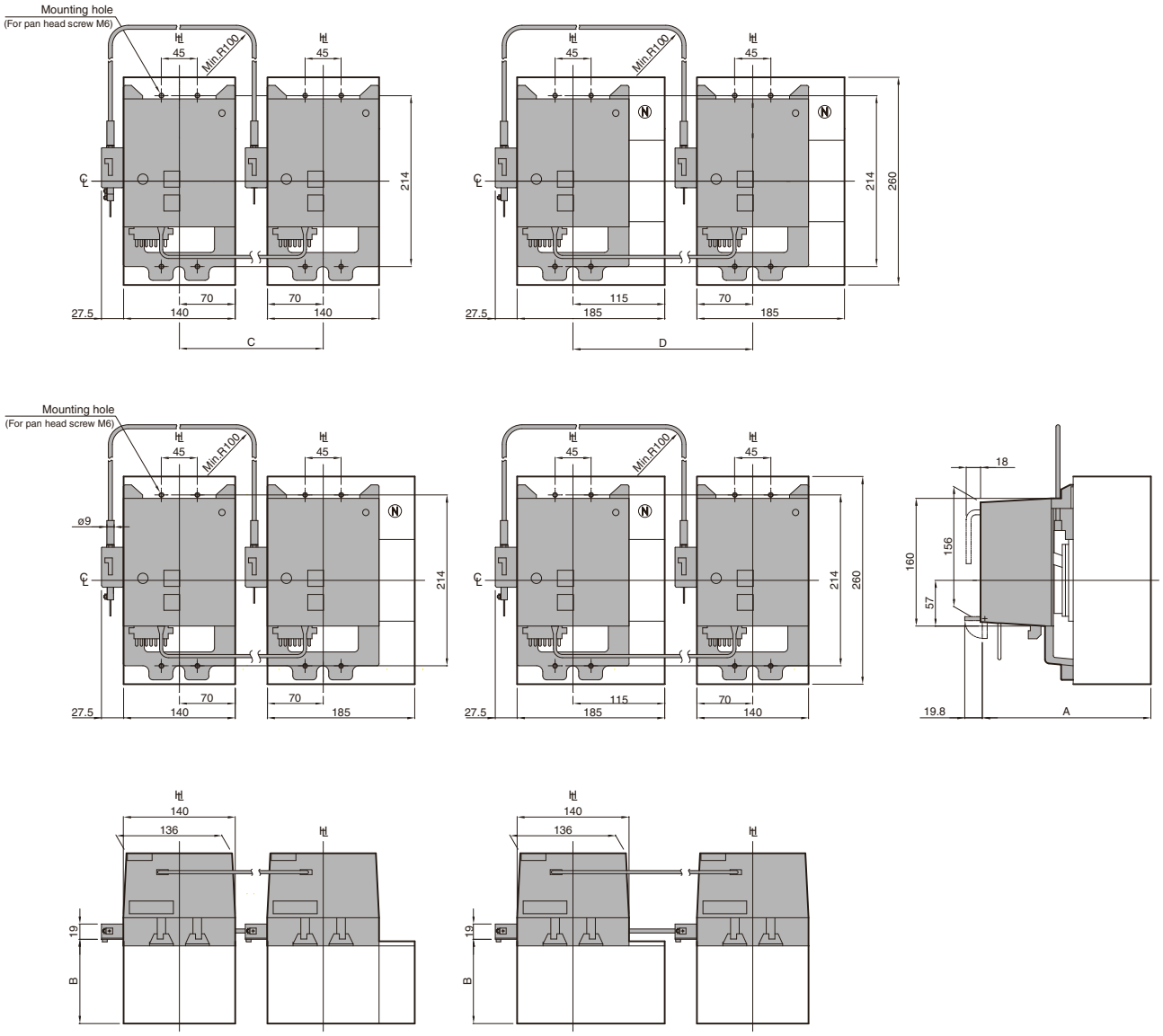
ASL : Arrangement Standard Line ℍ : Handle Frame Centre Line ℄ : Handle Centre Line

Mechanical Interlocks wire type (MW)

For 400A, 630A frame size

MCCB Type	Parts No.	A	B
E400, S400, E630, S630	T2MW40CA	213	105.4
H400, L400	T2MW40CA	250	142.4

Cable length	Parts No.	B	C
1.0m	T2MW00SA	180min. – 480max.	225min. – 480max.
1.5m	T2MW00LA	180min. – 930max.	225min. – 930max.



For 400A and 630A frame, the wire mechanical interlocks can not be used without motor operators. Please specify also the motor operators when ordering. Furthermore, please request the additional labels for the breakers to TERASAKI and put the labels on the side of the breakers.

DIMENSIONS

Wire Interlocks with breaker mounted handles

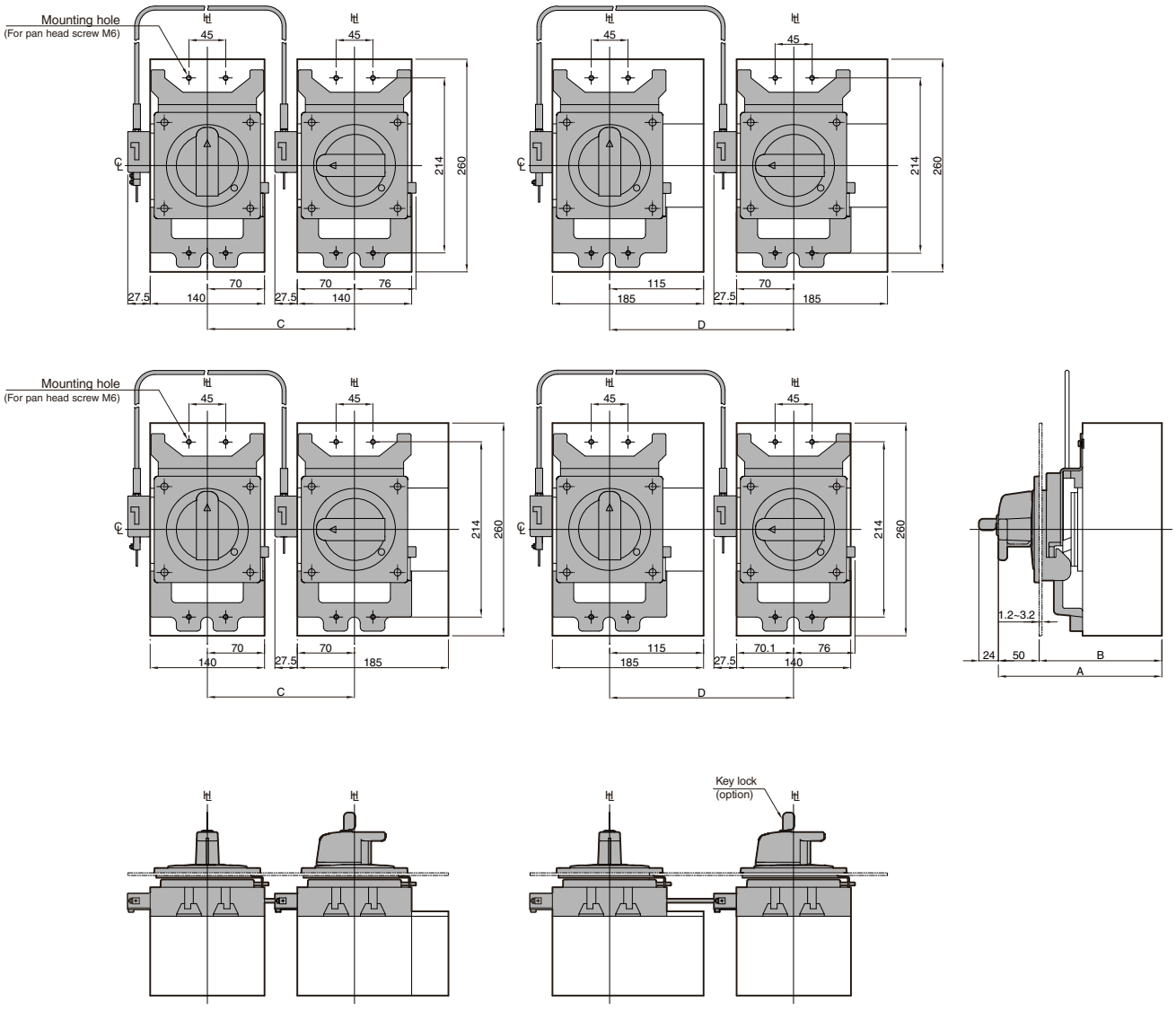
ASL : Arrangement Standard Line ℍ : Handle Frame Centre Line ℄ : Handle Centre Line

Mechanical Interlocks wire type (MW)

For 400A, 630A frame size

MCCB Type	Parts No.	A	B
E400, S400, E630, S630	T2MW40CA	200	150±2
H400, L400	T2MW40CA	237	187±2

Cable length	Parts No.	B	C
1.0m	T2MW00SA	180min. – 430max.	225min. – 430max.
1.5m	T2MW00LA	180min. – 930max.	225min. – 930max.



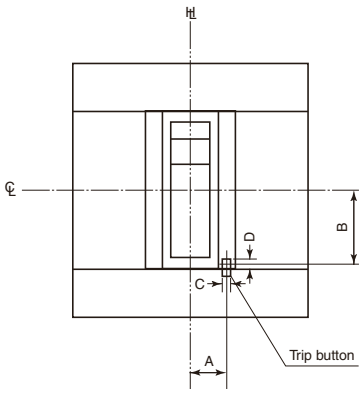
For 400A and 630A frame, the wire mechanical interlocks can not be used without breaker mounted handles. Please specify also the breaker mounted handles when ordering. Furthermore, please request the additional labels for the breakers to TERASAKI and put the labels on the side of the breakers.

SECTION 7

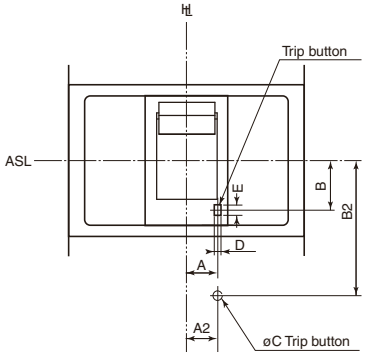
Position of Trip Button

Positions of Trip Button

ASL : Arrangement Standard Line ℍ : Handle Frame Centre Line ℄ : Handle Centre Line



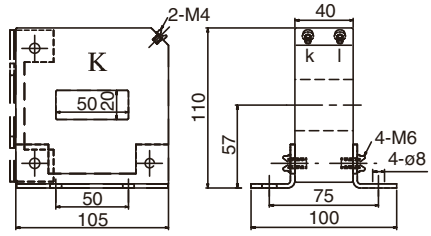
MCCB Type	Poles	A	B	C	D
E125, S125	3, 4	13.8	20.4	3.3	4.3
S160, E250, S250-NJ, S250-GJ, S250-NN,	3, 4	17.2	20.4	3.3	4.3
H125, L125, H160, L160, S250-NE, S250-GE, S250-PE, H250, L250	3, 4	17.2	20.4	3.3	4.3
E400, S400 H400, L400, E630, S630	3, 4	21.6	37.2	5.3	6.6
S800, S1000 H800, L800	3, 4	21.6	33	5.3	6.6



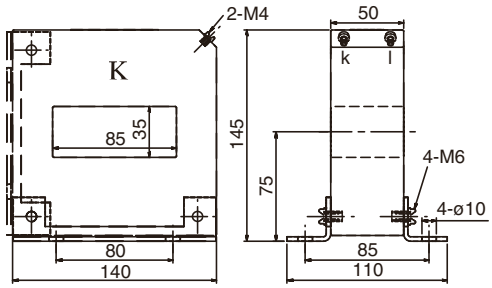
MCCB Type	Poles	A	B	A2	B2	C	D	E
S1250 S1600	3, 4	30	37.5	31	70.5	6	6	8

DIMENSIONS

External Neutral CT



Type of CT	Rated primary current (A)	Rated secondary current (mA)
T2GB40N04	400	100
T2GB40N06	630	100
T2GB40N08	800	100



Type of CT	Rated primary current (A)	Rated secondary current (mA)
T2GBX6N10	1000	100
T2GBX6N12	1250	100
T2GBX6N16	1600	100

Door Flanges

Door flanges are recommended to be used to cover the cutout of a switchboard panel.

Door Flange for toggle-operated MCCBs (mm)

MCCB Type	Parts No.	Fig.	A	B	C	D	E	F		G		H		K	d	t
								Min	Max	Min	Max	Min	Max			
E125, S125	T2DF25	1 ①	77.5	77.5	105	50	92	37	42	37	42	32	45	—	M3×0.5	2
H125, L125, H160, L160, S250-NE, S250-GE, S250-PE, H250, L250	T2DF25	1 ①	82.5	82.5	105	50	92	37	42	37	42	32	45	—	M3×0.5	2
S160, E250, S250-NJ, S250-GJ, S250-NN	T2DF25	1 ①	82.5	82.5	105	50	92	37	42	37	42	32	45	—	M3×0.5	2
E400, S400, E630, S630	T2DF40	2 ①	130	130	135	95	120	48	56	48	56	57	90	80	M3×0.5	2
H400, L400	T2DF40	2 ①	130	130	135	95	120	48	56	48	56	57	90	80	M3×0.5	2
S800, S1000	T2DF40	2 ②	132	141	135	95	120	48	56	48	56	57	90	80	M3×0.5	2
H800, L800	T2DF40	2 ②	132	141	135	95	120	48	56	48	56	57	90	80	M3×0.5	2
S1250	T2DFX6	2 ②	170	200	150	120	135	51	63.5	51	63.5	85	115	80	M3×0.5	2
S1600	T2DFX6	2 ②	170	200	150	120	135	51	63.5	51	63.5	85	115	80	M3×0.5	2

Notes:
① : ℄ Handle centre line is applied.
② : ASL Arrangement standard line is applied.

Fig. 1

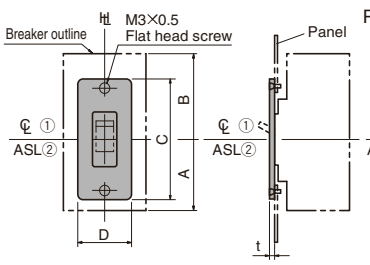
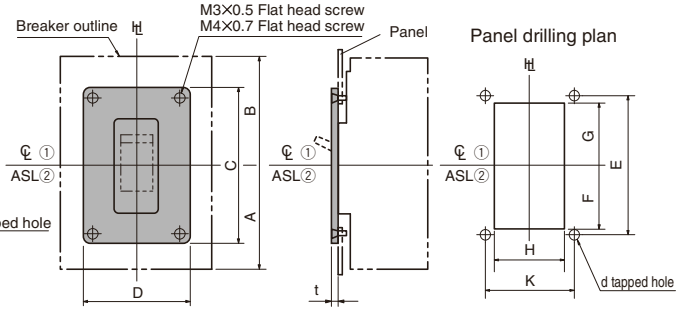


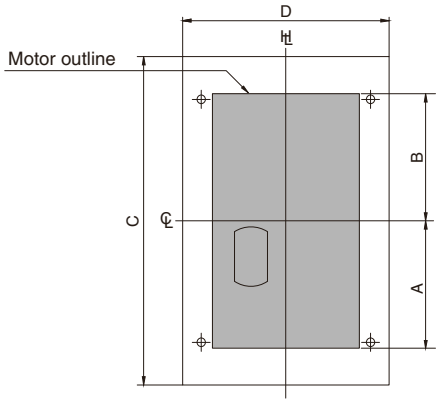
Fig. 2

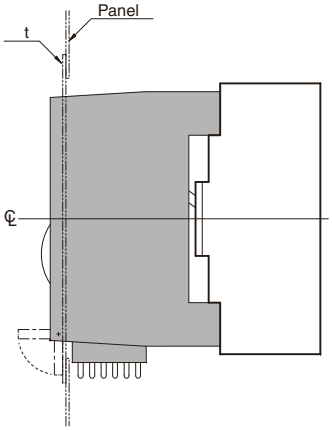


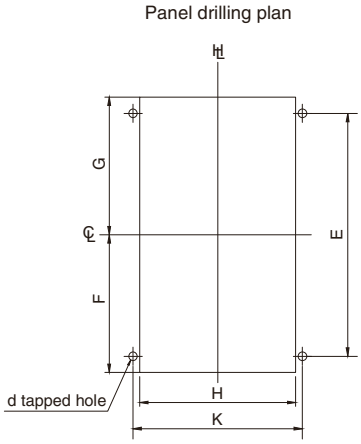
DIMENSIONS

Door Flange for motor-operated MCCBs (mm)

MCCB Type	Parts No.	A	B	C	D	E	F		G		H		K	d	t
							Min	Max	Min	Max	Min	Max			
E125 S125	T2DM25	77.5	77.5	200	130	151	80	90	80	90	94	98	106	4	3.5
H125, L125, H160, L160 S250-NE, S250-GE, S250-PE H250, L250	T2DM25	77.5	77.5	200	130	151	80	90	80	90	94	98	106	4	3.5
S160, E250, S250-NJ, S250-GJ, S250-NN	T2DM25	77.5	77.5	200	130	151	80	90	80	90	94	98	106	4	3.5
E400, S400 E630, S630	T2DM40	57	103	200	180	150	59	69	105	115	144	148	156	4	3.5
H400, L400	T2DM40	57	103	200	180	150	59	69	105	115	144	148	156	4	3.5
S800, S1000	T2DM40	58	102	200	180	150	60	70	104	114	144	148	156	4	3.5
H800, L800	T2DM40	58	102	200	180	150	60	70	104	114	144	148	156	4	3.5







SECTION 7

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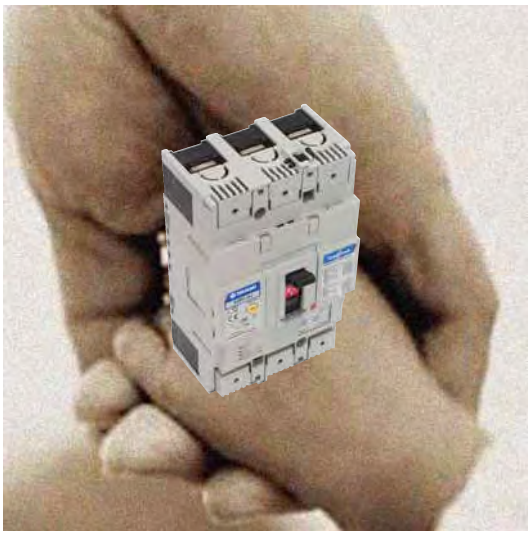


TERASAKI ELECTRIC CO., LTD.

Head Office: 7-2-10 Hannancho, Abenoku
Osaka, Japan

Circuit Breaker Division: 7-2-10 Kamihigashi, Hiranoku Osaka, Japan

Telephone: 81-6-6791-9323
Fax: 81-6-6791-9274
Email: int-sales@terasaki.co.jp
http://www.terasaki.co.jp/

Ratings and specifications are subject to change without notice.

CAT REF. '11-I61E

TERASAKI ELECTRIC (EUROPE) LTD.

79 Beardmore Way, Clydebank Industrial Estate
Clydebank, Glasgow, G81 4HT, Scotland (UK)

Telephone: 44-141-941-1940
Fax: 44-141-952-9246
Email: marketing@terasaki.co.uk
http://www.terasaki.com/

TERASAKI ITALIA s.r.l.

Via Ambrosoli, 4A-20090 Rodano, Milano, Italy

Telephone: 39-02-92278300
Fax: 39-02-92278320
Email: terasaki@terasaki.it
http://www.terasaki.it/

TERASAKI ELECTRIC (EUROPE) LTD. BRANCH IN SPAIN

Cal Ros Dels Ocells 5-7, Granollers 08403,
Barcelona, Spain

Telephone: 34-93-879-60-50
Fax: 34-93-870-39-05
Email: terasaki@terasaki.es
http://www.terasaki.es/

TERASAKI SKANDINAVISKA AB

Box 2082 SE-128 22 Skarpnäk Sweden

Telephone: 46-8-556-282-30
Fax: 46-8-556-282-39
Email: info@terasaki.se
http://www.terasaki.se/

TERASAKI CIRCUIT BREAKERS (S) PTE. LTD.

9 Toh Guan Road East 03-01 Alliance Building
Singapore 608604

Telephone: 65-6425-4915
Fax: 65-6425-4351
Email: tecs@pacific.net.sg

TERASAKI ELECTRIC (M) SDN, BHD.

Lot 3, Jalan 16/13D, 40000 Shah Alam, Selangor Darul
Ehsan, Malaysia

Telephone: 60-3-5549-3820
Fax: 60-3-5549-3960
Email: terasaki@terasaki.com.my

TERASAKI DO BRASIL LTDA.

Rua Cordovil, 259-Parada De Lucas, 21250-450
Rio De Janeiro-R.J., Brazil

Telephone: 55-21-3301-9898
Fax: 55-21-3301-9861
Email: terasaki@terasaki.com.br
http://www.terasaki.com.br

TERASAKI ELECTRIC (CHINA) LTD.

72 Pacific Industrial Park, Xin Tang Zengcheng,
Guangzhou 511340, China

Telephone: 86-20-8270-8556
Fax: 86-20-8270-8586
Email: terasaki@public.guangzhou.gd.cn

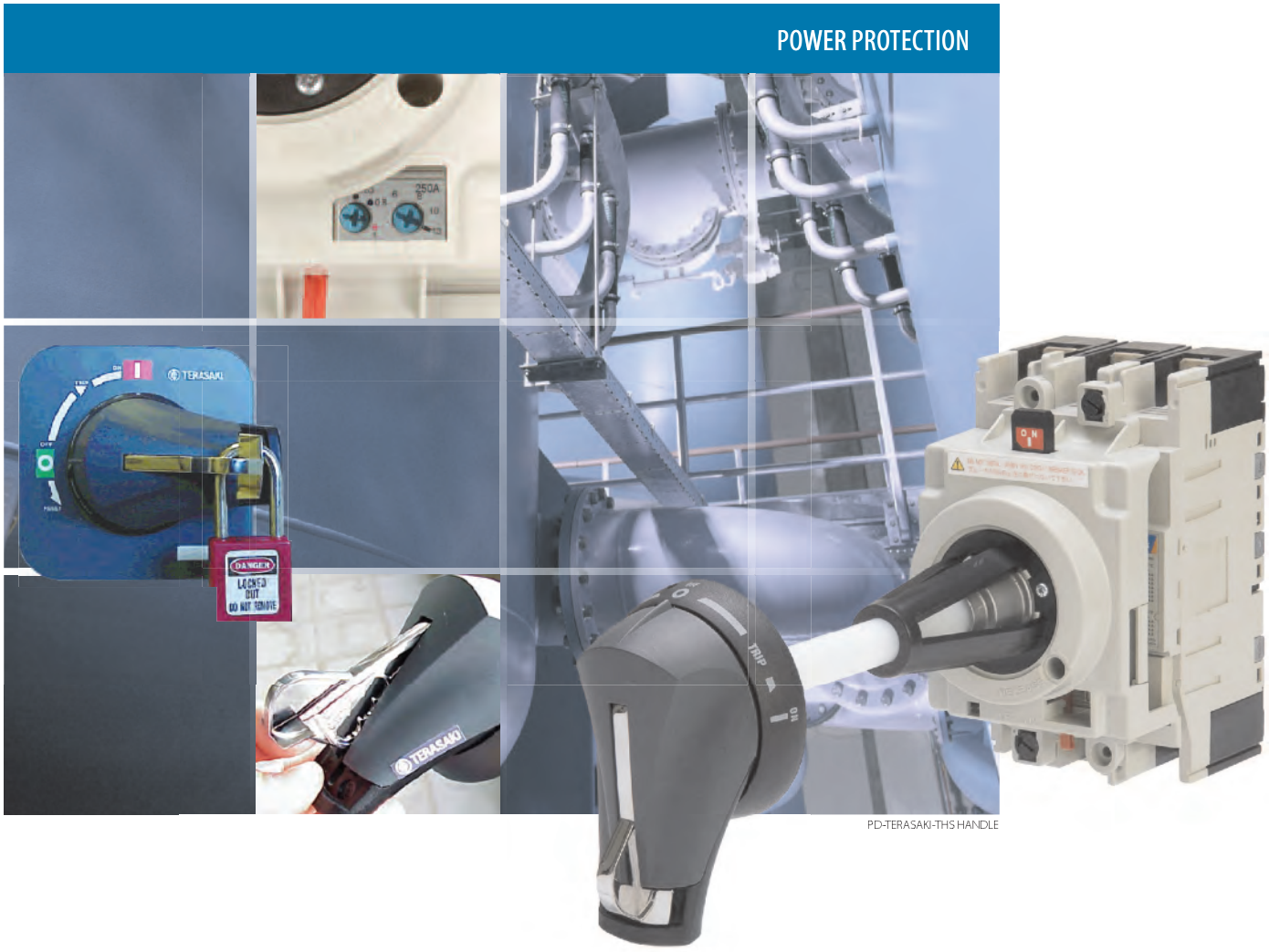
TERASAKI ELECTRIC GROUP SHANGHAI REPRESENTATIVE OFFICE

Room No. 1405-6, Tomson Commercial Building
710 Dong Fang Road, Pudong, Shanghai, 200122, China

Telephone: 86-21-58201611
Fax: 86-21-58201621
Email: terasaki@vip.163.com

T1HS / T2HS HANDLES

For Terasaki moulded case circuit breakers up to 1600 A.



- IP55 rated plastic handle
- Long variable depth shaft supplied standard
- Heavy duty metal locking lever standard
- Internal door interlocking components are all metal
- All handles mount in a 31-37 mm hole
- Short lever handles on MCCBs to 250 A, longer types 400 - 1600 A
- 105 mm^2 or 130 mm^2 escutcheon plates are optional
- Handles are padlockable in the OFF position as standard
- ON padlocking optional via on site handle modification
- Accepts up to three 4 - 8 mm locks or multi lock devices
- Door opens when handle is switched to OFF position
- Door will not open when handle is padlocked OFF
- Door defeat function standard
- Door defeat non functional when padlocked OFF
- Padlock option for handle mechanism mounted on MCCB
- All handle mechanisms allow MCCB dial setting viewing and access
- For IP 65 applications T1HP/T2HP handles are available
- ON indication flag on handle mechanism
- Prosafe trapped key interlock options

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T1HS / T2HS Handles
For Terasaki moulded case circuit breakers

Features
- IP 55 rated plastic handle
- Suitable for MCCBs 0.7 A to 1600 AF
- Long variable depth shaft supplied standard
- Heavy duty METAL locking lever standard
- Internal door interlocking components are metal
- All handles mount in a 31 - 37 mm hole
- Short lever handles on MCCBs to 250 A, longer types 400 - 1600 A (short handles optional for 400/630 A)
- 100 mm² escutcheon plates are optional
- Handles are padlockable in the OFF position as standard
- ON padlocking optional via on site handle modification
- Accepts up to three 4 - 8 mm locks or multi lock devices
- Door opens when handle is switched to OFF position
- Door will not open when handle is padlocked OFF
- Door defeat function standard
- Door defeat non functional when padlocked OFF
- Padlock option for handle mechanism mounted on MCCB
- All handle mechanisms allow MCCB dial setting viewing and access
- For IP 65 applications T1HP/T2HP handles are available

7

Field applications
- General and heavy duty applications
- Applications requiring padlocking
- Indoor and some outdoor areas


Metal lock lever standard


Handle escutcheon plate option


MCCB setting viewing window

T1HS and T2HS Handle Catalogue Numbers to suit MCCBs TemBreak 2, 125 - 630 A and TemBreak 1, 0.7 – 1600 A

MCCB Ampere Frame	0.7 – 12A	125AF	250AF	400 / 630AF	630 / 800AF	1250 / 1600AF
Grey handle:	T1HS03R5GM	T2HS12R5GM	T2HS25R5GM	T2HS40R5GM	T1HS80R5GM	T1HSX6R5GM
Red/Yellow handle:	T1HS03R5RM	T2HS12R5RM	T2HS25R5RM	T2HS40R5RM	T1HS80R5RM	T1HSX6R5RM
MCCB Amp ratings:	XM30PB	E125NJ	S160NJ / GJ	E400NJ	XS / XH630	XS1250SE
		S125NJ	H / L160NJ	S400CJ / NJ	XV630PE	XV1250NE
15 A to 1600 A		S125GJ	E250NJ	S400NE	XS / SH800	XS1600SE
		ZS250GJ	S250NJ/GJ/PE	S400GJ	XV800PE	TL630NE
		H125NJ	H250NJ / NE	S400NE / GE		TL800NE
		L125NJ	L250NJ	E630NE		TL1250NE
			ZS125GJ	S630CE / GE		

T1HS Handle Catalogue Numbers to suit TemBreak 1 MCCBs, 125 - 400 A

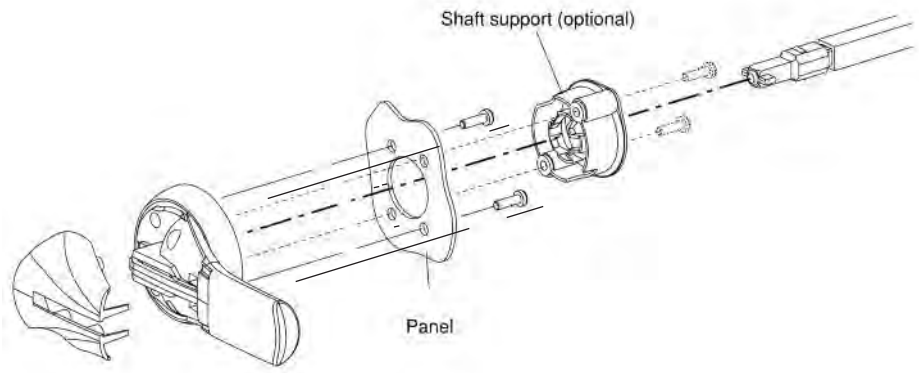
MCCB sizes	Grey handle:	T1HS12XR5GM	T1HS25XR5GM	T1HS40R5GM
15 A to 400 A		TL30NJ	XS250NJ	XS400NJ
		XS125NJ	XH250NJ	XH400SE
		XH125NJ		XV400NE
		TL100NJ		TL250NJ

Panel mount external operating handle
Type T1HS/T2HS

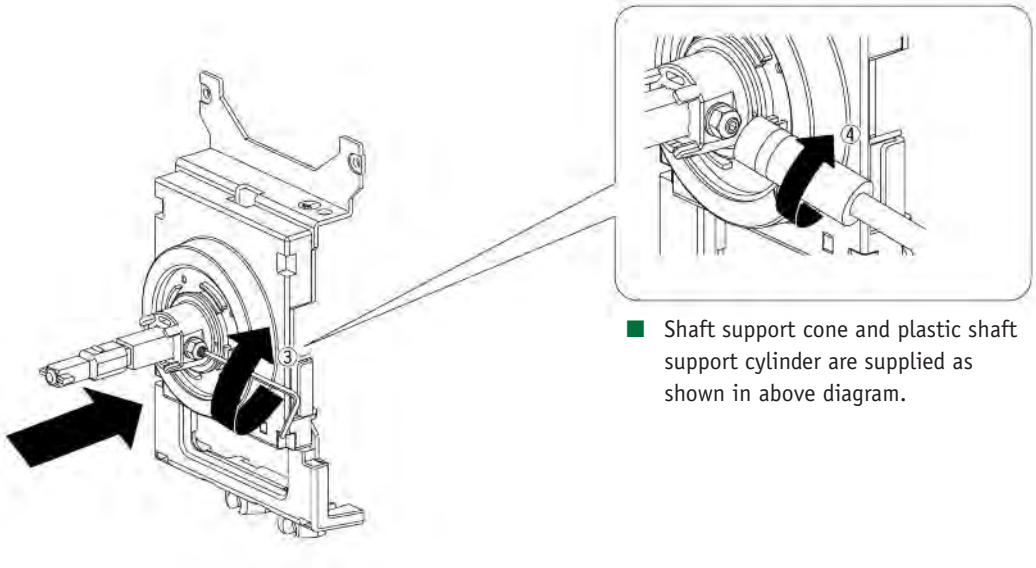
Handle type

Handle type T2HS12R5GM pictured

Handle assembly



Shaft installation



- Shaft support cone and plastic shaft support cylinder are supplied as shown in above diagram.

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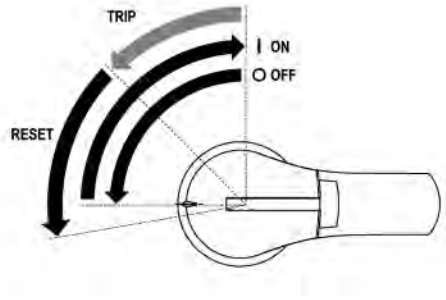
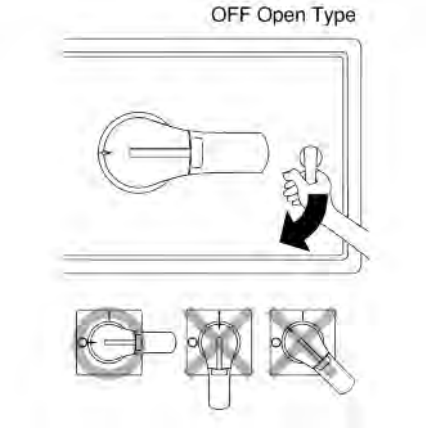
Panel mount external operating handles
Type T1HS/T2HS

Handle operation

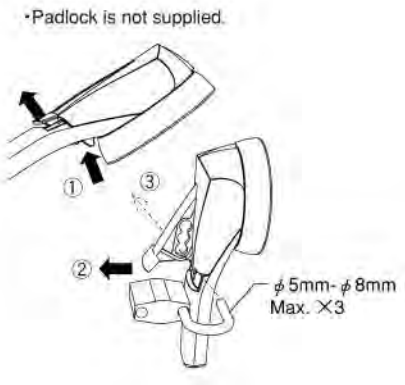


Notes: OFF position can be set at 9:00 o'clock or 12:00 o'clock orientation.

Panel opening procedure



Handle lock operation



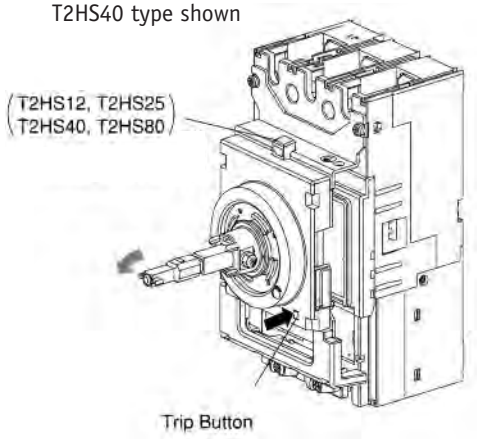
ON position locking

Modifying T1HS/T2HS handles to lock in the ON position

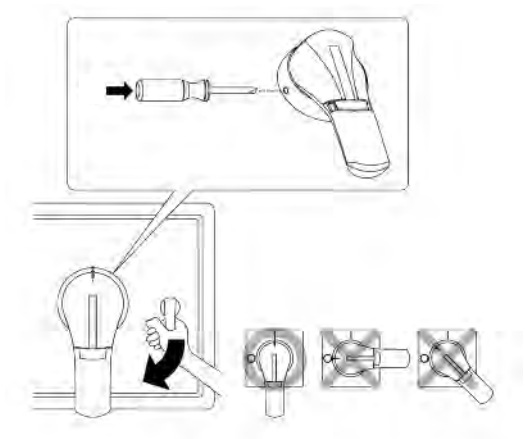
1. Unclip and remove the cover from the rear of the handle.
2. Locate and remove the knock-out tab in the rear of the handle to enable locking pin movement.
3. Check operation for ON locking.
4. Replace the clip on rear cover onto the rear of the handle.
5. The handle can now be installed. It will lock in both ON and OFF.

TRIP Operation with the panel open

T2HS40 type shown



Panel opening procedure by panel lock release

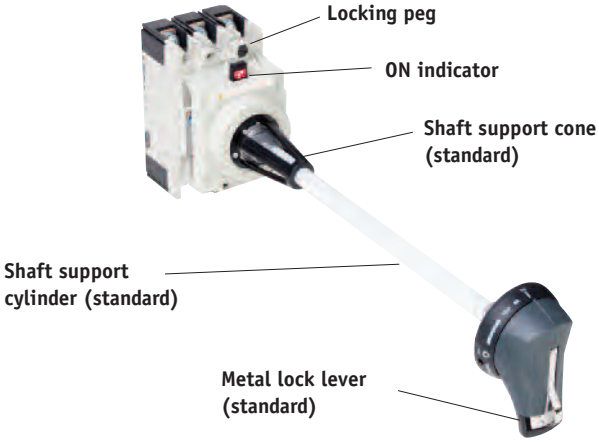


•This applies when the panel requires to be opened while the breaker is in the | (ON) position.

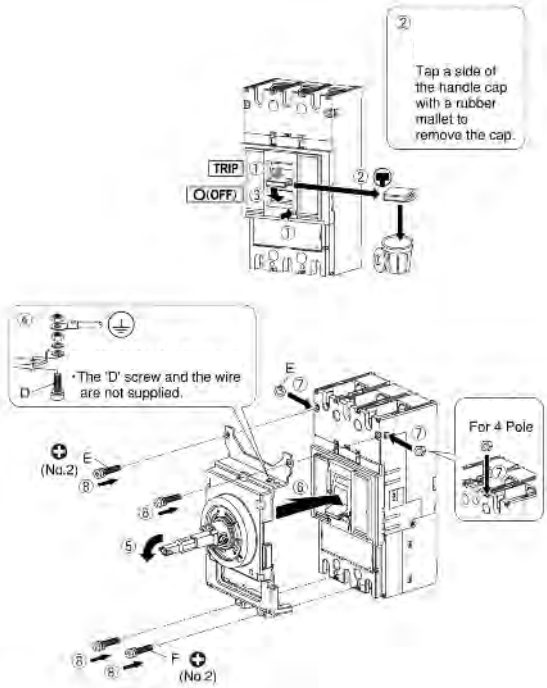
Panel mount external operating handles
Type T1HS/T2HS

T2HS12, T2HS25

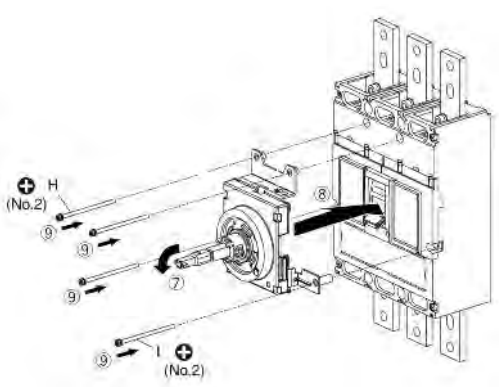
125/250 MCCB shown



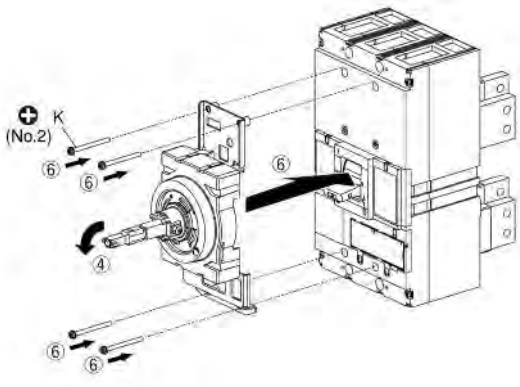
T2HS40



T1HS80



T1HSX6 / T1HSX6



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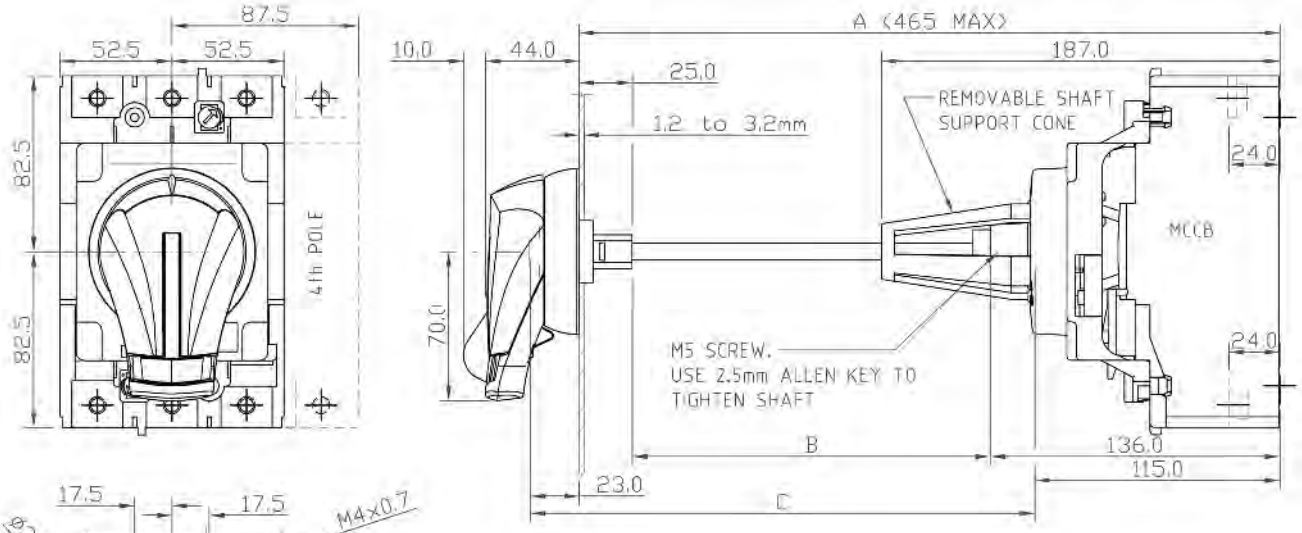
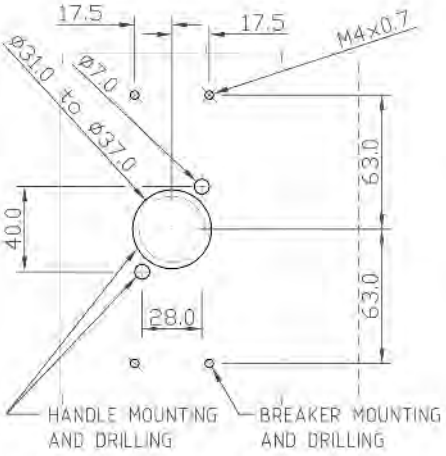
TemBreak 2 MCCB accessories
T1HS / T2HS Handle dimensions (mm)

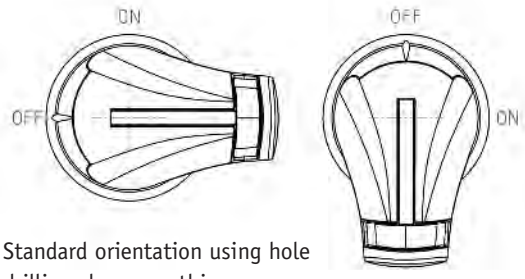
T2HS handle with S160NJ, S160GJ, E250NJ, S250NJ, S250GJ and ZS250GJ MCCB





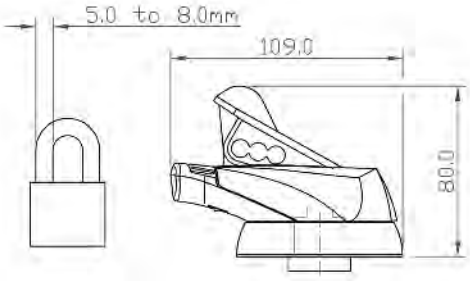
Notes:
1. Distance 'A' is total distance from front of gear plate to front surface of escutcheon. Minimum with plastic cone is (187+25) 212, without it is (136+25) 161 mm. Using special shaft 'T2HS250SHAFT', this can be reduced to (136+6) 142 mm.
2. Cut plastic sleeve to length 'B' determined by . B=A–(136+25).
3. Cut shaft to length 'C' determined by C=(A+23)–115.

Handle orientation options for OFF/ON



Standard orientation using hole drilling shown on this page. Also suitable for optional T2HSESC100 escutcheon label (not shown)

Alternative orientation



Padlock hasp size

Handle padlock lever fully extended

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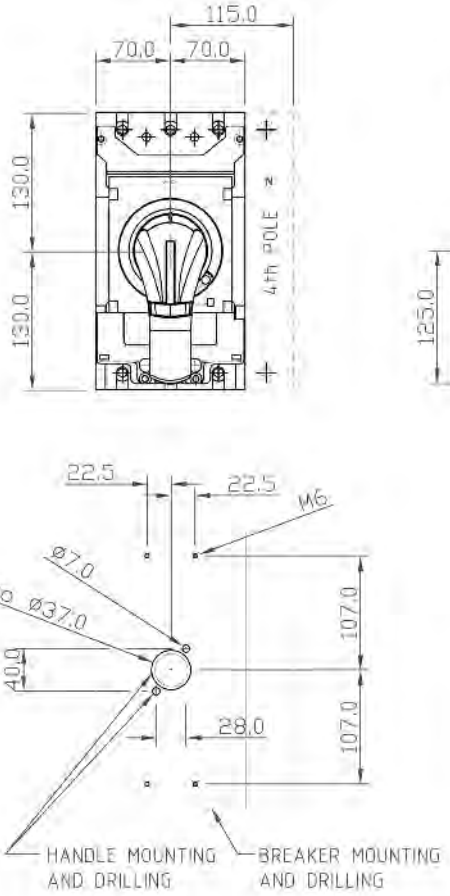
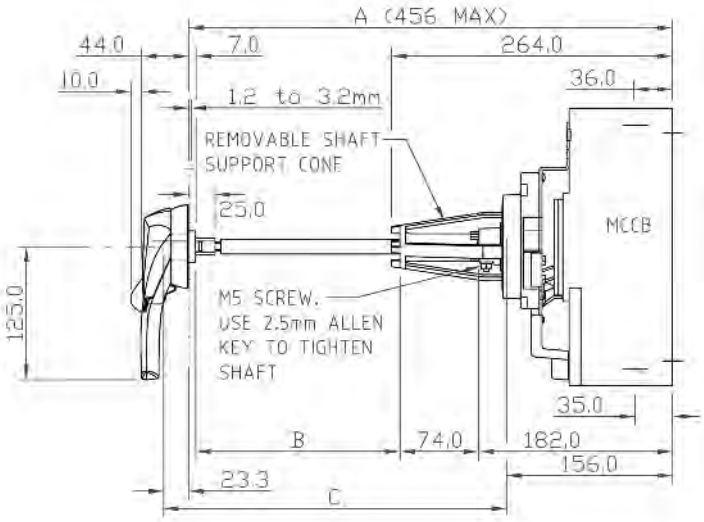
TemBreak 2 MCCB accessories
T1HS / T2HS Handle dimensions (mm)

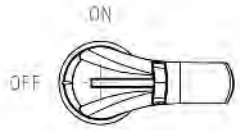
T2HS handle with E400NJ, S400CJ, S400NJ, S400NE, S400GJ, S400GE, E630NE, S630CE, S630GE MCCB



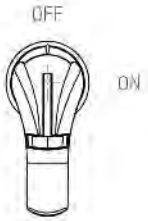


Notes:
1. Distance 'A' is total distance from front of gear plate to front surface of escutcheon. Minimum with plastic cone is (264+7) 271, without it is (182+25) 207 mm. Using special shaft 'T2HS400SHAFT', this can be reduced to (182+6) 188 mm.
2. Cut plastic sleeve to length 'B' determined by . B=A–(182+74+7).
3. Cut shaft to length 'C' determined by C=(A+23)–156.

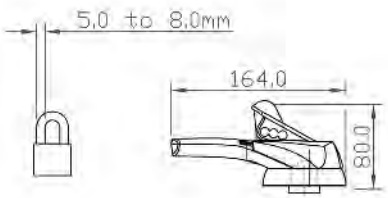
Handle orientation options for OFF/ON



Standard orientation using hole drilling shown on this page. Also suitable for optional T2HSESC100 escutcheon label (not shown)



Alternative orientation



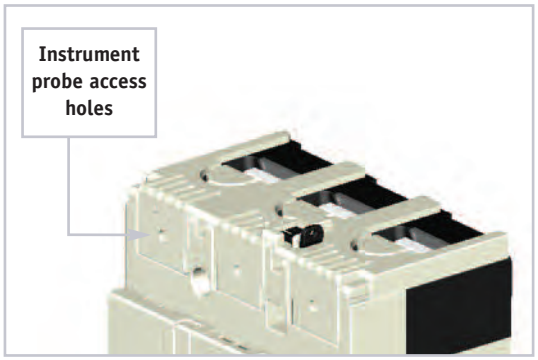
Padlock hasp size

Handle padlock lever fully extended

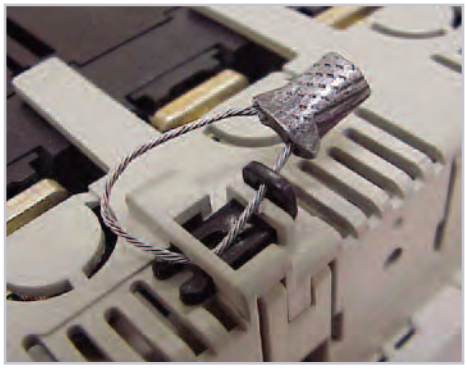
TemBreak 2 MCCB accessories
Insulation barriers, terminal covers

Terminal covers
Terminal covers are used to prevent direct contact with live circuit breaker terminations. They also provide additional insulation, to reduce the possibility of a short circuit between phases or to earth, when large conductors are used.

General features
- Terminal covers require no tools for installation
- All terminal covers have an IP 20 ingress protection rating
- Terminal covers are ordered individually. Two terminal covers are required to cover both the line and load terminals of an MCCB. Each cover can either be fitted to the top or bottom of the MCCB
- Terminal covers have an instrument probe access hole of 4 mm diameter on each phase.



Options
- A terminal cover lock allows an anti-tampering seal to be added.
- An earth barrier can be added to terminal covers for front connection, which provides insulation at the rear of the terminations.


Terminal cover lock with lead seal


Earth barrier fitted to rear of terminal cover

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TemBreak 2 MCCB accessories
Insulation barriers, terminal covers (cont)

125 / 160 / 250 A covers

Terminal covers for front connection (T2 CF)

Terminal covers for front connection are designed to cover the exposed live parts of conductors terminated on the MCCB.
Terminal covers are clip-on, and require no tools. For the 125 A and 250 A MCCBs, 'short' covers and longer, standard covers, are available.
Rear insulation inserts are available for protection against earthing.

Flush terminal covers

Flush terminal covers (T2 CS)

Flush terminal covers are useful for increasing the ingress protection rating at the terminals, without increasing the overall length. They can be used with busbar and for direct entry of stranded cable (with solderless cable clamp terminals).
Flush terminal covers are identical to rear terminal covers for the 400 A and 630 A models. The user can remove a section of the rear terminal cover to allow entry of the conductor.

Terminal covers for rear connection

Terminal covers for rear connection (T2 CR)

Terminal covers for rear connection can be used on MCCBs fitted with rear connections (RP) or plug-in connections (PM). They prevent access to the terminals from the front and top.

MCCB Fitted with interpole barriers on both ends

Interpole barriers between adjacent MCCBs

Interpole barriers (T2 BA)

Interpole barriers provide maximum insulation between phases at the terminals of the MCCB. They cannot be fitted at the same time as any of the terminal covers. Interpole barriers for use on one end of the MCCB are supplied as standard. Additional interpole barriers can be ordered individually and can easily be fitted to either end of an MCCB.
MCCB moulds have also been designed to accept an additional interpole barrier between two adjacent MCCBs.

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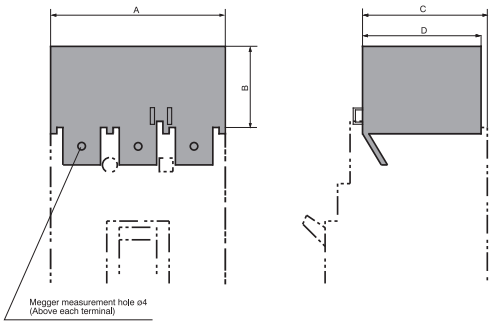
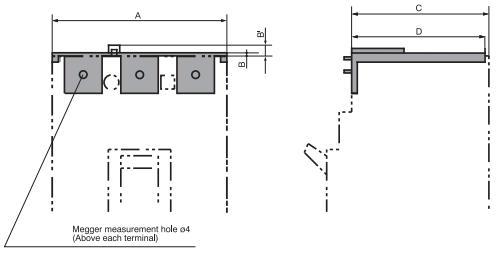
TemBreak 2 MCCB accessories
Terminal covers and interpole barriers
Dimensions (mm)

Terminal covers for front connected MCCBs (T2 CF)



Terminal covers for tunnel clamp terminal MCCBs (T2 CS)

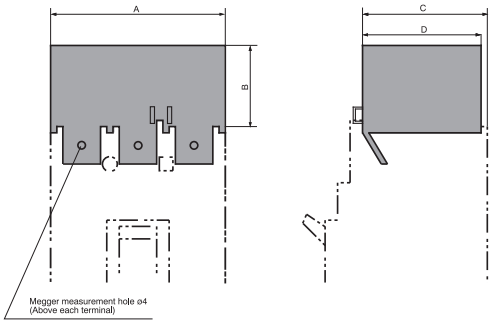


Dimensions (in mm)

Breaker	Connection	A			B			B[1]	C			D		
		1P	3P	4P	1P	3P	4P	3P 4P	1P	3P	4P	1P	3P	4P
E125, S125, ZS125	Front (long)	30	90	120	40	40	40	—	48	48	48	46	46	46
	Front (short)	—	90	120	—	22	22	—	—	48	48	—	46	46
	Tunnel clamp	30	90	120	2.5	2.5	2.5	6	62.5	61	61	60	59.5	59.5
S160	Front [1]) (long)	35	105	140	55	55	55	—	54	54	54	52	52	52
E250, S250 (except S250-PE)	Front (short) [1])	—	105	140	—	30	30	—	—	54	54	—	52	52
ZS250	Tunnel clamp	35	105	140	2.5	2.5	2.5	6	63	61	61	49.5	59.5	59.5
H125, L125, H160, L160	Front [1])	—	105	140	—	55	55	—	—	89	89	—	87	87
H250, L250, S250-PE	Tunnel clamp	—	105	140	—	2.5	2.5	4.5	—	96	96	—	59.5	59.5
E400, S400	Front (wide)	—	140	185	—	110	110	—	—	97	99	—	96	98
E630NE, S630CE, S630GE	Front (wide)	—	180	240	—	110	114	—	—	97	99	—	96	98
	Front (narrow) [1])	—	140	185	—	80	85	—	—	134	134	—	93	93
H400, L400	Tunnel clamp	—	140	185	—	3	3	4.5	—	97	97	—	93	93
	Front (wide)	—	180	240	—	110	114	—	—	134	136	—	96	98
	Tunnel clamp	—	140	185	—	3	3	4.5	—	134	134	—	93	93

Note: [1]) Not applicable when flat bars (FB) are fitted.

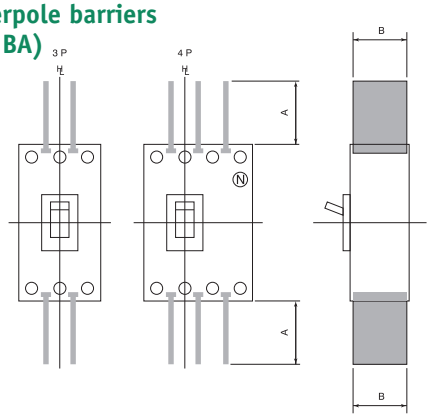
Terminal covers for rear connected and plug-in type MCCBs (T2 CR)



Dimensions (in mm)

Breaker	A		B	B[1]	C	D
	3 pole	4 pole				
E125, S125, ZS125	90	120	2	6	41.5	40.5
S160, ZS250 E250, S250 (except S250-PE)	105	140	2	6	41.5	39.5
H125, L125, H160, L160 H250, L250, S250-PE	105	140	2	6	77.5	39.5
E400, S400 H400, L400	140	185	3	4.5	97	93

Interpole barriers (T2 BA)



Dimensions (in mm)

Breaker	A	B
E125, S125	47	53
S160 E250, S250 (except S250-PE)	100	53
H125, L125, H160, L160 H250, L250, S250-PE	100	88
E400, S400, E630, S630 H400, L400	110	95

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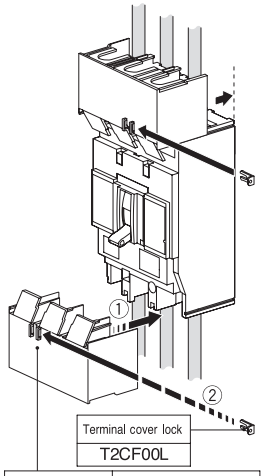
TemBreak 2 MCCB accessories

TemBreak 2 Terminal cover fitting

Terminal cover mounting procedure 125-250 A



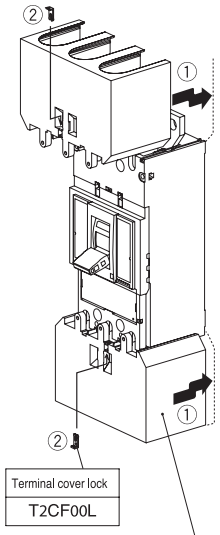
Terminal cover lock
T2CF00L

Connection	Terminal cover
Front connected (FC)	T2CF12✻S (E/S125 AF)
	T2CF25✻S (E/S250 AF)
	T2CF25✻L (H/L)
Rear /Plug-in (RC/PM)	T2CR12✻S (E/S125 AF)
	T2CR25✻S (E/S250 AF, H/L)
Solderless terminal (FC)	T2CS12✻S (E/S125 AF)
	T2CS25✻S (E/S250 AF, H/L)

✻: 2,3 or4 (Poles)

• When removing, remove the items in reverse order of mounting.

Terminal cover mounting procedure 400-630 A



Terminal cover lock
T2CF00L

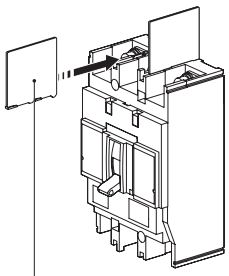
Connection	Terminal cover
FC (without Flat bar)	T2CF40* SL
FC (with Flat bar)	T2CF40* SW
RC / PM	T2CR40* S

*3 or 4 (Poles)

• When removing, remove the items in reverse order of mounting.

TemBreak 2 Interpole barriers 125-630 A

Interpole barrier mounting procedure 125-250 A

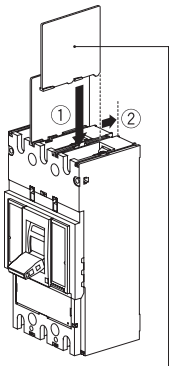


Interpole barrier
T2BA12S ✻ (E/S125 AF)
T2BA25S ✻ (E/S250 AF)
T2BA25L ✻ (H/L)

✻: 2,3 or4 (Poles)

• When removing, remove the items in reverse order of mounting.

Interpole barrier mounting procedure 400-630 A



Interpole barrier
T2BA40* S

*3 or 4 (Poles)

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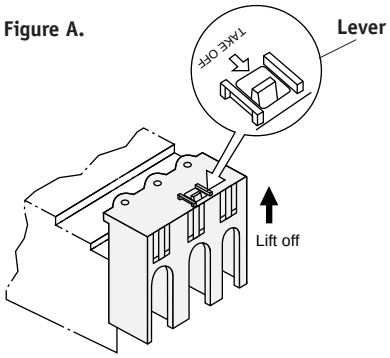
TemBreak 1 MCCB technical data
Terminal covers for front connected breakers

Terminal covers are designed to protect breaker terminals and other live parts from exposure.
Terminal covers are available for front or rear connection and plug-in types.

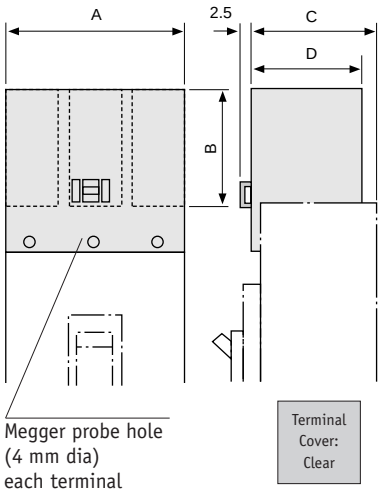
Snap-on cover
XPR type. To remove; press lever in direction of 'TAKE OFF' position (Refer to figure **A**).

Lever details

Figure A.

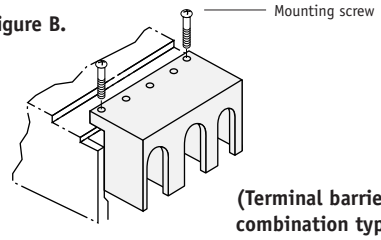


Front-connection application (TCF)



Screw-on cover
(Refer to figure **B**)
This cover screws directly onto insert nuts in the breaker cover however, insert nuts are not provided as standard on the breaker cover. Please specify if terminal cover (**TCF**) is to be used, when ordering the breaker.

Figure B.



(Terminal barrier and combination types)

Dimensions (in mm)

Frame (A)	Breaker	Cat. No.	No. of poles	A	B	C	D	Snap-on [1] cover	Cover [3] screw size	Refer fig.
125	XS125	**2H1407DAA**	3	89	40	79	78	●	—	A
	XH125, TL30F	**2H1408DAA**	4	124	40	79	78	–	—	A
160/250	XS250	**2H2135DAA**	3	104	55	81	80	●	—	A
		2H1410DAA	4	144	70	81.4	80	–	—	A
	XH160PJ,	**2H2136DAA**	3	104	55	98	97	●	—	A
	XH250NJ	**2H1412DAA**	4	144	70	98.4	97	–	M3	A
250/400	XH250PJ,	**2H1413DAB**	3	180	110	99	96	–	M3	B
	XS400, XH400	**2H1414DAB**	4	240	110	99	96	–	M3	B
	XV400	**2H1415DAB [2]**	3	145	85	99	96.5	–	M3	B
		2H1416DAB [2]	4	190	85	99	96.5	–	M3	B
630/800	XS630, XH630,	**2H1417DAB**	3	215	130	99.5 ('ON' side)	99	–		B
	XS800, XH800,					105.5 ('OFF' side)			M3	
	XV630/800	**2H1418DAB**	4	285	130	99.5 ('ON' side)	99	–		B
						105.5 ('OFF' side)			M3	
1250	XS1250	**2H1419DAB**	3	215	130	115	99	–	M3	B
	XV1250	**2H1420DAB**	4	285	130	115	99	–		B

Notes:
[1]) ● 'yes' or 'available'
– 'no' or 'not available'.
[2]) without attached busbars.
[3]) For screw-on cover.

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TemBreak 1 MCCB technical data

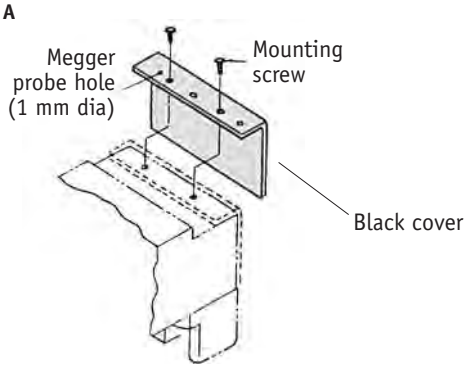
Terminal covers for rear-connect and plug-in breakers

Screw-on cover (TCR)

(Refer to figure **A**)

These covers screw directly onto insert nuts in the breaker cover however, insert nuts are not provided as standard on the breaker cover. Please specify if terminal cover (**TCR**) is to be used, when ordering the breaker.

Figure A



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Dimensions (in mm)

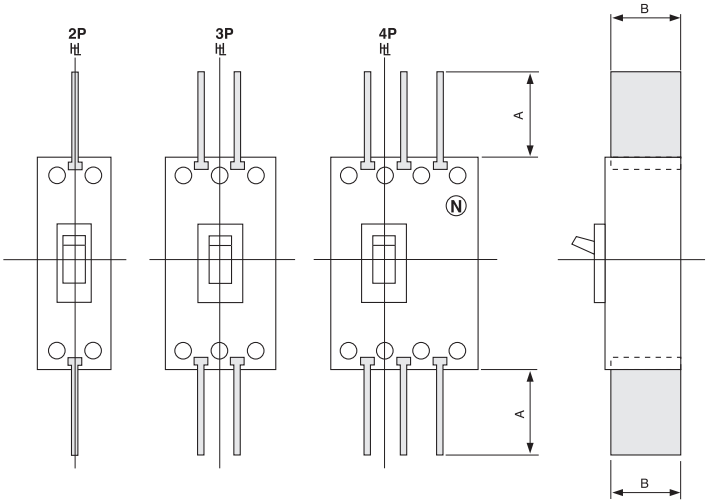
Frame (A)	Breaker	Cat. No.	No of poles	A	B	C	D	Cover screw size [3])
125	XS125, XH125	**UXPD0031A**	3	89	2	79.5	78.5	M2.6
	TL30F	**UXPD0032A**	4	119	2	79.5	78.5	M2.6
225	XE225	**2H1079CAA**	3	105	2	58	55	M2.6
160/250	XS250	**UXPD0027B**	3	104	3	81.5	80.5	M2.6
		UXPD0028B	4	139	3	81.5	80.5	M2.6
	XH160PJ	**UXPD0033B**	3	104	3	78.5	97.5	M3
	XH250NJ	**UXPD0034B**	4	139	3	78.5	97.5	M3
250/400	XH250PJ	**UXPD0011B**	3	140	3	99	98	M3
	XS/XH/XV400	**UXPD0012A**	4	185	3	99	98	M3
630/800	XS/XH/XV630	**UXPD0013B**	3	210	3	99 [1]) 105 [2])	93	M3
	XS/XH/XV800							
		UXPD0014B	4	280	3	99 [1]) 105 [2])	93	M3

Notes: [1]) ('ON' side).
[2]) ('OFF' side).
[3]) For screw-on cover.

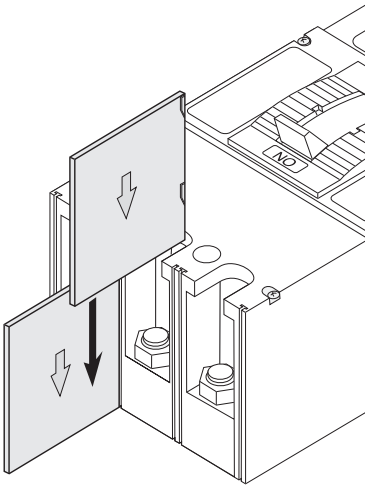
TemBreak 1 MCCB technical data
Interpole/isolation barrier

Interpole barriers completely isolate terminals to prevent accidental short-circuiting between two or more terminals.

Interpole barriers are supplied for the lineside only, as standard, with all 125 A – 1600 A MCCBs.



Colour: Black



Interpole barriers are inserted into grooves between the terminals, as shown.

Dimensions (in mm)

Frame (A)	Breaker	Barrier Cat. No.	A	B
125	XS125 [1])	**UXQH0002A**	67	77
	XH125 [1])			
160/225/250	XH160PJ	**UXQH0002A**	67	96
	XE225 [1])			
	XS250 [1])			
	XH250NJ [1])			
250/400	XH250PJ	**UXQH0004A**	110	95
	XS400			
	XH400			
	XV400			
630	XS630	**UXQH0004A**	110	95
	XH630			
	XV630			
800	XS800	**UXQH0004A**	110	95
	XH800			
	XV800			
1250	XS1250	**UXQH0004A**	110	95
	XV1250			
1600	XS1600	**UXQH0004A**	110	95

Note: [1]) The number of barriers are standard, as follows: 1 for 2 pole, 2 for 3 pole and 3 for 4 pole.

Panelboards, loadcentres and accessories

Concept busbar chassis assemblies for Din-T MCBs

- Standards AS/NZS 3439.1
- Current rating 250 A and 355 A
- Withstand rating 250 A/20 kA for 0.2 sec
- Withstand rating 355 A/25 kA for 0.3 sec
- Splayed busbar to suit 160 A and 250 A switch
- Top and bottom feed – splayed top & bottom
- Tee-offs stripped and 50 % capped
- Top power feed stripped and capped
- Full 35 mm DIN rail, improved MCB mounting security
- Improved insulation coating

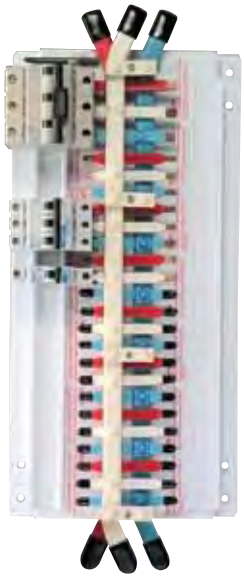
CONCEPT Din-T – 250 & 355 A to suit Din-T MCBs (18 mm pole pitch) [2])

Pole capacity	250 A Cat. No. [1])	355 A Cat. No. [1])
12	CD-2-12/18-3U	i CD-3-12/18-3U
18	CD-2-18/18-3U	i CD-3-18/18-3U
24	CD-2-24/18-3U	CD-3-24/18-3U
30	CD-2-30/18-3U	i CD-3-30/18-3U
36	CD-2-36/18-3U	CD-3-36/18-3U
42	CD-2-42/18-3U	CD-3-42/18-3U
48	CD-2-48/18-3U	CD-3-48/18-3U
54	CD-2-54/18-3U	i CD-3-54/18-3U
60	CD-2-60/18-3U	CD-3-60/18-3U
72	CD-2-72/18-3U	CD-3-72/18-3U
78	CD-2-78/18-3U	i CD-3-78/18-3U
84	CD-2-84/18-3U	CD-3-84/18-3U
96	CD-2-96/18-3U	CD-3-96/18-3U

3 pole CD chassis to suit Din-T MCBs

CONCEPT Din-T – Hybrid suits Din-T and Din-T10H MCBs (27/18 mm pole pitch)

Pole capacity 27 mm	Pole capacity 18 mm	355 A Cat. No. [1])
6	12	CDH-3-6/12-27/18-3U
6	24	CDH-3-6/24-27/18-3U
6	36	CDH-3-6/36-27/18-3U
12	30	CDH-3-12/30-27/18-3U
12	42	CDH-3-12/42-27/18-3U
12	60	CDH-3-12/60-27/18-3U



3 pole hybrid CD chassis to suit Din-T and Din-T10H MCBs

Accessories

Description	Cat. No.
Split tariff kit 250/355 A (supplied loose)	STKCD
Split tariff kit (fitted)	REFER NHP
Plastic tee-off cap 250 / 355 A	CD250TOPC

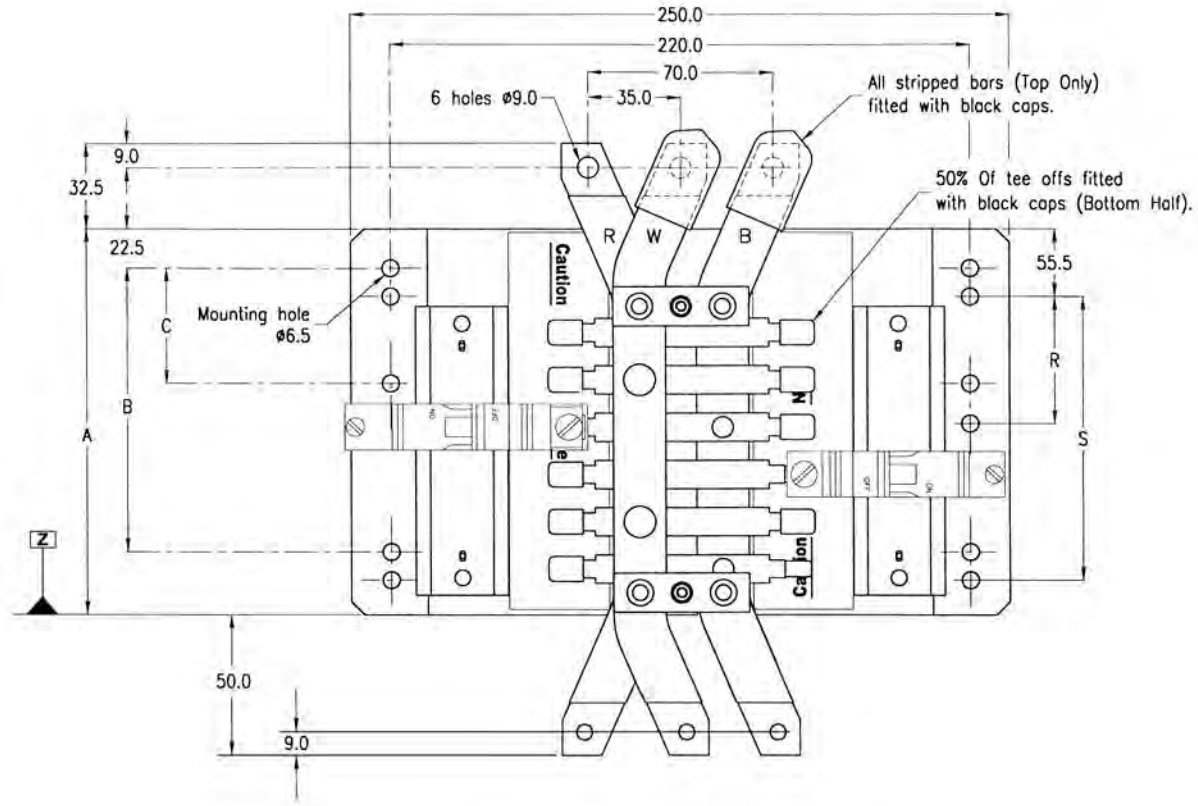
Notes: [1]) 4 pole and other special configurations available to special order refer NHP.
[2]) Not suitable for CONCEPT economy Panelboards. Contact NHP for availability.
'OFF' (line) side of MCB connects to chassis tee-off.
MCB DIN clips may be disengaged or removed when mounting onto "CD" chassis. If applicable use insulated tool provided to disengage DIN clip when removing MCB from chassis.
i Available on indent only.

Technical data	Page
Dimensions	2 - 61 to 2 - 62

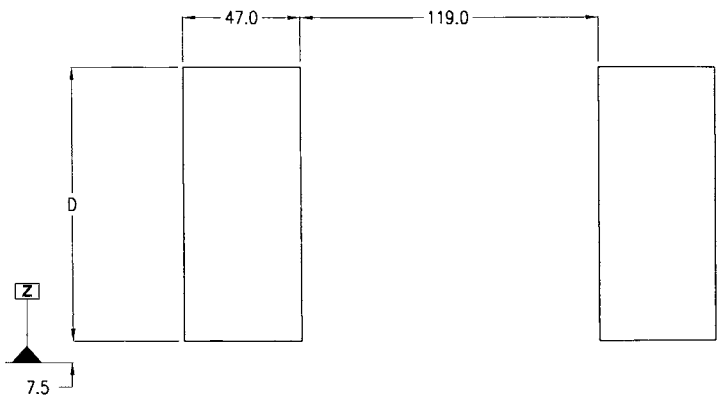
Panelboards, loadcentres and accessories

Dimensions (mm) (cont.)

CD chassis 250/355 A to suit Din-T6, 10 and 15



Escutcheon cut-out details



Dimensions (mm)

Chassis size [1])	A	B	C	D	R	S
CD-X-12/18-3U	152	100	–	110	–	100
CD-X-18/18-3U	206	100	–	164	–	100
CD-X-24/18-3U	260	100	–	218	–	100
CD-X-30/18-3U	314	200	–	272	–	200
CD-X-36/18-3U	368	300	–	326	–	300
CD-X-42/18-3U	422	300	–	380	–	300
CD-X-48/18-3U	476	400	–	434	–	400
CD-X-54/18-3U	530	400	–	488	–	400
CD-X-60/18-3U	584	500	–	542	–	500
CD-X-72/18-3U	692	600	–	650	–	600
CD-X-78/18-3U	745	700	300	704	300	700
CD-X-84/18-3U	800	700	300	758	300	700
CD-X-96/18-3U	908	800	400	866	400	800

Notes: [1]) "X" insert **2** = 250 A or **3** = 355 A, current rating does not effect above dims.
Maximum current rating of tee-off = 100 A.
'OFF' (line) side of MCB connects to chassis tee-off.
MCB DIN clips may be disengaged or removed when mounting onto "CD" chassis.
Use insulated tool provided to disengage DIN clip if removing MCB from chassis.
– **Z** = End of chassis metal pan.

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Miniature circuit breakers

The range of miniature circuit breakers stocked by NHP fall into two categories.

Safe-T range which is the NEMA style zero point extinguishing circuit breaker. This range covers 6 to 100 A in 1, 2, 3 and 4 pole configurations with a short circuit rating of 6 kA. Being a zero point extinguishing circuit breaker minimal current limiting is experienced during a short circuit. This situation in the past has been acceptable and was compensated for by designing a system to cope with the high currents.

However as systems became more detailed and sophisticated there was a need to find an alternative which would have features allowing greater control than using fuses or zero point extinguishing circuit breakers. This alternative was the Din-T range of miniature circuit breakers.

Din-T miniature circuit breakers are a current limiting type device with a wide range of short circuit capacities, current ratings and curve types to choose from. Din-T circuit breakers are available in 6, 10 and 15 kA from 0.5 to 125 A in 1, 2, 3, and 4 pole configurations.

As a brief comparison of the current limiting abilities of the Safe-T and Din-T circuit breakers, consider the graphs below.

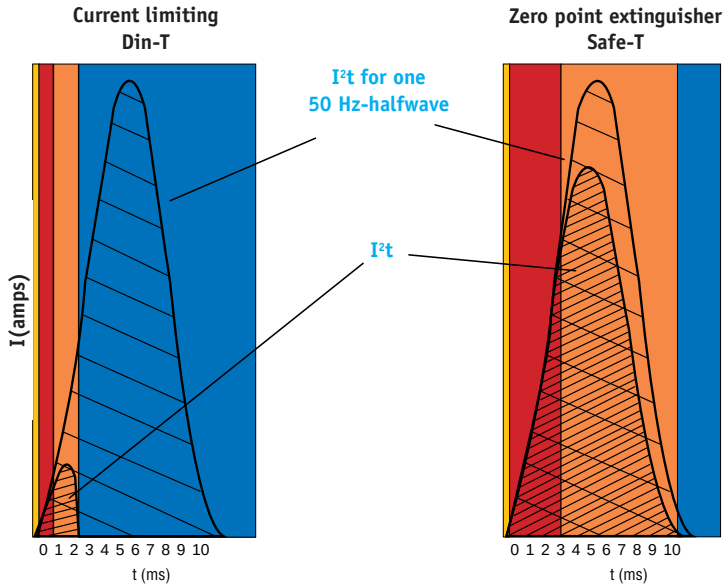
Prior to miniature circuit breakers the most common device for overcurrent and short circuit protection was a fuse.

Fuses however have major disadvantages such as:

- After overcurrent or short circuit the fuse had to be replaced. In the case of a circuit breaker a reset only is required.
- Fuses could be replaced with different current ratings quite easily to overcome apparent problems.
- During overloads in three phase systems “single phasing” can occur when just one fuse blows. Especially for motor loads, this is a great disadvantage.
- Fuses deteriorate with age.
- Fuses have higher wattage losses.

The introduction of circuit breakers brought advantages such as:

- Less downtime – quick reset.
- High circuit integrity due to different curve types and difficulty in interchanging different MCBs versus fuse cartridges.
- Increased personal safety through lower risk of contact with live parts.
- Simultaneous trip of all phases in a three phase system.
- No deterioration with age.
- Lower watts loss than a fuse.



These graphs indicate the three stages of arc formation, arc extinction and I^2t let through values.

1. Instantaneous trip time (yellow stage) indicates fault current levels just prior to magnetic trip mechanism response. (7-10 In).
2. Magnetic response time (red stage) from time of magnetic trip operation to time of arc being formed. Din-T style 1 millisecond, Safe-T style 3 milliseconds.
3. Arc extinction time (orange stage) from arc formation to complete arc extinction. Din-T style 2 milliseconds, Safe-T style 10 milliseconds.

Because total operating time of Din-T is much faster than Safe-T style MCB, the level of let-through energy in MCB is dramatically reduced. This is demonstrated by the difference in the I^2t areas detailed above.

Miniature circuit breakers (cont.)

The NHP range of miniature circuit breakers features a complete range of quality products for the protection of an electrical installation against overcurrent, short circuit and earth leakage.

The choice of miniature circuit breakers is influenced by:

(i) the magnitude of the prospective short circuit current determined by

- the size of conductors,
- the capacity of the supply transformer,
- the distance between the transformer and the short circuit point.

(ii) The required selectivity or association of the upstream circuit breaker or fuses and the downstream devices.

(iii) The earthing system and the maximum cable length.

(iv) The maximum nominal current required by the circuit.

(v) The expected initial current determined by the type of load.

(vi) The application area and the specified standard.

Din-T miniature circuit breakers can offer an application solution in every area.
Supporting the Din-T series of circuit breakers are an assortment of accessories which complete the range, they include:

- Auxiliary and alarm switches
- Earth leakage modules type Din-Safe-M
- Earth leakage circuit breakers type Din-Safe-MCB
- Earth leakage safety switches type Din-Safe
- Earth leakage relays RD series
- Surge diverters
- Time switches
- DIN rail mountable meters
- Main switches
- Changeover switches
- Impulse relays
- Hour run meters
- DIN rail mount contactors
- Pilot lights
- Pushbuttons
- Busbar combinations and lugs
- Insulated and metal enclosures
- Shunt trips
- Undervoltage trips

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Miniature circuit breakers Safe-T & Din-T

Miniature Circuit Breakers	Safe-T	DIN-T6	Din-T10
Standard [1])	AS 3111 / AS 2184	AS/NZS 60898	AS/NZS 60947-2
No. poles & module width	1P - 25 mm 2P - 50 mm 3P - 75 mm 4P - 100 mm	1P - 18 mm 2P - 36 mm 3P - 54 mm	1P - 18 mm 2P - 36 mm 3P - 54 mm 4P - 72 mm
Mounting	Clip tray	DIN rail	DIN rail
Current ratings	6 A - 100 A	2 A - 63 A	0.5 A - 63 A
Short circuit rating (kA)	6 kA	6 kA	10 kA
Curve types	General	C & D	B, C & D
Rated AC voltage 1P/2,3,4P	240/415 V	240/415 V	240/415 V
Rated DC voltage	250 V -2P 5 kA	48 V 1P 110 V 2P series	48 V 1P 110 V 2P series
Sealable in ON-Off position	No	Yes	Yes
Trip-free mechanism	Yes	Yes	Yes
Centre trip position	Yes	No	No
Padlock facility- non captive	Yes	Yes	Yes
Padlock facility- captive	Yes	Yes	Yes
Busbar connection- On-top	Fork	Pin	Pin
Busbar connection- OFF-bottom	Fork	Fork/Pin	Fork/Pin
Terminal size- On-top	-	35 mm^2	35 mm^2
Terminal size- OFF-bottom	-	35 mm^2	35 mm^2

Notes: [1]) UL listed MCB refer to NHP.

Din-Safe DSRCBH	**Din-Safe DSRCB**	**Din-Safe DSRCB-P**	**Din-Safe DSRCM**	**Din-Safe Easy-fit**
AS/NZS 61009	AS/NZS 61009	AS/NZS 61009	AS 3190	AS/NZS 61008
1P + N - 18 mm	2P - 36 mm	2P - 36 mm	1P + N, 3P & 3P + N	2P - 36 mm, 4P - 72 mm
DIN rail	DIN rail	DIN rail	DIN rail	DIN rail
6 A, 10 A, 16 A, 20 A, 25 A, 32 A & 40 A	6 A, 10 A, 16 A, 20 A, 25 A, 32 A & 40 A	6 A, 10 A, 16 A, 20 A, 25 A, 32 A & 40 A	32 A, 63 A	40 A, 63 A
10 mA & 30 mA	10 mA & 30 mA	10 mA & 30 mA	30 mA, 100 mA & 300 mA	30 mA
A	AC & A	AC & A	AC & A	AC
10 kA	10 kA	10 kA	-	Inc - 10 kA MCB or fuse backup
C	C	C	-	-
240 V	110 V/240 V	110 V/240 V	240 V/415 V	240 V/415 V
Yes	Yes	Yes	No	Yes
Yes	Yes	Yes	Yes	Yes
No	No	No	No	No
Yes	Yes	Yes	No	Yes
Yes	Yes	Yes	No	No
-	Pin	-	-	-
Fork/Pin	Fork/Pin	Fork/Pin	-	Pin
25 mm^2	25 mm^2	25 mm^2	32 A- 16 mm^2 63 A- 25 mm^2	50 mm^2
35 mm^2	35 mm^2	35 mm^2	-	50 mm^2

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Miniature circuit breakers

Din-T10 series 10 kA MCB

- Standard AS/NZS 60898 [1])
- Approval No. N17481
- Current range 0.5 - 63 Amps 1, 2, 3 and 4 pole
- Sealable and lockable handle
- Modular design
- Available in curve type B, C and D
- Mounts on NC or CD chassis

DTCB10
1 pole

1 pole 1 module

In (A)	B – Curve 3-5 In Cat. No.	C – Curve [1]) 5-10 In Cat. No.	D – Curve 10-20 In Cat. No.
0.5	-	DTCB10105C	[i] DTCB10105D
1	-	DTCB10101C	DTCB10101D
2	-	DTCB10102C	DTCB10102D
3	-	DTCB10103C	-
4	-	DTCB10104C	DTCB10104D
6	DTCB10106B	DTCB10106C	DTCB10106D
10	DTCB10110B	DTCB10110C	DTCB10110D
13	[i] DTCB10113B	[i] DTCB10113C	[i] DTCB10113D
16	DTCB10116B	DTCB10116C	DTCB10116D
20	DTCB10120B	DTCB10120C	DTCB10120D
25	DTCB10125B	DTCB10125C	DTCB10125D
32	DTCB10132B	DTCB10132C	DTCB10132D
40	DTCB10140B	DTCB10140C	DTCB10140D
50	[i] DTCB10150B	DTCB10150C	DTCB10150D
63	DTCB10163B	DTCB10163C	DTCB10163D

2 pole 2 modules

0.5	-	[i] DTCB10205C	[i] DTCB10205D
1	-	DTCB10201C	DTCB10201D
2	-	DTCB10202C	DTCB10202D
4	-	DTCB10204C	DTCB10204D
6	DTCB10206B	DTCB10206C	DTCB10206D
10	DTCB10210B	DTCB10210C	DTCB10210D
13	[i] DTCB10213B	[i] DTCB10213C	[i] DTCB10213D
16	DTCB10216B	DTCB10216C	DTCB10216D
20	DTCB10220B	DTCB10220C	DTCB10220D
25	DTCB10225B	DTCB10225C	DTCB10225D
32	DTCB10232B	DTCB10232C	DTCB10232D
40	DTCB10240B	DTCB10240C	DTCB10240D
50	[i] DTCB10250B	DTCB10250C	DTCB10250D
63	[i] DTCB10263B	DTCB10263C	DTCB10263D

Notes: [1]) A range of UL standard MCBs is available on indent. (ref DTCBUL10_ _ _ C).
[2]) 2 pole MCB connected in series.
The line side is the "OFF" (bottom) side of the MCB, and connects to NC or CD chassis tee-offs.
[i] Available on indent only.

Short circuit capacity 10 kA

In (A)	0.5 - 63
1 P	240 V AC
2 P	240/415 V AC
3 P	240/415 V AC
4 P	240/415 V AC

Use at DC

	1 P	2 P [2])
Short circuit	25 kA	30 kA
Max voltage	48 V DC	110 V DC

Accessories

Technical data

Miniature circuit breakers

Din-T10 series 10 kA MCB (cont.)

3 pole 3 modules

In (A)	B – Curve 3-5 In Cat. No.	C – Curve 5-10 In Cat. No.	D – Curve 10-20 In Cat. No.
0.5	–	DTCB10305C	[i] DTCB10305D
1	–	DTCB10301C	[i] DTCB10301D
2	–	DTCB10302C	[i] DTCB10302D
4	–	DTCB10304C	DTCB10304D
6	[i] DTCB10306B	DTCB10306C	DTCB10306D
10	DTCB10310B	DTCB10310C	DTCB10310D
13	[i] DTCB10313B	[i] DTCB10313C	[i] DTCB10313D
16	DTCB10316B	DTCB10316C	DTCB10316D
20	DTCB10320B	DTCB10320C	DTCB10320D
25	DTCB10325B	DTCB10325C	DTCB10325D
32	DTCB10332B	DTCB10332C	DTCB10332D
40	DTCB10340B	DTCB10340C	DTCB10340D
50	[i] DTCB10350B	DTCB10350C	DTCB10350D
63	DTCB10363B	DTCB10363C	DTCB10363D

4 pole 4 modules [1])

6	[i] DTCB10406B	DTCB10406C	[i] DTCB10406D
10	[i] DTCB10410B	DTCB10410C	[i] DTCB10410D
13	[i] DTCB10413B	[i] DTCB10413C	[i] DTCB10413D
16	[i] DTCB10416B	DTCB10416C	[i] DTCB10416D
20	[i] DTCB10420B	DTCB10420C	DTCB10420D
25	[i] DTCB10425B	DTCB10425C	DTCB10425D
32	[i] DTCB10432B	DTCB10432C	DTCB10432D
40	[i] DTCB10440B	DTCB10440C	[i] DTCB10440D
50	[i] DTCB10450B	DTCB10450C	[i] DTCB10450D
63	[i] DTCB10463B	DTCB10463C	[i] DTCB10463D

Accessories	Page
Add-on RCD	1 - 28 to 1 - 29
Shunt trip	1 - 36 to 1 - 38
UVT	1 - 39 to 1 - 40
Auxiliary/alarm	1 - 32 to 1 - 35
Padlock bracket	1 - 45
Link bars and terminals	1 - 44 to 1 - 45
Enclosures	Section 2
Busbar chassis	2 - 52

Technical data	Page
Technical data	Section 3
Tripping characteristics	3 - 6, 3 - 8
Dimensions	3 - 24

Notes: [1]) All poles include overcurrent and short circuit protection.
[i] Available on indent only.

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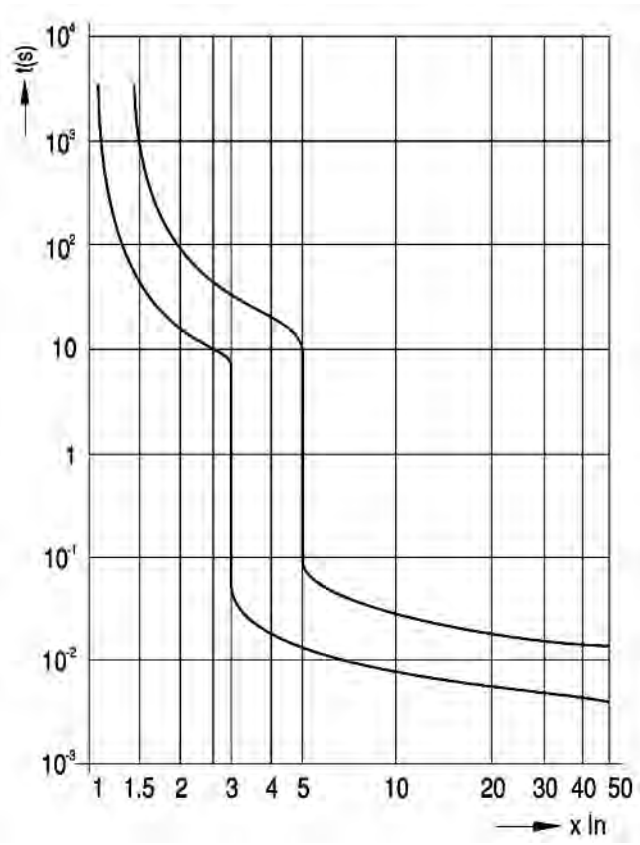
Din-T MCBs + RCDs Technical data
Tripping curves according to AS/NZS 60898

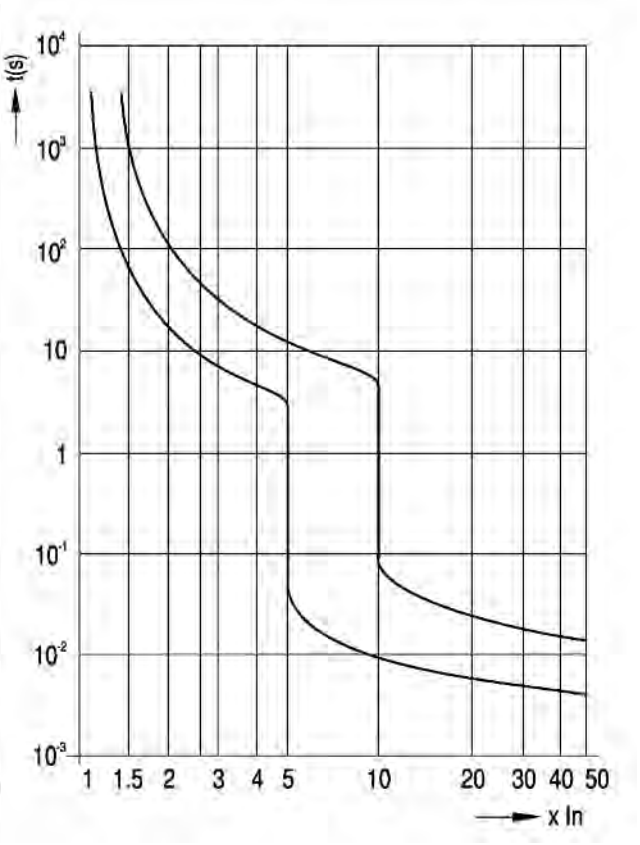
The following tables show the average tripping curves of the Terasaki Din-T MCBs based on the thermal and magnetic characteristics.

3

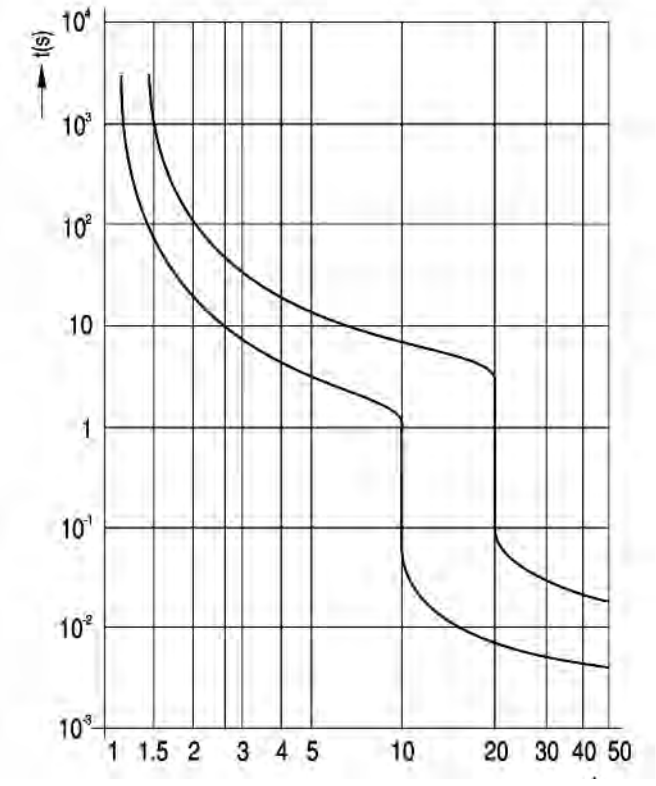
Curve B



Curve C



Curve D



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Din-T MCBs + RCDs Technical data
Definitions related to circuit breakers

MCB = Miniature Circuit Breaker

Short-circuit (making and breaking) capacity
Alternating component of the prospective current, expressed by its RMS value, which the circuit breaker is designed to make, to carry for its opening time and to break under specified conditions.

Ultimate or rated short-circuit breaking capacity (Icn - AS/NZS 60898)
A breaking capacity for which the prescribed conditions, according to a specified test sequence, do not include the capability of the MCB to carry 0.96 times its rated current for the conventional time.

Ultimate short-circuit breaking capacity (Icu - AS/NZS 60947-2)
A breaking capacity for which the prescribed conditions, according to a specified test sequence, do not include the capability of the MCB to carry its rated current for the conventional time.

Service short-circuit breaking capacity (Ics - AS/NZS 60898)
A breaking capacity for which the prescribed conditions, according to a specified test sequence, include the capability of the MCB to carry 0.96 times its rated current for the conventional time.

Prospective current
The current that would flow in the circuit, if each main current path of the MCB were replaced by a conductor of negligible impedance.

Conventional non-tripping current (Int)
A specified value of current which the circuit breaker is capable of carrying for a specified time without tripping.

Open position
The position in which the predetermined clearance between open contacts in the main circuit of the MCB is secured.

Closed position
The position in which the predetermined continuity of the main circuit of the MCB is secured.

Maximum prospective peak current (Ip)
The prospective peak current when the initiation of the current takes place at the instant which leads to the highest possible value.

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Din-T MCBs + RCDs Technical data

Influence of ambient air temperature on the rated current

3

The maximum value of the current which can flow through an MCB depends on the nominal current of the MCB, the conductor cross-section and the ambient air temperature.

The values shown in the table below are for devices in free air. For devices installed with other modular devices in the same switchboard, a correction factor (K) shall be applied relative to the mounting situation of the MCB, the ambient temperature and the number of main circuits in the installation.

No of devices	K [1])
2 or 3	0.9
4 or 5	0.8
6 or 9	0.7
> 10	0.6

Calculation example

Within a distribution board consisting of eight 2 Pole, 16 A, 'C' curve type MCBs, with an operating ambient temperature of 45 °C, which is the highest temperature the MCB can operate at without unwanted tripping?

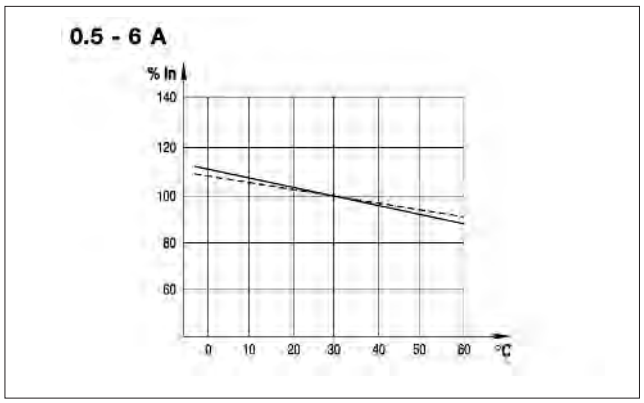
Calculation

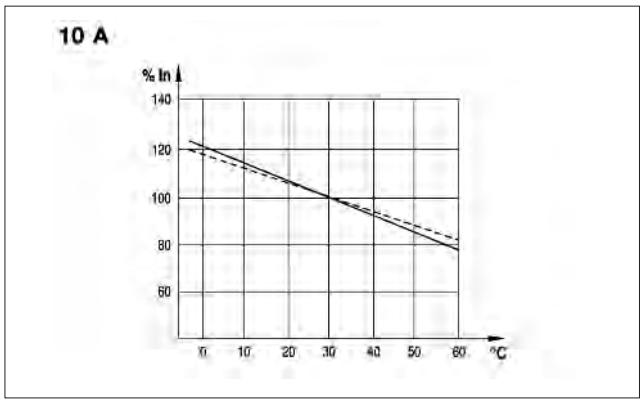
The correction factor K = 0.7, for use in an eight circuit installation: 16 A x 0.7 = 11.2 A

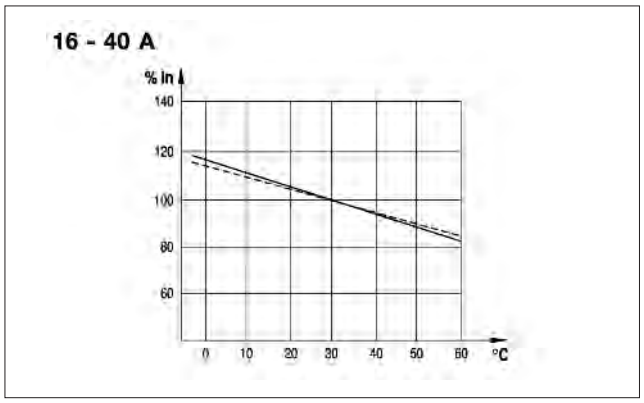
As the MCB is working at 45 °C it shall be given another factor (90 % = 0.9):
In at 45 °C = In at 30 °C x 0.9 = 11.2 A x 0.9 = 10.1 A.

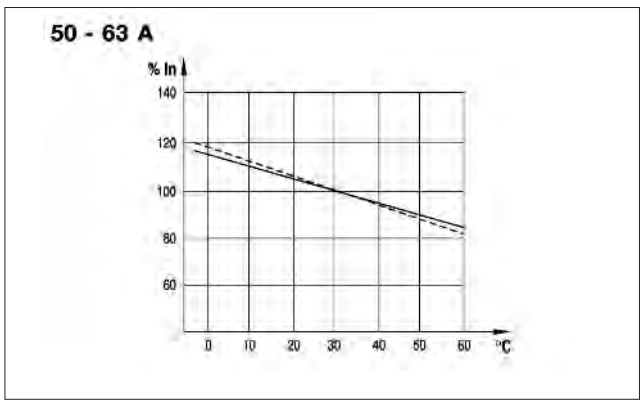
Note: [1]) Applicable for MCBs working at maximum rated currents.

The thermal calibration of the MCBs was carried out at an ambient temperature of 30 °C. Ambient temperatures different from 30 °C influence the bimetal and this results in earlier or later thermal tripping.









——— : 1P (single pole)

- - - - - - - - : mP (multi-pole)

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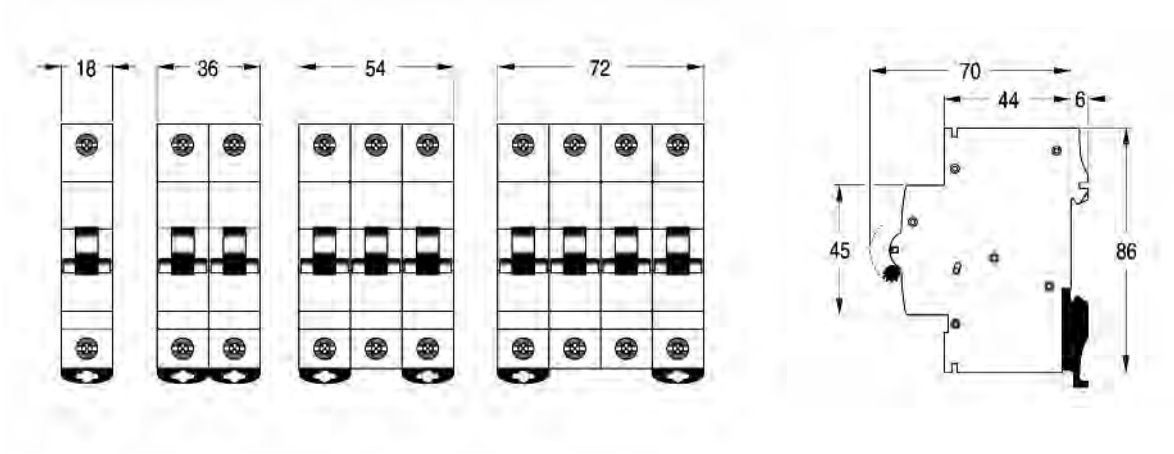
Din-T MCBs + RCDs Technical data

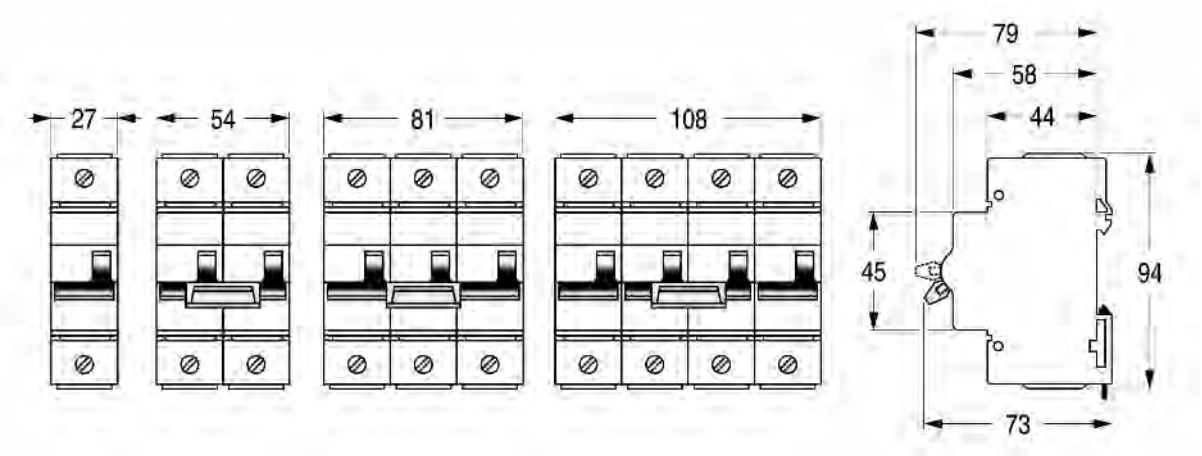
Miniature circuit breakers - Din-T 6, 10, 15 / Easy-fit

3

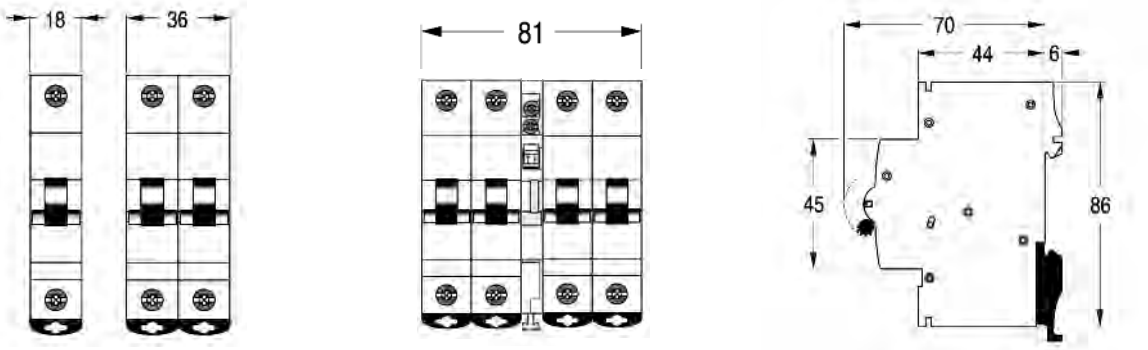
Dimensions in mm.



Miniature circuit breakers - Din-T 10H



Miniature circuit breakers - Din-T DC



Miniature circuit breakers

Din-Safe single pole width residual current circuit breaker (RCBO) 10 kA

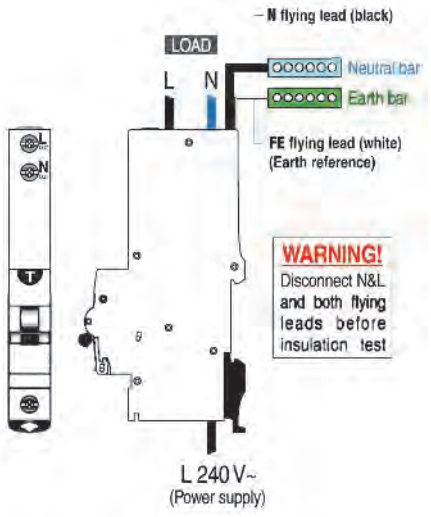
- Standards AS/NZS 61009
- Approval N17482
- One module wide (18 mm)
- Short circuit, overcurrent and earth leakage protection
- Short circuit protection, 10 kA
- Sensitivity 30 mA, 10 mA
- DIN rail mount
- Suits NC or CD chassis
- Type 'A' residual current device
- 240 V AC

Trip sensitivity	Amp rating (A)	Cat. No [1][2]
10 mA	6	i DSRCBH0610A
	10	DSRCBH1010A
	16	DSRCBH1610A
	20	DSRCBH2010A
	25	i DSRCBH2510A
	32	i DSRCBH3210A
	40	i DSRCBH4010A
30 mA	6	DSRCBH0630A
	10	DSRCBH1030A
	16	DSRCBH1630A
	20	DSRCBH2030A
	25	DSRCBH2530A
	32	DSRCBH3230A
	40	DSRCBH4030A

Application

The Din-Safe single pole width residual current circuit breaker will fit the standard Din-T chassis for use in NHP panelboards. The design makes it possible to provide an MCB complete with earth leakage protection in an 18 mm wide module, which allows a greater number of devices to be fitted into a distribution board.

Connection diagram

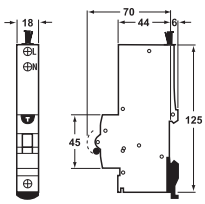


Operation

This unit combines the overload and short circuit protection of an MCB with earth leakage protection of an RCD. The unit occupies one, sub- circuit (one pole) of the distribution board and provides single phase protection against overload, short circuit and earth leakage current.

- The MCB element provides thermal and magnetic tripping protection which is rated to 6 kA prospective fault current.
- The RCD element of the device provides core-balance detection of the difference between the active and neutral currents and amplification to provide high sensitivity. The rated residual operating current (IΔn) is 30 mA.
- The white earth reference cable, in case of loss of supply neutral, ensures the device will continue to provide earth leakage protection and will operate normally upon detection of an earth leakage current.

Dimensions (mm)



Accessories	Page
Padlock bracket	1 - 45
Link bars and terminals	1 - 44 to 1 - 45
Enclosures	Section 2

Technical data	Page
Tripping characteristics	Section 3
Technical data / wiring	Section 3

Notes: [1] Neutral not switched.
[2] Will not accept Din-T side mounting accessories.
30 mA tripping characteristics: 0.5 x IΔn = no tripping, 1 x IΔn = T ≤300 mS
2 x IΔn = T ≤150 mS, 5 x IΔn = T ≤40 mS
Nuisance tripping may be experienced in VFD and motor starting applications refer NHP.
i Available on indent only.

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Miniature circuit breakers

Din-Safe-M add-on earth leakage modules

The Din-Safe-M package contains all the necessary parts to combine the earth leakage module and the Din-T MCB to form a combination MCB/RCD.

All parts required to complete this unit are supplied – including protection caps, clips and assembly instruction sheet.

Din-Safe-M module and MCB combination offer the following functions:

- Protection against earth leakage faults thus protecting against:
  - indirect contact
  - direct contact
  - fire
- Trip Sensitivities (I△n):
  - 30 mA
  - 100 mA
  - 300 mA
- Short circuit protection.
- Overload protection.

DSRCM

Operation

The combined Din-T MCB/Din-Safe-M earth leakage module has two operating toggles which indicate the reason for the trip:

– When an overload or short circuit occurs the Din-T MCB will operate. In this case the Din-Safe-M toggle will remain in the ON position.

– If an earth leakage occurs both toggles will move to the OFF position. In order to reset the MCB the Din-Safe-M unit must be reset first.

– In both instances – if the cause of the trip operation has not been rectified, a trip operation will occur as soon as the MCB is turned to the ON position. The trip free mechanism of the MCB ensures that a successful trip operation takes place even when the toggle is held in the ON position.

DSRCM + DTCB10 MCB

Test button

The built-in test facility simulates an earth fault ensuring correct operation of MCB + RCD components.

Testing is recommended monthly.

Fitting of Din-T auxiliary and alarm switches or Din-T shunt are not affected and will function as normal.

Miniature circuit breakers

Din-Safe-M add-on earth leakage modules

- Standard AS/NZS 3190
- Approval No. N11974
- Offers protection against overcurrent, earth leakage and short circuit faults when added to Din-T MCB
- Test button
- Indication of trip position
- Current ratings 32 and 63 amps

DSRCM

Din-Safe-M modules to suit Din-T6, 10 and 15 [5])

Sensitivity (mA)	MCB rating (A) [3])	No. of Poles [1])	Width Mods [2])	Dim. [4])	Cat. No.
30	32	1 P+N	2	A	DSRCM-32-30-1PN
		3 P+N	2	B	DSRCM-32-30-3PN
100	32	1 P+N	2	A	DSRCM-32-100-1PN
		3 P+N	2	B	DSRCM-32-100-3PN
300	32	1 P+N	2	A	DSRCM-32-300-1PN
		3 P+N	2	B	DSRCM-32-300-3PN
30	63	1 P+N	2	A	DSRCM-63-30-1PN
		3 P+N	3	C	DSRCM-63-30-3PN
		3 P	3	D	DSRCM-63-30-3P
100	63	1 P+N	2	A	DSRCM-63-100-1PN
		3 P+N	3	C	DSRCM-63-100-3PN
		3 P	3	D	DSRCM-63-100-3P
300	63	1 P+N	2	A	DSRCM-63-300-1PN
		3 P+N	3	C	DSRCM-63-300-3PN
		3 P	3	D	[i] DSRCM-63-300-3P

Technical data

Model	Voltage (V)
1 P + N	240/415 V AC
3 P + N	415 V AC
3 P	415 V AC

Terminal capacity

In (A)	(mm^2)
up to 32	16
63	25

Technical data	Page
Tripping characteristics	Section 3
Technical data	Section 3
Dimensions	3 - 47

DSRCM

DTCB10

After fitting

Notes:
[1]) 1 P+N and 3 P+N type supply neutral is connected by 'pigtail' cable.
[2]) Dimensions of Din-Safe-M unit only; add MCB dimensions for total installed width.
[3]) "MCB rating" refers to the max. MCB size the module can be fitted to.
[4]) A, B, C, D refers to dimensional diagrams refer page 3 - 47.
[5]) Not suitable for Din-T 10H.
[i] Available on indent only.

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Din-T MCBs + RCDs Technical data

What is an RCD?

3

The RCD (Residual Current Device) is a device intended to protect people against indirect contact, the exposed conductive parts of the installation being connected to an appropriate earth electrode. It may be used to provide protection against fire hazards due to a persistent earth fault current, without operation of the overcurrent protective device.

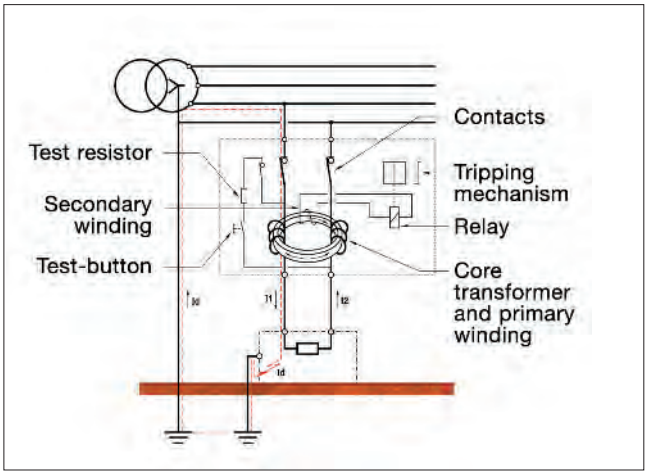
RCDs having a rated residual operating current not exceeding 30 mA are also used as a means for additional protection in case of failure of the protective means against electric shock (direct contact).

Working Principle

The main components of an RCD are the following:

- The core transformer: which detects the earth fault current.
- The relay: when an earth fault current is detected, the relay reacts by tripping and opening the contacts.
- The mechanism: element to open and close the contacts either manually or automatically.
- The contacts: to open or close the main circuit.

The RCD constantly monitors the vectorial sum of the current passing through all the conductors. In normal conditions the vectorial sum is zero (I1+I2=0) but in case of an earth fault, the vectorial sum differs from zero (I1+I2=Id), this causes the actuation of the relay and therefore the release of the main contacts.



Definitions related to RCDs

RCCB = Residual Current Circuit Breaker *without* overcurrent protection.

RCBO = Residual Current Circuit Breaker *with* overcurrent protection.

Breaking capacity

A value of AC component of a prospective current that an RCCB is capable of breaking at a stated voltage under prescribed conditions of use and behaviour.

Residual making and breaking capacity (I∆m)

A value of the AC component of a residual prospective current which an RCCB can make, carry for its opening time and break under specified conditions of use and behaviour.

Conditional residual short-circuit current (I∆c)

A value of the AC component of a prospective current which an RCCB protected by a suitable SCPD (short-circuit protective device) in series, can withstand, under specific conditions of use and behaviour.

Conditional short-circuit current (Inc)

A value of the AC component of a residual prospective current which an RCCB protected by a suitable SCPD in series, can withstand, under specific conditions of use and behaviour.

Residual short-circuit withstand current

Maximum value of the residual current for which the operation of the RCCB is ensured under specified conditions, and above which the device can undergo irreversible alterations.

Prospective current

The current that would flow in the circuit, if each main current path of the RCCB and the overcurrent protective device (if any) were replaced by a conductor of negligible impedance.

Making capacity

A value of AC component of a prospective current that an RCCB is capable to make at a stated voltage under prescribed conditions of use and behaviour.

Open position

The position in which the predetermined clearance between open contacts in the main circuit of the RCCB is secured.

Closed position

The position in which the predetermined continuity of the main circuit of the RCCB is secured.

Tripping time

The time which elapses between the instant when the residual operating current is suddenly attained and the instant of arc extinction in all poles.

Residual current (I∆n)

Vector sum of the instantaneous values of the current flowing in the main circuit of the RCCB.

Residual operating current

Value of residual current which causes the RCCB to operate under specified conditions.

Rated short-circuit capacity (Icn)

Is the value of the ultimate short-circuit breaking capacity assigned to the circuit breaker. (Only applicable to RCBO).

Conventional non-tripping current (Int)

A specified value of current which the circuit breaker is capable of carrying for a specified time without tripping. (Only applicable to RCBO).

Conventional tripping current (It)

A specified value of current which causes the circuit breaker to trip within a specified time.
(Only applicable to RCBO).

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Din-T MCBs + RCDs Technical data

RCDs classification according to AS/NZS 61008/61009

RCDs may be classified according to:

The behaviour in the presence of DC current

(types for general use).

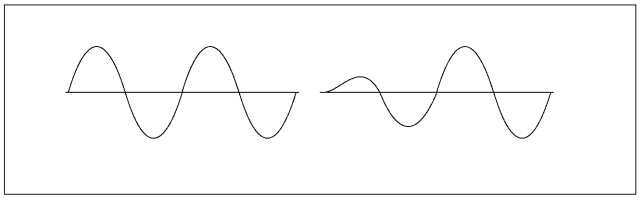
- Type AC
- Type A

The time-delay (in the presence of residual current)

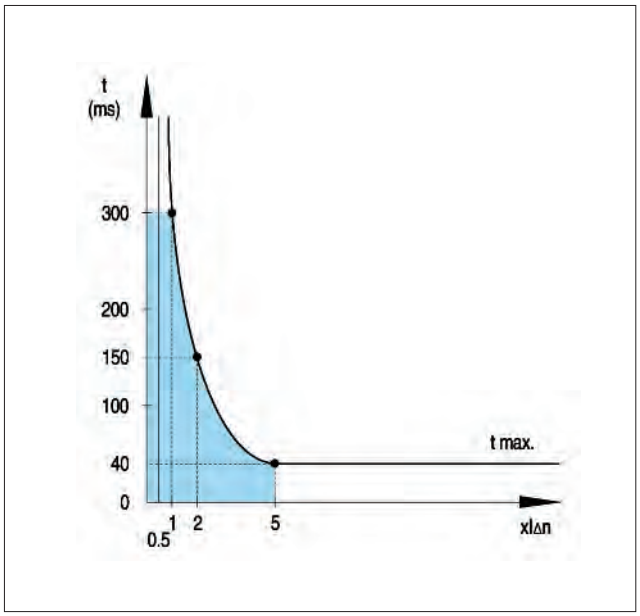
- RCDs without time delay: type for general use
- RCDs with time delay: type S for selectivity

Type AC

The type AC RCDs are designed to release with sinusoidal residual currents which occur suddenly or slowly rise in magnitude.



Residual current	Tripping time
0.5 x IΔn	t = ∞
1 x IΔn	t = <300 ms
2 x IΔn	t = <150 ms
5 x IΔn	t = ≤40 ms



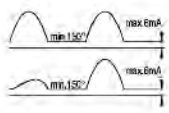
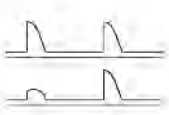
Tripping curve type AC

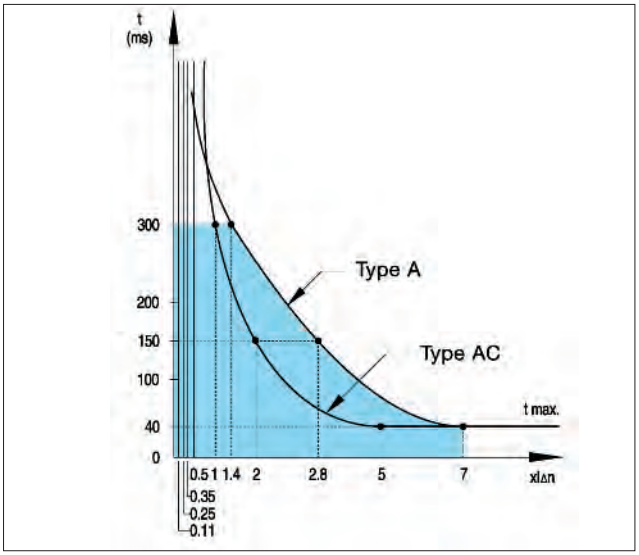
Type A

Certain devices during faults can be the source of non-sinusoidal earth leakage currents (DC components) due to the electronic components e.g. diodes, thyristors etc.

Type A RCDs are designed to ensure that under these conditions the residual current devices operate on sinusoidal residual current and also with pulsating direct current [1]) which occur suddenly or slowly rise in magnitude.

[1]) Pulsating direct current: current of pulsating wave form which assumes, in each period of the rated power frequency, the value 0 or a value not exceeding 0.006 A DC during one single interval of time, expressed in angular measure of at least

	Residual current	Tripping time
1. For sinusoidal residual current		
	0.5 x IΔn	t = ∞
	1 x IΔn	t = <300 ms
	2 x IΔn	t = <150 ms
	5 x IΔn	t = ≤40 ms
2. For residual pulsating direct current		
	At point of wave 0°	
	0.35 x IΔn	t = ∞
	1.4 x IΔn	t = <300 ms
	2.8 x IΔn	t = <150 ms
	7 x IΔn	t = ≤40 ms
	At point of wave 90°	
	0.25 x IΔn	t = ∞
	1.4 x IΔn	t = <300 ms
	2.8 x IΔn	t = <150 ms
	7 x IΔn	t = ≤40 ms
	At point of wave 135°	
	0.11 x IΔn	t = ∞
	1.4 x IΔn	t = <300 ms
	2.8 x IΔn	t = <150 ms
	7 x IΔn	t = ≤40 ms



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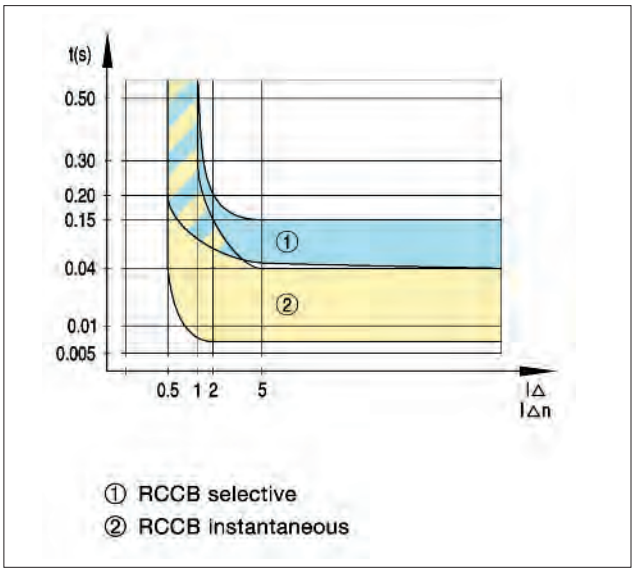
Din-T MCBs + RCDs Technical data
Selectivity

3

Type S [S] [1])

RCDs type A or AC have instantaneous tripping. In order to provide full people protection in vertical installations with more than one circuit, as well as to ensure the service in the installation in case of earth leakage in one of the circuits, or to avoid unwanted tripping because of harmonics, high connection currents due to the use of motors, reactive loads, or variable speed drives, we need to use selective RCDs at the top of the installation.

Any RCD type S is selective to any other instantaneous RCD installed downstream with lower sensitivity.



Note: [1]) DSRCD Safety switches are available as "S" types.

Type B

In the event of a fault occurring electronic devices can, in addition to AC residual currents and pulsating DC residual currents, give rise to smooth DC and AC residual currents of various frequencies which would not trip Type AC or A residual current circuit-breakers. The Type B devices respond to all types of residual currents in accordance with tripping characteristic B of IEC Standard 60755, i.e. also smooth DC residual currents. Furthermore, AC residual currents of any frequency up to 1 MHz will also be detected.

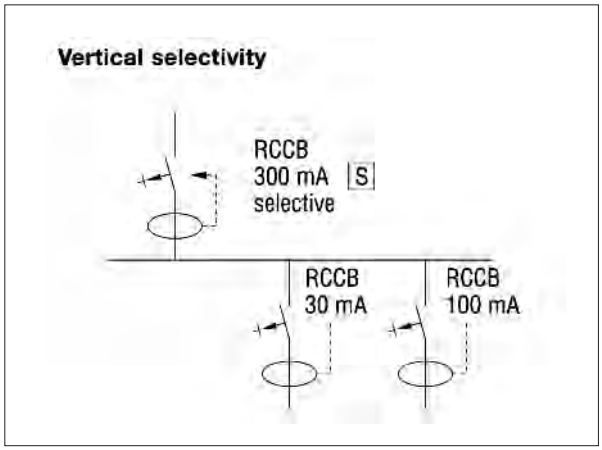
Vertical selectivity

In an installation with RCDs installed in series we need to pay special attention to the vertical selectivity, in order to ensure that in case of earth leakage only, the RCD which is immediately upstream of the fault point will operate.

Selectivity is ensured when the characteristic time/current of the upstream RCD is above the characteristic time/current of the downstream RCD. To obtain vertical selectivity we should take into consideration the following parameters:

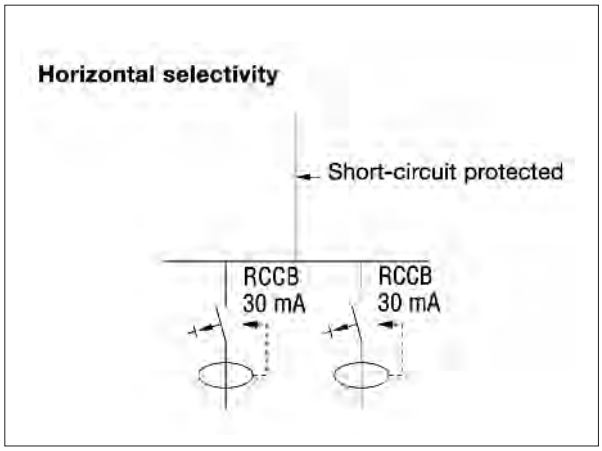
The RCD placed at the top of the installation shall be Type S. The residual operating current of the RCCB installed downstream shall have a lower residual operating current than the RCD installed upstream according to:

IΔn downstream< IΔn upstream/3



Horizontal selectivity

To have horizontal selectivity in an installation with RCDs we need to avoid the use of RCDs in cascading. Every single circuit of the installation shall be provided with an RCD of the appropriate residual operating current. The connection between the back-up protective device and the RCD must be short-circuit protected.



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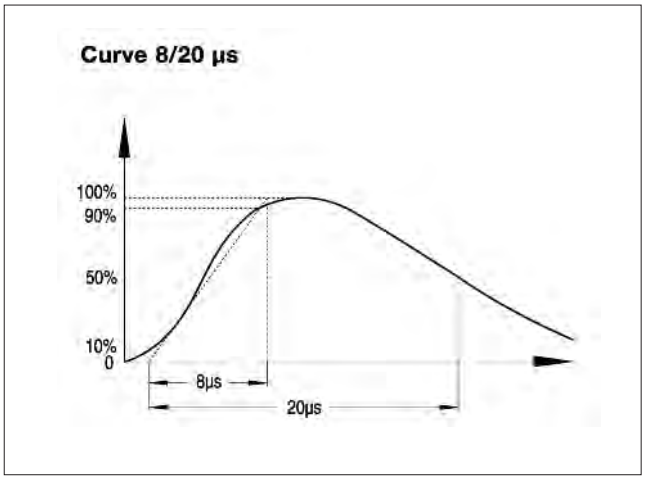
Din-T MCBs + RCDs Technical data
Nuisance tripping

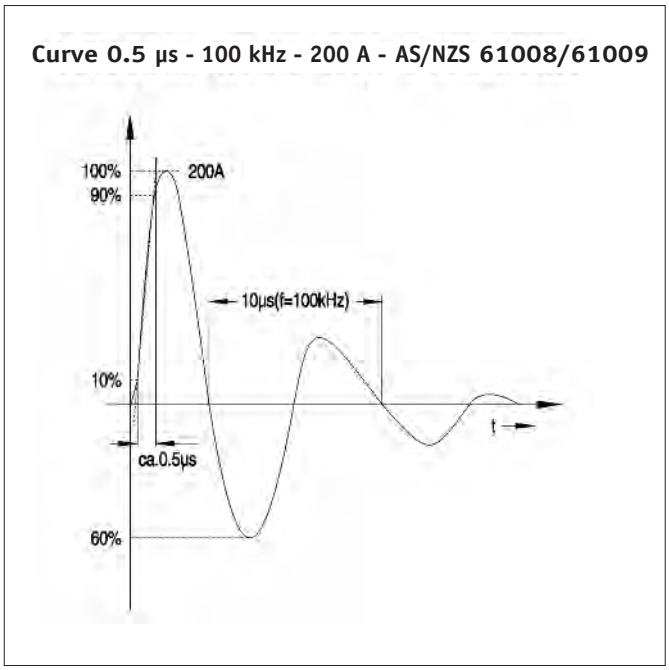
All DinSafe RCDs have a high level of immunity to transient currents, against current impulses of 8/20 µs according to AS/NZS 61008/61009.

Type A, AC.....250 A 8/20 µs

Type AI, S .....3000 A 8/20 µs



RCDs have a high level of immunity against alternating currents of high frequency 0.5 µs/ 100 kHz according to AS/NZS 61008/61009, up to 200 A.



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Din-T MCBs + RCDs Technical data
Din-Safe-M add-on earth leakage modules

Assembly

To assemble the Din-T MCB and the Din-Safe-M unit follow the steps below:

Place the MCB and Din-Safe-M unit on a flat surface. Be sure that both the MCB and the Din-Safe-M toggles are in the On position.

Slide the two units towards each other and insert the connecting link or links into the MCB tunnel terminal. Do not put any pressure onto the metal pin of the Din-Safe-M unit.

Push in the connecting clip, locking the unit together.

Check that the MCB trips when the toggle on the Din-Safe-M is moved to the OFF position.

Tighten the connections between the MCB and the Din-Safe-M and fit the insulating covers supplied.

After power is applied check unit operation with test button provided on Din-Safe-M module.

If pigtail and N are reversed, the breaker will trip as soon as load is energised.

Reset Din-Safe-M module before switching MCB 'ON'.

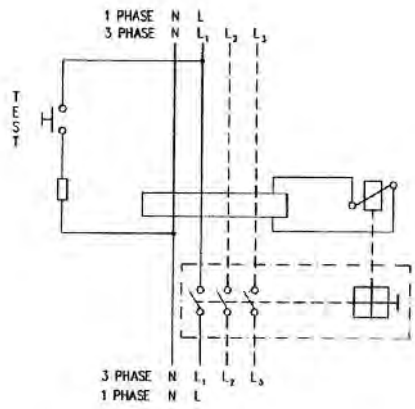
If the unit is feeding three phase load (no neutral) use 3 phase models only.

Din-Safe-M space requirements

Type	Without MCB fitted neutral not switched	MCB fitted neutral not switched	MCB fitted neutral switched
1 P + N 32/63 A	2 modules (36 mm)[1])	3 modules (54 mm)	4 modules (72 mm)
3 P + N 32 A	2 modules (36 mm)[1])	5 modules (90 mm)	6 modules (108 mm)
3 P + N 63 A	3 modules (54 mm)[2])	6 modules (108 mm)	7 modules (126 mm)
3 P 63 A	3 modules (54 mm)[2])	6 modules (108 mm)	N/A

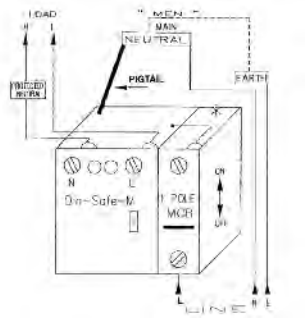
Connection diagram

1 PHASE N L and 3 PHASE N L_1 L_2 L_3

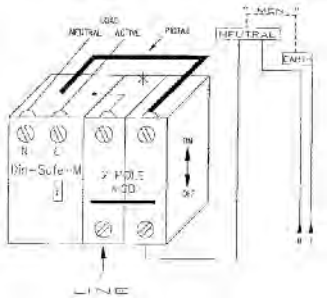


Notes: [1]) Refer diagrams A, B & C on Page 3 - 47.
[2]) Refer diagram D on Page 3 - 47.

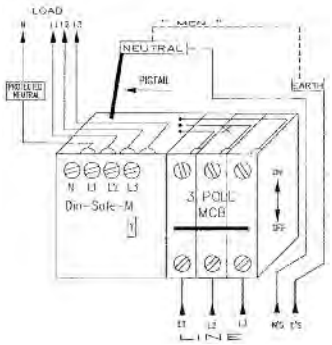
Din-Safe-M 1P + N with 1 pole MCB (Neutral not switched)



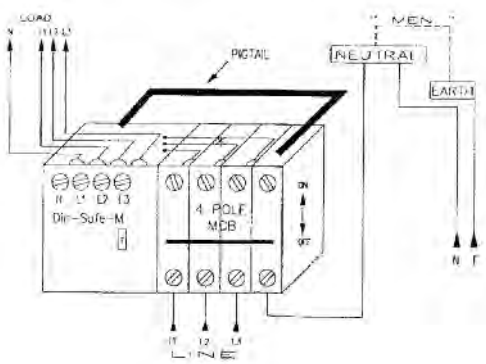
Din-Safe-M 1P + N with 2 pole MCB (Switching active + neutral)



Din-Safe-M 3P + N with 3 pole MCB (Neutral not switching)



Din-Safe-M 3P + N with 4 pole MCB (Switching active + neutral)



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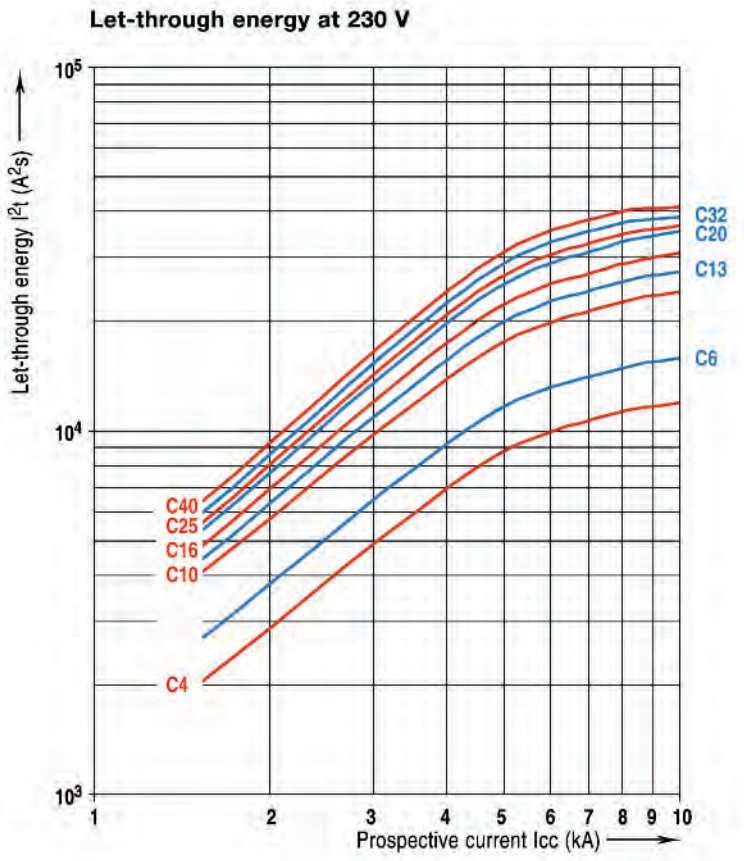
Din-T MCBs + RCDs Technical data

RCBO (DSRCB) let-through energy I^2t

The benefit of an RCBO in short-circuit conditions, is its ability to reduce the value of the let-through energy that the short-circuit would be generating.

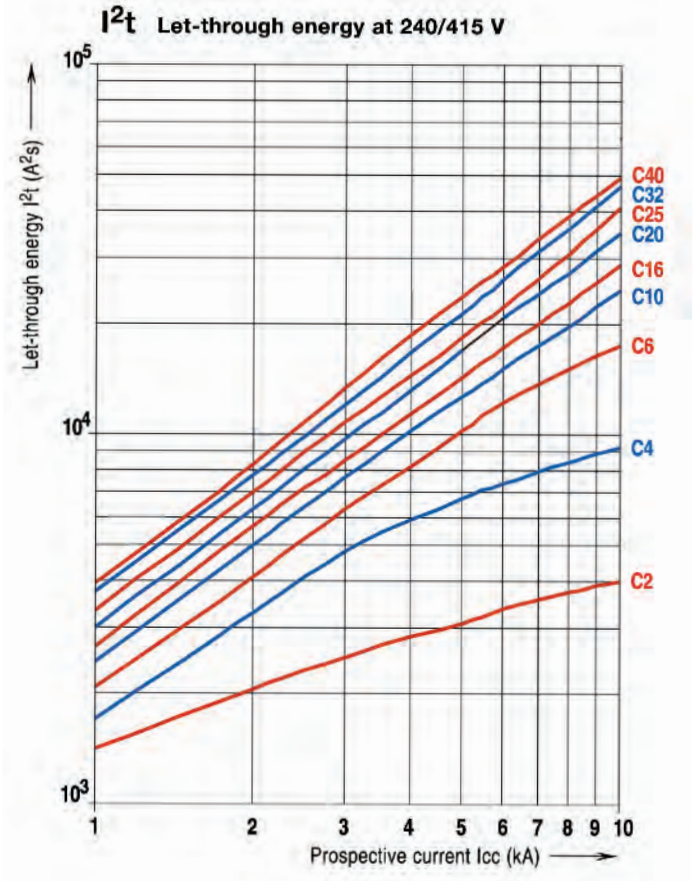
Din-Safe DSRCB

Curve C



Din-T single pole width RCD (DSRCBH)

Curve C



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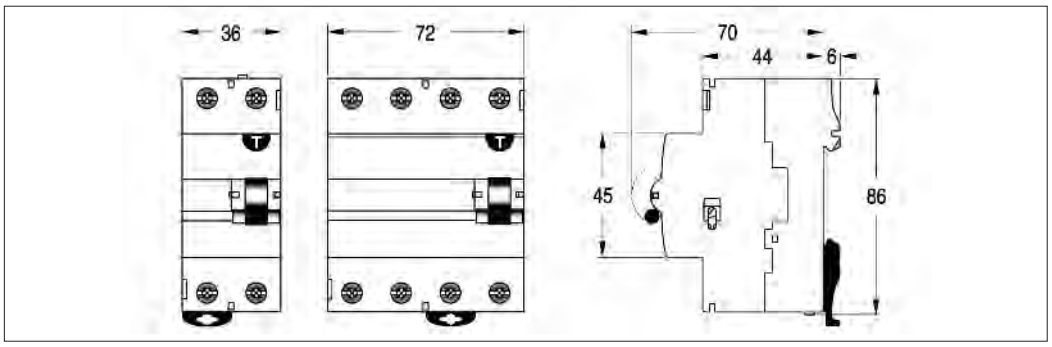
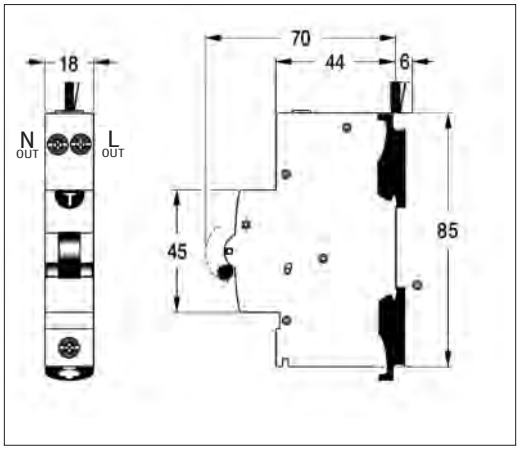
Din-T MCBs + RCDs Technical data

RCCB - Din-Safe safety switch (DSRCD)

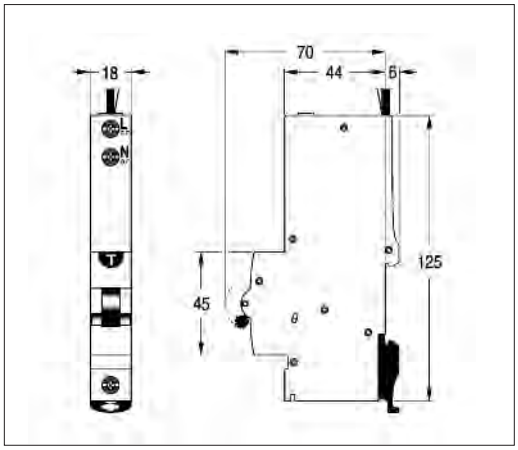
Dimensions in mm



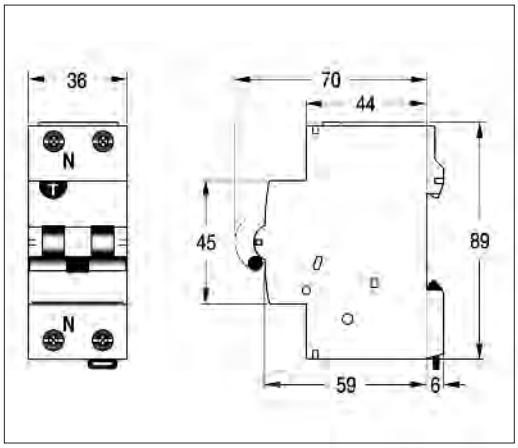
RCBO - Din-Safe (DSRCBS)



RCBO - Din-Safe (DSRCBH)



RCBO - Din-Safe (DSRCB)



Din-Safe-M clip-on earth leakage module (DSRCM)

Diagram (A)

1 P+N

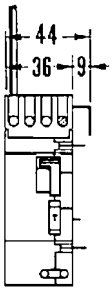


Diagram (B)

3 P+N

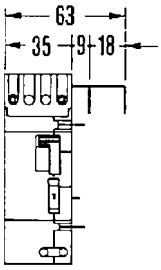


Diagram (C)

3 P+N

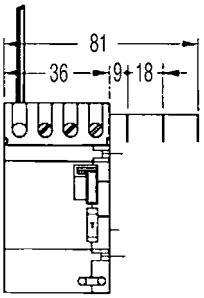
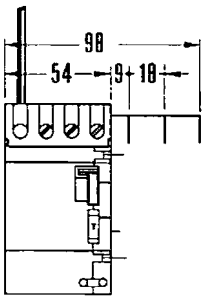


Diagram (D)

3 P



Note: **(A), (B), (C) and (D),** refer to earth leakage modules shown on pages 1 - 29 and 3 - 38.

3.2 CONTROL DEVICES & FUSES

- CARLO GAVAZZI – **DAA-01-D-M24** Delay On Timer
- CARLO GAVAZZI – **DPA-01-C-M44** Phase Failure Relay

- FINDER – **55.34.0074 24VDC + 94.04 Base** Relay

- NHP – **NV32FW** 32A Fuse Holder
- NHP – **NNS4** Fuse Link

A further step in Carlo Gavazzi's timer range

When simplicity meets quality and flexibility, the result is Carlo Gavazzi's line of timers!

All of the most important functions, such as delay on operate, delay on release, interval, recycler and star-delta are available in this comprehensive range. All of the timers operate on multiple supply voltages up to 240VAC, and provide up to two relay outputs.

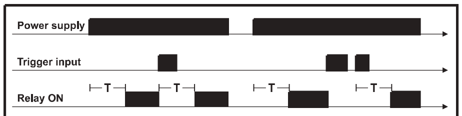
- **17.5 mm housing for DIN-rail**
- **Multivoltage power supply**
- **DIN-rail mount and plug-in housings**
- **Three housings, same functions**

- **Time setting from 0.1s to 100h**

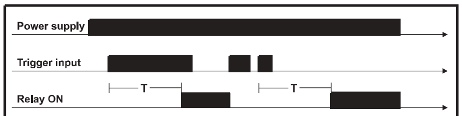
	Delay on operate		**Multifunction**		**Asymmetrical recycler**	
Mini-D Housing		DAA51CM24 Function: O 1 relay output Power supply: 24 VDC and 24 to 240 VAC		DMB51CM24 DMB51CW24 Functions: Op, In, Id, Io, Dr, R, Rb 1 relay output Power supply: 24VDC & 24-240 VAC or 12 to 240 VAC/DC		DCB51CM24 Functions: Aa, Ab 1 relay output Power supply: 24 VDC and 24 to 240 VAC
D-Housing		DAA01CM24 DAA01DM24 Function: O 1 or 2 relays output Power supply: 24 VDC and 24 to 240 VAC		DMB01CM24 DMB01DM24 Functions: Op, In, Id, Io, Dr, R, Rb 1 or 2 relays output Power supply: 24VDC & 24-240 VAC		DCB01CM24 DCB01DM24 Functions: Aa, Ab, Sh, Dt 1 or 2 relays output Power supply: 24 VDC and 24 to 240 VAC
P-Housing		PAA01CM24 PAA01DM24 Function: O 1 or 2 relays output Power supply: 24 VDC and 24 to 240 VAC		PMB01CM24 PMB01DM24 Functions: Op, In, Id, Io, Dr, R, Rb 1 or 2 relays output Power supply: 24VDC & 24-240 VAC		PCB01CM24 PCB01DM24 Functions: Aa, Ab, Sh, Dt 1 or 2 relays output Power supply: 24 VDC and 24 to 240 VAC

Flexible functionality responds to your every timing need

Delay on operate - automatic start O

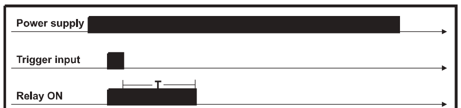


Delay on operate - automatic and manual start Oa



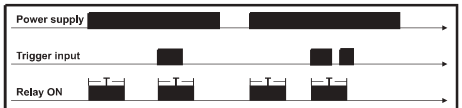
Delay on operate - manual start Op

One shot Sh

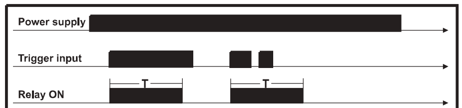


Delay on release Dr

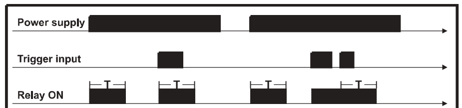
True delay on release Tr



Interval - automatic and manual start with no time reset Na



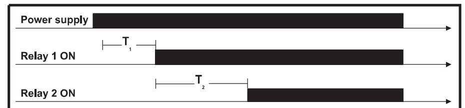
Interval - manual start with no time reset Nr



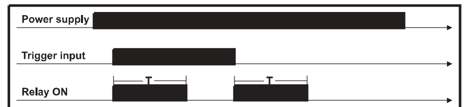
Interval - automatic and manual start Ia

Interval - manual start In

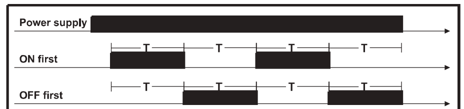
Interval on trigger open Io



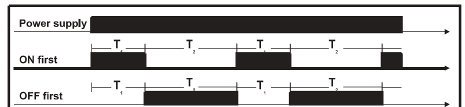
Double delay on operate Dt



Double interval Id



Symmetrical recycler R - Rb



Asymmetrical recycler Aa - Ab

Star delta SD

Star-delta

DAC51CM24

Function: SD
Power supply: 24 to 240 VAC/DC

DAC01CM24
DAC01CM40

Function: SD
Power supply: 24 to 240 VAC/DC, 380 to 415 VAC

PAC01CM24
PAC01CM40

Function: SD
Power supply: 24 VDC and 24 to 240 VAC, 380 to 415 VAC

True delay on release

DBB51CM2410S
DBB51CM241M
DBB51CM2410M

Function: Tr
1 relay output
Power supply: 24 VDC and 24 to 240 VAC

DBB01CM24
DBB01DM24
DBB02CM24
DBB02DM24

Function: Tr
1 or 2 relays output
Power supply: 24 VDC and 24 to 240 VAC

PBB01CM24
PBB01DM24
PBB02CM24
PBB02DM24

Function: Tr
1 or 2 relays output
Power supply: 24 VDC and 24 to 240 VAC

All-in-one systems


DMC01C724 DMC01D724
DMC01CB48 DMC01DB48
DMC01CB23 DMC01DB23

Functions: Op, Oa, In, Ia, Nr, Na, Dr - NPN, PNP and Namur sensor input and supply
1 or 2 relays output

PMC01C724 PMC01D724
PMC01C024 PMC01D024
PMC01C115 PMC01D115
PMC01C230 PMC01D230

Functions: Op, Oa, In, Ia, Nr, Na, Dr - NPN, PNP and Namur sensor input and supply
1 or 2 relays output

Typical Timing Applications

Food/Feed Dispensing

DCB01, PCB01 and DCB51 can provide food or feed (ie for fish, cattle, etc.) across a predetermined period of time.

Signaling Alarms

DMB51 can provide a flashing red light to signal an alarm condition (ie for fume or smoke detection in a tunnel).

Compressors

DAA01 and PAA01 for starting several compressors, thus avoiding high and dangerous inrush current.

Bell Activation

DMC and PMC01 can be used to obtain a fixed activation time for a bell or buzzer if an object activates or deactivates a sensor.

Contrlling a Fan

DBB together with a current relay (such as DIB01), to switch on an extractor fan if a machine is on and to switch it off for a fixed period of time after the last machine has turned off.

Tanning Beds

Interval timing of DMB01 and PMB01 are used in tanning beds to prevent health problems due to mechanical timer failure.

Inductive Proximity • Capacitive Proximity • Magnetic Switches • Photoelectric • Level Controls • Limit Switches • Current Monitors Voltage Monitors • Panel Meters • Phase Monitors • Timers • PID Controllers • Energy Management • Solid State Relays Electromechanical Relays • Motor Controllers • Pushbuttons • Switches • Pilot Devices • Rotary Disconnects • Cam Switches

A Global Force in Industrial Automation

CARLO GAVAZZI has a multitude of sales offices spanning North America *(not to mention our hundreds of distributors)*. Therefore, we can be viewed as "your local automation resource", assisting you every step of the way in finding the proper solution for your various application requirements.

Naturally, our job is greatly simplified as we have such a vast range of solutions to offer via our comprehensive product ‘package’ — and what better way to install those products than in one of our new enclosures, modular cabinets or freestanding consoles.

Our worldwide sales offices make us an ideal business partner, *especially* for manufacturers of exported machinery, as our products are available locally and they are CE marked.

Timer Brochure 4/02

Your Authorized Distributor:

Monitoring Relays
3-Phase Sequence and Phase Loss
Types DPA01, PPA01

CARLO GAVAZZI


DPA01


PPA01

- 3-phase monitoring relays for phase sequence and phase loss
- Detect when all 3 phases are present and have the correct sequence
- Measure their own power supply
- Power supply range: 208 to 690 VAC (+10 -15%)
- Output: 8 A SPDT relay or 8 A DPDT normally energized
- For mounting on DIN-rail in accordance with DIN/EN 50 022 (DPA01) or plug-in module (PPA01)
- 22.5 mm Euronorm housing (DPA01) or 36 mm plug-in module (PPA01)
- LED indication for relay and power supply ON

Product Description

3-phase relay for detection of incorrect phase sequence, total and partial phase loss. Supply range from 208 to 690 VAC covered by two multi-voltage relays.

For mounting on DIN-rail or plug-in module. The device detects regenerated voltages up to 85% of the nominal voltage (phase-phase).

Ordering Key

DPA 01 C M44

- **Housing**
- **Function**
- **Type**
- **Item number**
- **Output**
- **Power supply**

Type Selection

Mounting	Output	208 to 480 VAC	208 to 240 VAC	380 to 480 VAC	380 to 600 VAC	600 to 690 VAC
DIN-rail	SPDT	**DPA 01 C M44**			**DPA 01 C M60**	**DPA 01 C M69**
DIN-rail	DPDT		**DPA 01 D M23**	**DPA 01 D M48**		

Mounting	Output	208 to 415 VAC	208 to 240 VAC	380 to 415 VAC
Plug-in	SPDT	**PPA 01 C M44**		
Plug-in	DPDT		**PPA 01 D M23**	**PPA 01 D M48**

Input Specifications

Input	
L1, L2, L3	DPA01: Terminals L1, L2, L3 PPA01: Terminals 5, 6, 7 Measure their own supply
Measuring ranges	
208 to 480 VAC (DPA01CM44)	177 to 550 VAC
380 to 600 VAC (DPA01CM60)	323 to 690 VAC
600 to 690 VAC (DPA01CM69)	510 to 760 VAC
208 to 415 VAC (PPA01CM44)	177 to 475 VAC
208 to 240 VAC (DPA01DM23)	177 to 275 VAC
380 to 480 VAC (DPA01DM48)	323 to 550 VAC
208 to 240 VAC (PPA01DM23)	177 to 275 VAC
380 to 415 VAC (PPA01DM48)	323 to 475 VAC
ON-level	> 85% of the mains phase-phase voltage

Output Specifications

Output		SPDT or DPDT relay, N.E.
Rated insulation voltage		250 VAC
Contact ratings ($AgSnO_2$)		µ
DPA01C, PPA01C (SPDT):		
Resistive loads	AC 1	8 A @ 250 VAC
	DC 12	5 A @ 24 VDC
Small inductive loads	AC 15	2.5 A @ 250 VAC
	DC 13	2.5 A @ 24 VDC
DPA01D, PPA01D (DPDT):		
Resistive loads	AC 1	8 A @ 250 VAC
Small inductive loads	AC 15	3 A @ 250 VAC
	DC 13	2 A @ 24 VDC
Mechanical life		≥ 30 x 10^6 operations
Electrical life		≥ 10^5 operations (at 8 A, 250 V, cos φ = 1)
Operating frequency		≤ 7200 operations/h
Dielectric strength		
Dielectric voltage		≥ 2 kVAC (rms)
Rated impulse withstand volt.		4 kV (1.2/50 µs)

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Supply Specifications

Power supply	Overvoltage cat. III
Rated operational voltage through terminals:	(IEC 60664, IEC 60038)
(DPA01)	L1, L2, L3
(PPA01)	5, 6, 7
DPA01CM44	208 to 480 VAC ± 15%, 45 to 65 Hz
DPA01CM60	380 to 600 VAC±15%, 45 to 65 Hz
PPA01CM44	208 to 415 VAC ± 15%, 45 to 65 Hz
DPA01CM69	600 to 690 VAC +10 -15%, 45 to 65 Hz
DPA01DM23	208 to 240 VAC ± 15%, 45 to 65 Hz
DPA01DM48	380 to 480 VAC ± 15%, 45 to 65 Hz
PPA01DM23	208 to 240 VAC ± 15%, 45 to 65 Hz
PPA01DM48	380 to 415 VAC ± 15%, 45 to 65 Hz
Rated operational power	
M23	6 VA @ 230 VAC, 50 Hz
M44, M48	10 VA @ 400 VAC, 50 Hz
M60	15VA @ 600 VAC, 50Hz
M69	15VA @ 690 VAC, 50Hz
	Supplied by L2 and L3

General Specifications

Reaction time		
Alarm ON delay		< 100 ms
Alarm OFF delay		< 350 ms
Accuracy		(15 min warm-up time)
Temperature drift		± 1000 ppm/°C
Repeatability		± 0.5%
Indication for		
Power supply ON		LED, green
Relay ON		LED, yellow
Environment		(EN 60529)
Degree of protection		IP 20
Pollution degree		3 (DPA01), 2 (PPA01)
Operating temperature		
@ Max. voltage, 50 Hz		-20 to +60°C, R.H. < 95%
@ Max. voltage, 60 Hz		-20 to +50°C, R.H. < 95%
Storage temperature		-30 to +80°C, R.H. < 95%
Housing		
Dimensions	DPA01	22.5 x 80 x 99.5 mm
	PPA01	36 x 80 x 94 mm
Material		PA66 or Noryl
Weight		Approx. 100 g
Screw terminals		(DPA01)
Tightening torque		Max. 0.5 Nm acc. to IEC 60947
Product standard		EN 60947-5-1
Approval		UL - CSA (except PPA01D, DPA01CM69), CCC (GB14048.5) only DPA
CE Marking		L.V. Directive 2006/95/EC EMC Directive 2004/108/EC
EMC		
Immunity		According to EN 61000-6-2
Emissions		According to EN 61000-6-3

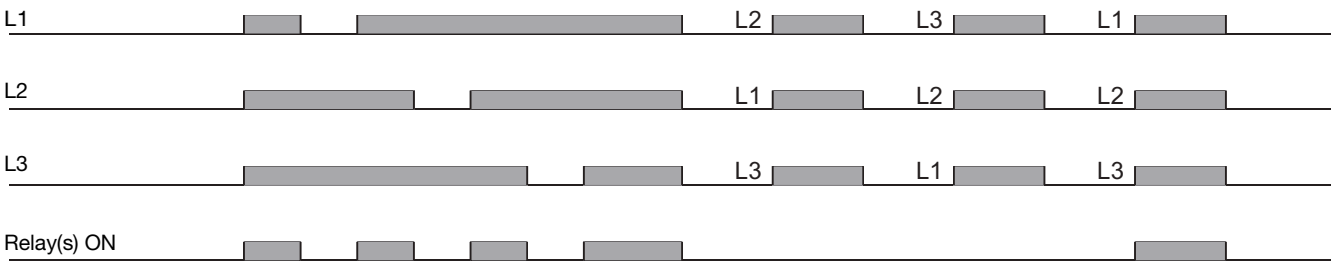
Mode of Operation

DPA01 and PPA01 monitor their own 3-phase power supply. The relay operates when all the phases are present and the phase sequence is correct. The relay releases when one phase-phase voltage drops below 85% of the other phase-phase voltages.

Example 1
The relay monitors that the power supply has the correct phase sequence and that all phase voltages are present.

Example 2
The relay releases in case of interruption of one or more phases, provided that the regenerated voltage does not exceed 85% of the phase-phase voltage.

Operation Diagram

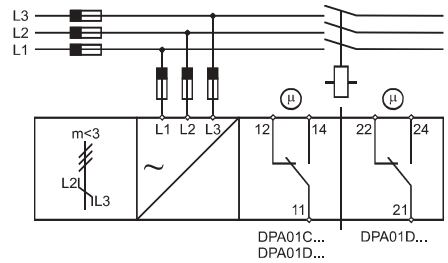


DPA01, PPA01

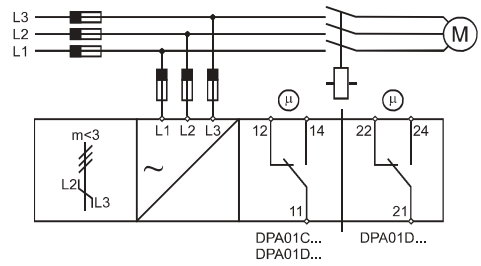
CARLO GAVAZZI

Wiring Diagrams

Example 1

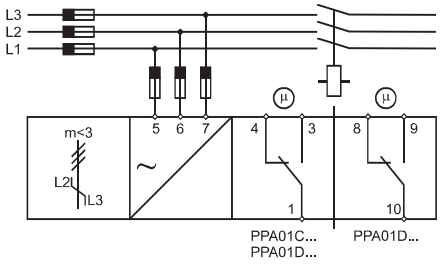


Example 2

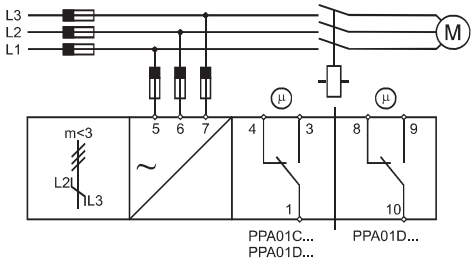


DPA01

Example 1



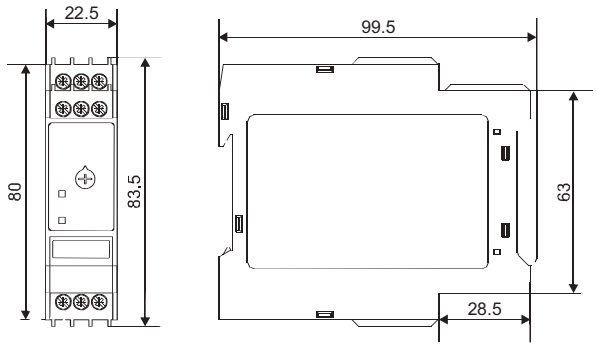
Example 2



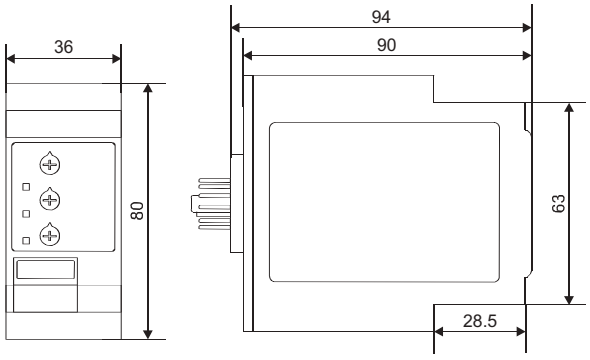
PPA01

Dimensions

DIN-rail



Plug-in



finder

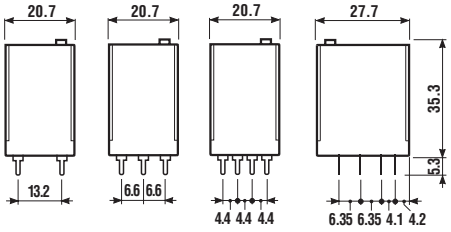
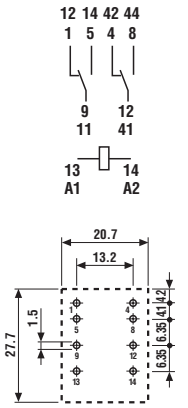
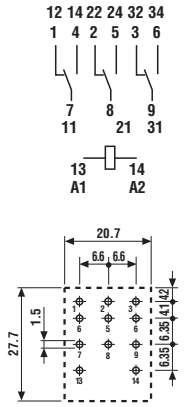
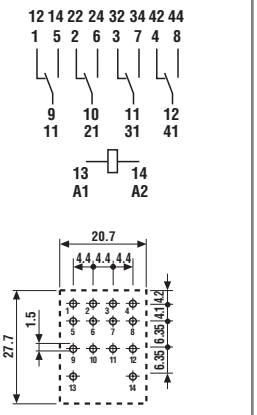
55 Series - General purpose relays 7 - 10 A

Features

Printed circuit mount, general purpose
2, 3 & 4 Pole relays

55.12 - 2 Pole 10 A
55.13 - 3 Pole 10 A
55.14 - 4 Pole 7 A

- AC coils & DC coils
- Cadmium Free contacts (preferred version)
- Contact material options
- RT III (wash tight) option available

	55.12	55.13	55.14
			
	• 2 pole, 10 A • PCB mount	• 3 pole, 10 A • PCB mount	• 4 pole, 7 A • PCB mount
	 55.12 55.13 55.14	 Copper side view	 Copper side view	 Copper side view
For UL Horsepower and Pilot Duty ratings See "General technical information" page V			
Contact specification			
Contact configuration	2 CO (DPDT)	3 CO (3PDT)	4 CO (4PDT)
Rated current/Maximum peak current A	10/20	10/20	7/15
Rated voltage/Maximum switching voltage V AC	250/400	250/400	250/250
Rated load AC1 VA	2,500	2,500	1,750
Rated load AC15 (230 V AC) VA	500	500	350
Single phase motor rating (230 V AC) kW	0.37	0.37	0.125
Breaking capacity DC1: 30/110/220V A	10/0.25/0.12	10/0.25/0.12	7/0.25/0.12
Minimum switching load mW (V/mA)	300 (5/5)	300 (5/5)	300 (5/5)
Standard contact material	AgNi	AgNi	AgNi
Coil specification			
Nominal voltage (U_N) V AC (50/60 Hz)	6 - 12 - 24 - 48 - 60 - 110 - 120 - 230 - 240		
V DC	6 - 12 - 24 - 48 - 60 - 110 -125 - 220		
Rated power AC/DC VA (50 Hz)/W	1.5/1	1.5/1	1.5/1
Operating range AC	(0.8...1.1)U_N	(0.8...1.1)U_N	(0.8...1.1)U_N
DC	(0.8...1.1)U_N	(0.8...1.1)U_N	(0.8...1.1)U_N
Holding voltage AC/DC	0.8 U_N/0.5 U_N	0.8 U_N/0.5 U_N	0.8 U_N/0.5 U_N
Must drop-out voltage AC/DC	0.2 U_N/0.1 U_N	0.2 U_N/0.1 U_N	0.2 U_N/0.1 U_N
Technical data			
Mechanical life AC/DC cycles	$20 \cdot 10^6$/$50 \cdot 10^6$	$20 \cdot 10^6$/$50 \cdot 10^6$	$20 \cdot 10^6$/$50 \cdot 10^6$
Electrical life at rated load AC1 cycles	$200 \cdot 10^3$	$200 \cdot 10^3$	$150 \cdot 10^3$
Operate/release time ms	9/3	9/3	9/3
Insulation between coil and contacts (1.2/50 µs) kV	4	4	4
Dielectric strength between open contacts V AC	1,000	1,000	1,000
Ambient temperature range °C	–40...+85	–40...+85	–40...+85
Environmental protection	RT I	RT I	RT I
Approvals (according to type)	CE ABS ANCE SP D FI PG LR Lloyd's Register N RINA S cULus NF VDE		

finder

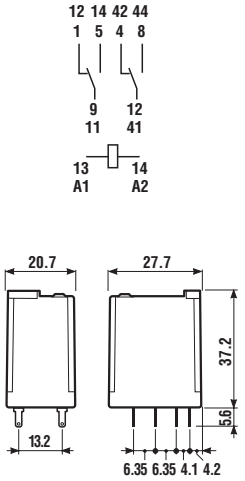
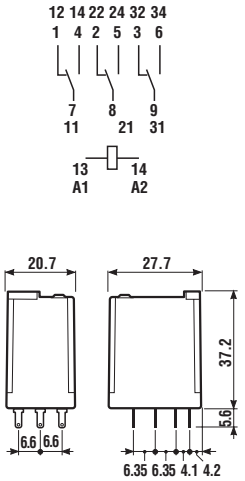
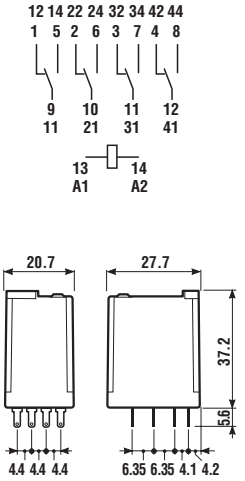
55 Series - General purpose relays 7 - 10 A

Features

Plug-in mount, general purpose
2, 3 & 4 Pole relays

55.32 - 2 Pole 10 A
55.33 - 3 Pole 10 A
55.34 - 4 Pole 7 A

- Lockable test button and mechanical flag indicator as standard on 2 & 4 pole types
- AC coils & DC coils
- UL Listing (certain relay/socket combinations)
- Cadmium Free contacts (preferred version)
- Contact material options
- Rear flange mount option
- 94 series sockets
- Coil EMC suppression
- Timer accessories 86 series

	55.32	55.33	55.34
			
	• 2 pole, 10 A • Plug-in 94 series sockets	• 3 pole, 10 A • Plug-in 94 series sockets	• 4 pole, 7 A • Plug-in 94 series sockets
			
For UL Horsepower and Pilot Duty ratings *See "General technical information" page V*			
Contact specification			
Contact configuration	2 CO (DPDT)	3 CO (3PDT)	4 CO (4PDT)
Rated current/Maximum peak current A	10/20	10/20	7/15
Rated voltage/Maximum switching voltage V AC	250/400	250/400	250/250
Rated load AC1 VA	2,500	2,500	1,750
Rated load AC15 (230 V AC) VA	500	500	350
Single phase motor rating (230 V AC) kW	0.37	0.37	0.125
Breaking capacity DC1: 30/110/220 V A	10/0.25/0.12	10/0.25/0.12	7/0.25/0.12
Minimum switching load mW (V/mA)	300 (5/5)	300 (5/5)	300 (5/5)
Standard contact material	AgNi	AgNi	AgNi
Coil specification			
Nominal voltage (U_N) V AC (50/60 Hz)	6 - 12 - 24 - 48 - 60 - 110 - 120 - 230 - 240		
V DC	6 - 12 - 24 - 48 - 60 - 110 - 125 - 220		
Rated power AC/DC VA (50 Hz)/W	1.5/1	1.5/1	1.5/1
Operating range AC	$(0.8...1.1)U_N$	$(0.8...1.1)U_N$	$(0.8...1.1)U_N$
DC	$(0.8...1.1)U_N$	$(0.8...1.1)U_N$	$(0.8...1.1)U_N$
Holding voltage AC/DC	$0.8\ U_N/0.5\ U_N$	$0.8\ U_N/0.5\ U_N$	$0.8\ U_N/0.5\ U_N$
Must drop-out voltage AC/DC	$0.2\ U_N/0.1\ U_N$	$0.2\ U_N/0.1\ U_N$	$0.2\ U_N/0.1\ U_N$
Technical data			
Mechanical life AC/DC cycles	$20 \cdot 10^6/50 \cdot 10^6$	$20 \cdot 10^6/50 \cdot 10^6$	$20 \cdot 10^6/50 \cdot 10^6$
Electrical life at rated load AC1 cycles	$200 \cdot 10^3$	$200 \cdot 10^3$	$150 \cdot 10^3$
Operate/release time ms	9/3	9/3	9/3
Insulation between coil and contacts (1.2/50 µs) kV	4	4	4
Dielectric strength between open contacts V AC	1,000	1,000	1,000
Ambient temperature range °C	–40...+85	–40...+85	–40...+85
Environmental protection	RT I	RT I	RT I
Approvals (according to type)	CE ABS ANCE SP D FI PG LR N RINA S cULus NF VDE		

finder

55 Series - General purpose relays 7 - 10 A

Ordering information

Example: 55 series plug-in relay, 4 CO (4PDT), 12 V DC coil, lockable test button and mechanical indicator.

5	5	.	3	4	.	9	.	0	1	2	.	A: 0	B: 0	C: 4	D: 0

Series

Type
1 = PCB
3 = Plug-in

No. of poles
2 = 2 pole, 10 A
3 = 3 pole, 10 A
4 = 4 pole, 7 A

Coil version
8 = AC (50/60 Hz)
9 = DC

Coil voltage
See coil specifications

A: Contact material
0 = Standard AgNi
2 = AgCdO
5 = AgNi + Au (5 µm)

B: Contact circuit
0 = CO (nPDT)

D: Special versions
0 = Standard
1 = Wash tight (RT III) for 55.12, 55.13 and 55.14 only
6 = Rear flange mount

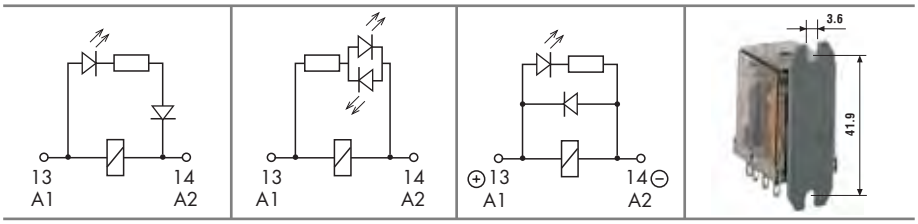
C: Options
0 = None
1 = Lockable test button
2 = Mechanical indicator
3 = LED (AC)
4 = Lockable test button+mechanical indicator
5 = Lockable test button + LED (AC)
54 = Lockable test button + LED (AC) + mechanical indicator
6* = Double LED (DC non-polarized)
7* = Lockable test button + double LED (DC non-polarized)
74* = Lockable test button + double LED (DC non-polarized) + mechanical indicator
8* = LED + diode (DC, polarity positive to pin A1/13)
9* = Lockable test button + LED + diode (DC, polarity positive to pin A1/13)
94* = Lockable test button + LED + diode (DC, polarity positive to pin A1/13) + mechanical indicator

* Option not available for the 220 V DC version.

Selecting features and options: only combinations in the same row are possible.
Preferred selections for best avaliability are shown in **bold.**

Type	Coil version	A	B	C	D
55.32/34	AC-DC	0 - 2 - 5	0	0	0 - 6
	AC	**0** - 2 - 5	**0**	2 - 3 - **4** - 5	**0** - 6
	AC	0 - 2 - 5	0	54	/
	DC	**0** - 2 - 5	**0**	2 - **4** - 6 - 7 - 8 - 9	**0** - 6
	DC	0 - 2 - 5	0	74 - 94	/
55.33	AC-DC	**0** - 2 - 5	**0**	**0**	**0** - 6
	AC	0 - 2 - 5	0	1 - 3 - 5	0 - 6
	DC	0 - 2 - 5	0	1 - 6 - 7 - 8 - 9	0 - 6
55.12/13/14	AC-DC	**0** - 2 - 5	**0**	**0**	**0** - 1

Descriptions: options and special versions



C: Option 3, 5, 54
LED (AC)

C: Option 6, 7, 74
Double LED
(DC non-polarized)

C: Option 8, 9, 94
LED + diode (DC, polarity positive to pin A1/13)

D: Special versions 6
Rear flange mount

Lockable test button and mechanical flag indicator (0010, 0040, 0050, 0054, 0070, 0074, 0090, 0094)

The dual-purpose Finder test button can be used in two ways:
Case 1) The plastic pip (located directly above the test button) remains intact. In this case, when the test button is pushed, the contacts operate. When the test button is released the contacts return to their former state.
Case 2) The plastic pip is broken-off (using an appropriate cutting tool). In this case, (in addition to the above function), when the test button is pushed and rotated, the contacts are latched in the operating state, and remain so until the test button is rotated back to its former position.
In both cases ensure that the test button actuation is swift and decisive.

finder

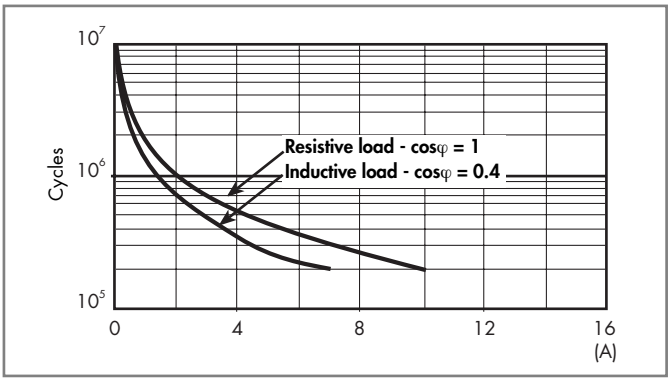
55 Series - General purpose relays 7 - 10 A

Technical data

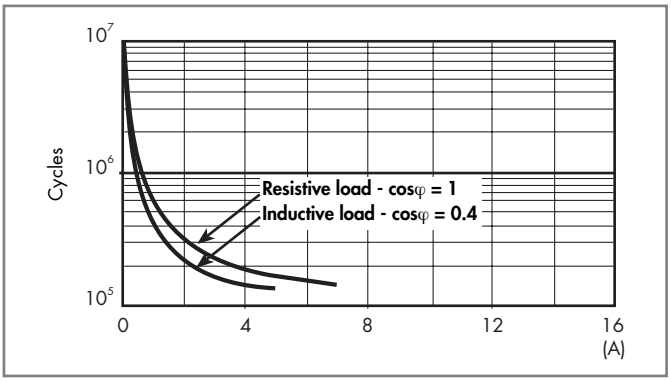
Insulation according to EN 61810-1:2004			2 pole - 3 pole		4 pole
Nominal voltage of supply system		V AC	230/400		230
Rated insulation voltage		V AC	400		250
Pollution degree			2		2
Insulation between coil and contact set					
Type of Insulation			Basic		Basic
Overvoltage category			III		III
Rated impulse voltage		kV (1.2/50 µs)	4		4
Dielectric strength		V AC	2,000		2,000
Insulation between adjacent contacts					
Type of insulation			Basic		Basic
Overvoltage category			III		II
Rated impulse voltage		kV (1.2/50 µs)	4		2.5
Dielectric strength		V AC	2,000		1,550
Insulation between open contacts					
Type of disconnection			Micro-disconnection		Micro-disconnection
Dielectric strength		V AC/kV (1.2/50 µs)	1,000/1.5		1,000/1.5
Conducted disturbance immunity					
Burst (5...50)ns, 5 kHz, on A1 - A2			EN 61000-4-4		level 4 (4 kV)
Surge (1.2/50 µs) on A1 - A2 (differential mode)			EN 61000-4-5		level 4 (4 kV)
Other data					
Bounce time: NO/NC		ms	1/4		
Vibration resistance (5...55)Hz: NO/NC		g	15/15		
Shock resistance		g	16		
Power lost to the environment	without contact current	W	1		
	with rated current	W	3 (2 pole)	4 (3 pole)	3 (4 pole)
Recommended distance between relays mounted on PCB		mm	5		

Contact specification

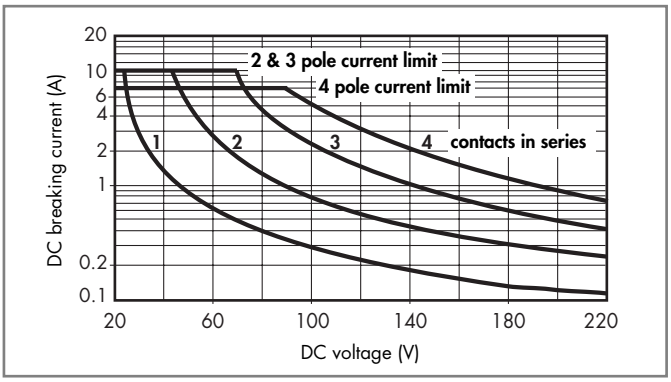
F 55 - Electrical life (AC) v contact current
2 and 3 pole relays



F 55 - Electrical life (AC) v contact current
4 pole relay



H 55 - Maximum DC1 breaking capacity



- When switching a resistive load (DC1) having voltage and current values under the curve, an electrical life of ≥ $100 \cdot 10^3$ can be expected.
- In the case of DC13 loads, the connection of a diode in parallel with the load will permit a similar electrical life as for a DC1 load.
  Note: the release time for the load will be increased.

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55 Series - General purpose relays 7 - 10 A

Coil specifications

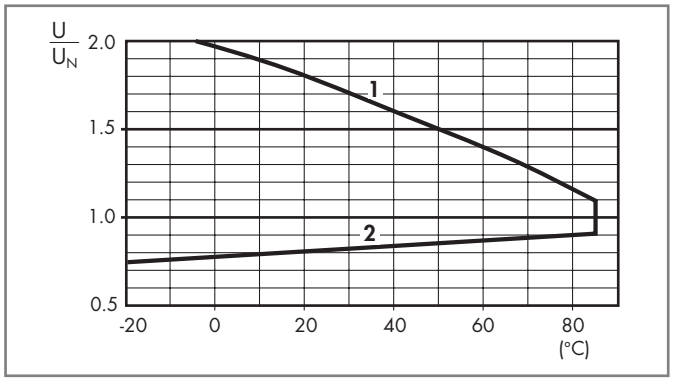
DC coil data

Nominal voltage U_N	Coil code	Operating range U_{min}	Operating range U_{max}	Resistance R	Rated coil consumption I at U_N
V		V	V	Ω	mA
6	**9**.006	4.8	6.6	40	150
12	**9**.012	9.6	13.2	140	86
24	**9**.024	19.2	26.4	600	40
48	**9**.048	38.4	52.8	2,400	20
60	**9**.060	48	66	4,000	15
110	**9**.110	88	121	12,500	8.8
125	**9**.125	100	137.5	17,300	7.2
220	**9**.220	176	242	54,000	4

AC coil data

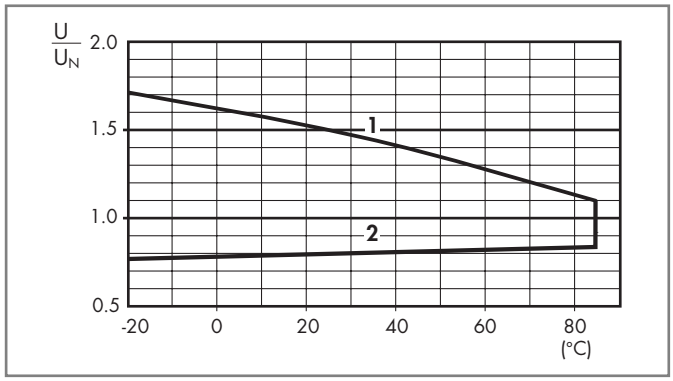
Nominal voltage U_N	Coil code	Operating range U_{min}	Operating range U_{max}	Resistance R	Rated coil consumption I at U_N (50Hz)
V		V	V	Ω	mA
6	**8**.006	4.8	6.6	12	200
12	**8**.012	9.6	13.2	50	97
24	**8**.024	19.2	26.4	190	53
48	**8**.048	38.4	52.8	770	25
60	**8**.060	48	66	1,200	21
110	**8**.110	88	121	4,000	12.5
120	**8**.120	96	132	4,700	12
230	**8**.230	184	253	17,000	6
240	**8**.240	192	264	19,100	5.3

R 55 - DC coil operating range v ambient temperature



1 - Max. permitted coil voltage.
2 - Min. pick-up voltage with coil at ambient temperature.

R 55 - AC coil operating range v ambient temperature



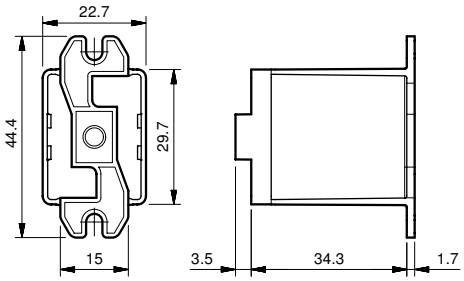
1 - Max. permitted coil voltage.
2 - Min. pick-up voltage with coil at ambient temperature.

Accessories

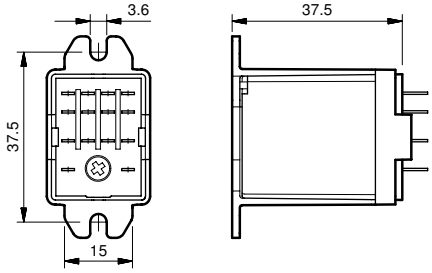

055.15


055.15 with relay

Adaptor with top mount flange for 55.32, 55.33, 55.34 | 055.15



055.15

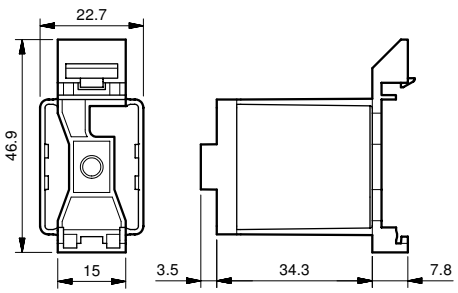


055.15 with relay

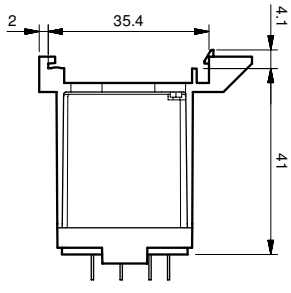

055.17


055.17 with relay

Top 35 mm rail (EN 50022) adaptor for 55.32, 55.33, 55.34 | 055.17



055.17



055.17 with relay

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94 Series - Socket overview for 55 series relays

See page 7

Module	Socket	Relay	Description	Mounting	Accessories
99.02	94.02	55.32	**Screw terminal (Box clamp) socket**	Panel or 35 mm rail (EN 50022) mount	- Coil indication and EMC suppression modules - Jumper link - Timer modules - Plastic retaining and release clip
	94.03	55.33	- Top terminals - Contacts		
	94.04	55.32 55.34	- Bottom terminals - Coil		

See page 8

Module	Socket	Relay	Description	Mounting	Accessories
99.80	94.54.1	55.32 55.34	**Screwless terminal socket** - For fast cable connections - Top terminals - Contacts - Bottom terminals - Coil	35 mm rail (EN 50022) mount	- Coil indication and EMC suppression modules - Plastic retaining and release clip
					

See page 9

Module	Socket	Relay	Description	Mounting	Accessories
99.01	94.72	55.32	**Screw terminal (Plate clamp) socket**	Panel or 35 mm rail (EN 50022) mount	- Coil indication and EMC suppression modules - Metal retaining clip
	94.73	55.33			
	94.74	55.32 55.34			

See page 9

Module	Socket	Relay	Description	Mounting	Accessories
99.01	94.82	55.32	**Screw terminal (Plate clamp) socket** - 23 mm wide for space saving	Panel or 35 mm rail (EN 50022) mount	- Coil indication and EMC suppression modules - Metal retaining clip
					

See page 10

Module	Socket	Relay	Description	Mounting	Accessories
99.80	94.84.2	55.32 55.34	**Screw terminal (Box clamp) socket**	Panel or 35 mm rail (EN 50022) mount	- Coil indication and EMC suppression modules - Jumper link - Plastic retainig and release clip
	94.82.3	55.32			
	94.84.3	55.32 55.34			

See page 11

Module	Socket	Relay	Description	Mounting	Accessories
99.80	94.92.3	55.32	**Screw terminal (Box clamp) socket**	Panel or 35 mm rail (EN 50022) mount	- Coil indication and EMC suppression modules - Jumper link - Plastic retaining and release clip
	94.94.3	55.32 55.34	- Top terminals - Contacts - Bottom terminals - Coil		

See page 12

Module	Socket	Relay	Description	Mounting	Accessories
—	94.12	55.32	**PCB sockets**	PCB mounting	- Metal retaining clip
—	94.13	55.33			
—	94.14	55.32 55.34			

See page 12

Module	Socket	Relay	Description	Mounting	Accessories
—	94.22	55.32	**Panel mount**	Panel mount on 1 mm thick panel	- Metal retaining clip
—	94.23	55.33	**with solder connections**		
—	94.24	55.32 55.34			

See page 13

Module	Socket	Relay	Description	Mounting	Accessories
—	94.32	55.32	**Panel mount**	M3 screw fixing	- Metal retaining clip
—	94.33	55.33	**with solder connections**		
—	94.34	55.32 55.34			

94 Series - Sockets and accessories for 55 series relays


94.04

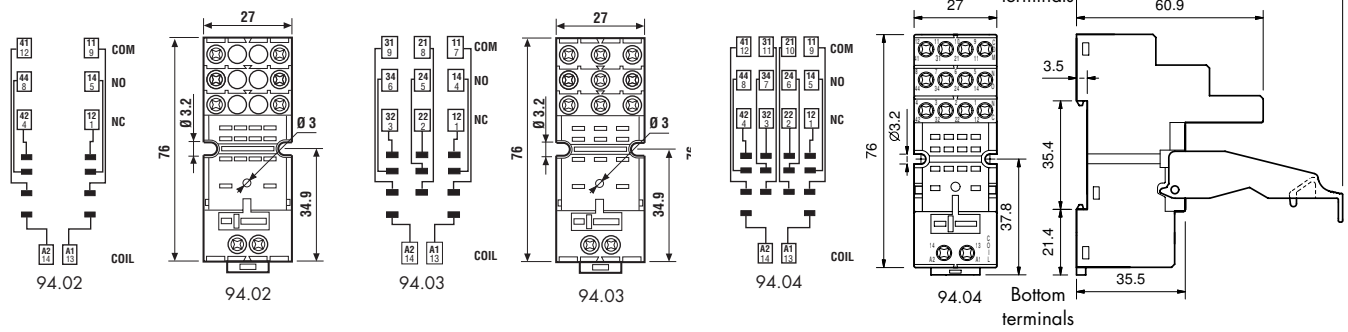
Approvals (according to type):

Certain relay/socket combinations


094.91.3

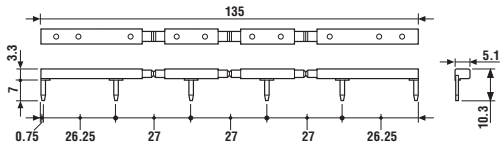

060.72

Screw terminal (Box clamp) socket panel or 35 mm rail mount		**94.02 Blue**	**94.02.0 Black**	**94.03 Blue**	**94.03.0 Black**	**94.04 Blue**	**94.04.0 Black**
For relay type		55.32		55.33		55.32, 55.34	
Accessories							
Metal retaining clip		094.71					
Plastic retaining and release clip (supplied with socket - packaging code SPA)		094.91.3	094.91.30	094.91.3	094.91.30	094.91.3	094.91.30
6-way jumper link		094.06	094.06.0	094.06	094.06.0	094.06	094.06.0
Identification tag		094.00.4					
Modules (see table below)		99.02					
Timer modules (see table below)		86.30					
Sheet of marker tags for retaining and release clip 094.91.3 plastic, 72 tags, 6x12 mm		060.72					
Technical data							
Rated values		10 A - 250 V					
Dielectric strength		2 kV AC					
Protection category		IP 20					
Ambient temperature	°C	–40...+70					
Screw torque	Nm	0.5					
Wire strip length	mm	8					
Max. wire size for 94.02/03/04 sockets		solid wire		stranded wire			
	mm²	1x6 / 2x2.5		1x4 / 2x2.5			
	AWG	1x10 / 2x14		1x12 / 2x14			




094.06

6-way jumper link for 94.02, 94.03 and 94.04 sockets	094.06 (blue)	094.06.0 (black)
Rated values	10 A - 250 V	




86.30

86 series timer modules	
(12...24)V AC/DC; Bi-function: AI, DI; (0.05s...100h)	86.30.0.024.0000
(230...240)V AC; Bi-function: AI, DI; (0.05s...100h)	86.30.8.240.0000

Approvals (according to type):

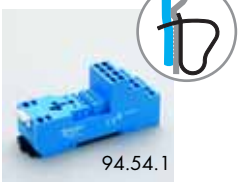

99.02

Approvals (according to type):

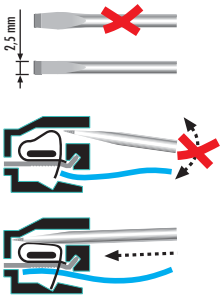
DC Modules with non-standard polarity (+A2) on request.

99.02 coil indication and EMC suppression modules for 94.02, 94.03 and 94.04 sockets		
Diode (+A1, standard polarity)	(6...220)V DC	99.02.3.000.00
LED	(6...24)V DC/AC	99.02.0.024.59
LED	(28...60)V DC/AC	99.02.0.060.59
LED	(110...240)V DC/AC	99.02.0.230.59
LED + Diode (+A1, standard polarity)	(6...24)V DC	99.02.9.024.99
LED + Diode (+A1, standard polarity)	(28...60)V DC	99.02.9.060.99
LED + Diode (+A1, standard polarity)	(110...220)V DC	99.02.9.220.99
LED + Varistor	(6...24)V DC/AC	99.02.0.024.98
LED + Varistor	(28...60)V DC/AC	99.02.0.060.98
LED + Varistor	(110...240)V DC/AC	99.02.0.230.98
RC circuit	(6...24)V DC/AC	99.02.0.024.09
RC circuit	(28...60)V DC/AC	99.02.0.060.09
RC circuit	(110...240)V DC/AC	99.02.0.230.09
Residual current by-pass	(110...240)V AC	99.02.8.230.07

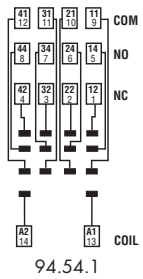
94 Series - Sockets and accessories for 55 series relays



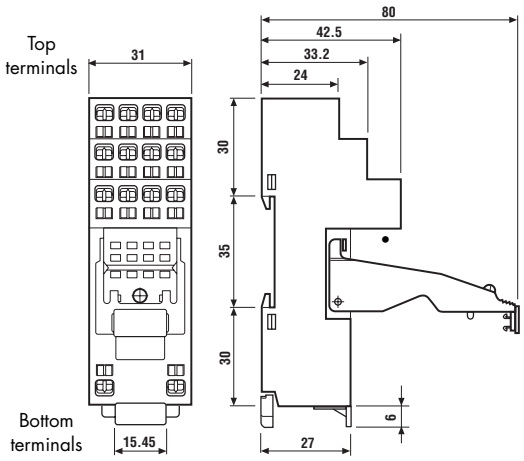
Approvals (according to type):



Screwless terminal socket 35 mm rail (EN 50022) mount		**94.54.1 (blue)**	**94.54.10 (black)**
For relay type		55.32, 55.34	
Accessories			
Metal retaining clip		094.71	
Plastic retaining and release clip		094.92	
Modules (see table below)		99.80	
Sheet of marker tags for retaining and release clip 094.92 plastic, 24 tags, 9x17 mm		020.24	
Technical data			
Rated values		10 A - 250 V	
Dielectric strength		2 kV AC	
Protection category		IP 20	
Ambient temperature	°C	–25...+70	
Wire strip length	mm	7	
Max. wire size for 94.54.1 socket		solid wire	stranded wire
	mm²	2x(0.2...1.5)	2x(0.2...1.5)
	AWG	2x(24...18)	2x(24...18)



94.54.1



Approvals (according to type):

* Modules in Black housing are available on request.

Green LED is standard. Red LED available on request.

99.80 coil indication and EMC suppression modules for 94.54.1 socket		**Blue***
Diode (+A1, standard polarity)	(6...220)V DC	99.80.3.000.00
LED	(6...24)V DC/AC	99.80.0.024.59
LED	(28...60)V DC/AC	99.80.0.060.59
LED	(110...240)V DC/AC	99.80.0.230.59
LED + Diode (+A1, standard polarity)	(6...24)V DC	99.80.9.024.99
LED + Diode (+A1, standard polarity)	(28...60)V DC	99.80.9.060.99
LED + Diode (+A1, standard polarity)	(110...220)V DC	99.80.9.220.99
LED + Varistor	(6...24)V DC/AC	99.80.0.024.98
LED + Varistor	(28...60)V DC/AC	99.80.0.060.98
LED + Varistor	(110...240)V DC/AC	99.80.0.230.98
RC circuit	(6...24)V DC/AC	99.80.0.024.09
RC circuit	(28...60)V DC/AC	99.80.0.060.09
RC circuit	(110...240)V DC/AC	99.80.0.230.09
Residual current by-pass	(110...240)V AC	99.80.8.230.07

94 Series - Sockets and accessories for 55 series relays

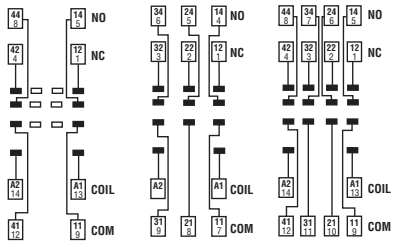
Approvals (according to type):

Approvals (according to type):

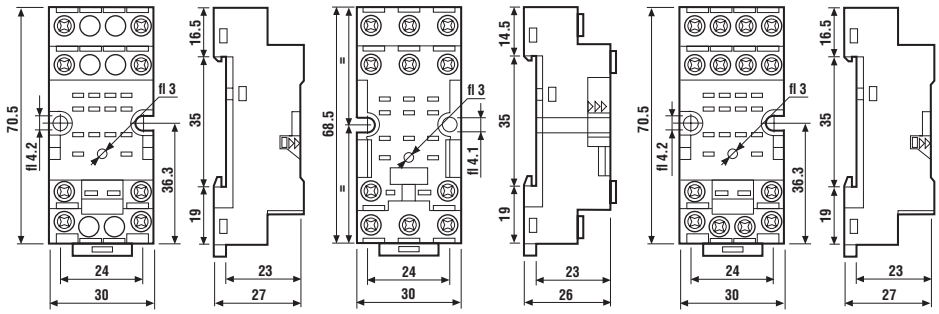
Screw terminal (Plate clamp) socket panel or 35 mm rail mount	**94.72 Blue**	**94.72.0 Black**	**94.73 Blue**	**94.73.0 Black**	**94.74 Blue**	**94.74.0 Black**
For relay type	55.32		55.33		55.32, 55.34	
Accessories						
Metal retaining clip (supplied with socket - packaging code SMA)	094.71					
Modules (see table below)	99.01					

Screw terminal (Plate clamp) socket: panel or 35 mm rail mount	**94.82 (blue)**	**94.82.0 (black)**
For relay type	55.32	55.32
Accessories		
Metal retaining clip (supplied with socket - packaging code SMA)	094.71	
Modules (see table below)	99.01	

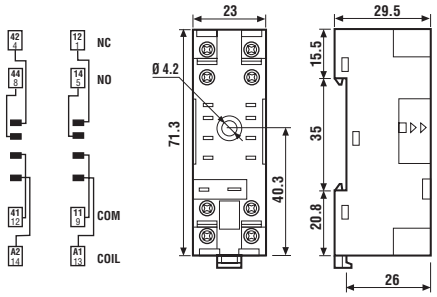
Technical data			
Rated values		10 A - 250 V	
Dielectric strength		2 kV AC	
Protection category		IP 20	
Ambient temperature	°C	–40...+70	
Screw torque	Nm	0.5	
Wire strip length	mm	8 (94.72/73/74)	9 (94.82)
Max. wire size for 94.72/73/74 and 94.82 sockets		solid wire	stranded wire
	mm^2	1x2.5 / 2x1.5	1x2.5 / 2x1.5
	AWG	1x14 / 2x16	1x14 / 2x16



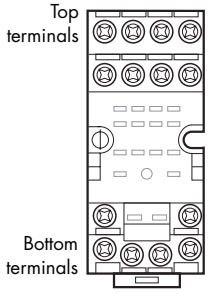
94.72 94.73 94.74



94.72 94.73 94.74



94.82



Approvals (according to type):

99.01 coil indication and EMC suppression modules for 94.72, 94.73, 94.74 and 94.82 sockets

		Blue*
Diode (+A1, standard polarity)	(6...220)V DC	99.01.3.000.00
Diode (+A2, non standard polarity)	(6...220)V DC	99.01.2.000.00
LED	(6...24)V DC/AC	99.01.0.024.59
LED	(28...60)V DC/AC	99.01.0.060.59
LED	(110...240)V DC/AC	99.01.0.230.59
LED + Diode (+A1, standard polarity)	(6...24)V DC	99.01.9.024.99
LED + Diode (+A1, standard polarity)	(28...60)V DC	99.01.9.060.99
LED + Diode (+A1, standard polarity)	(110...220)V DC	99.01.9.220.99
LED + Diode (+A2, non standard polarity)	(6...24)V DC	99.01.9.024.79
LED + Diode (+A2, non standard polarity)	(28...60)V DC	99.01.9.060.79
LED + Diode (+A2, non standard polarity)	(110...220)V DC	99.01.9.220.79
LED + Varistor	(6...24)V DC/AC	99.01.0.024.98
LED + Varistor	(28...60)V DC/AC	99.01.0.060.98
LED + Varistor	(110...240)V DC/AC	99.01.0.230.98
RC circuit	(6...24)V DC/AC	99.01.0.024.09
RC circuit	(28...60)V DC/AC	99.01.0.060.09
RC circuit	(110...240)V DC/AC	99.01.0.230.09
Residual current by-pass	(110...240)V AC	99.01.8.230.07

* Modules in Black housing are available on request.

Green LED is standard. Red LED available on request.

94 Series - Sockets and accessories for 55 series relays

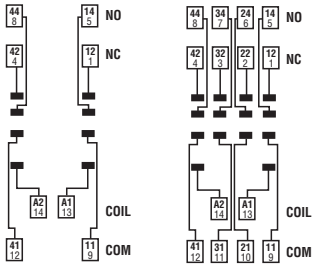
Approvals (according to type):

Screw terminal (Box clamp) socket panel or 35 mm rail mount	**94.82.3** Blue	**94.82.30** Black	**94.84.3** Blue	**94.84.30** Black
For relay type	55.32		55.32, 55.34	
Accessories				
Metal retaining clip (supplied with socket - packaging code SMA)	094.71			
Plastic retaining and release clip	094.91.3	094.91.30	094.91.3	094.91.30
6-way jumper link	094.06	094.06.0	094.06	094.06.0
Identification tag	094.80.3			
Modules (see table next page)	99.80			
Sheet of marker tags for retaining and release clip 094.91.3 plastic, 72 tags, 6x12 mm	060.72			

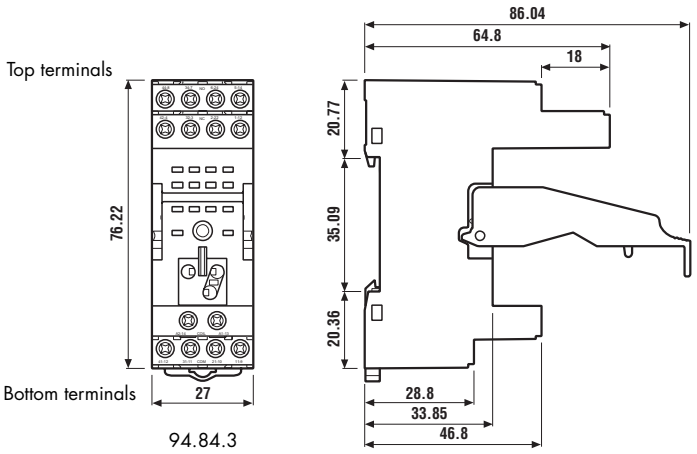
Approvals (according to type):

Screw terminal (Box clamp) socket panel or 35 mm rail mount	**94.84.2** Blue	**94.84.20** Black
For relay type	55.32, 55.34	
Accessories		
Metal retaining clip (supplied with socket - packaging code SMA)	094.71	
Plastic retaining and release clip	094.91.3	094.91.30
6-way jumper link	094.06	094.06.0
Identification tag	094.80.3	
Modules (see table next page)	99.80	
Sheet of marker tags for retaining and release clip 094.91.3 plastic, 72 tags, 6x12 mm	060.72	

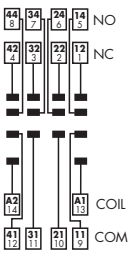
Technical data			
Rated values		10 A - 250 V	
Dielectric strength		2 kV AC	
Protection category		IP 20	
Ambient temperature	°C	–40...+70	
Screw torque	Nm	0.5	
Wire strip length	mm	7	
Max. wire size for 94.82.3, 94.84.3 and 94.84.2 sockets		solid wire	stranded wire
	mm^2	1x6 / 2x2.5	1x4 / 2x2.5
	AWG	1x10 / 2x14	1x12 / 2x14



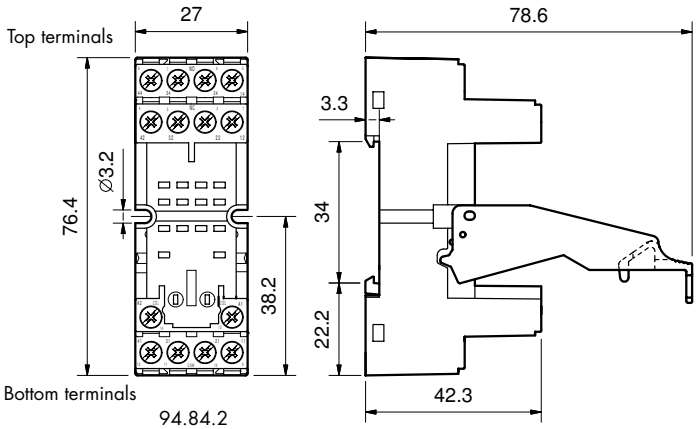
94.82.3 94.84.3



94.84.3



94.84.2

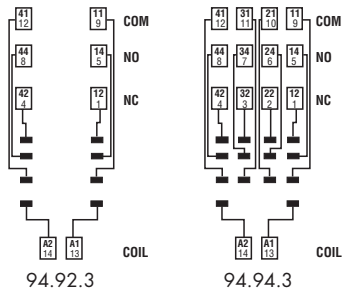


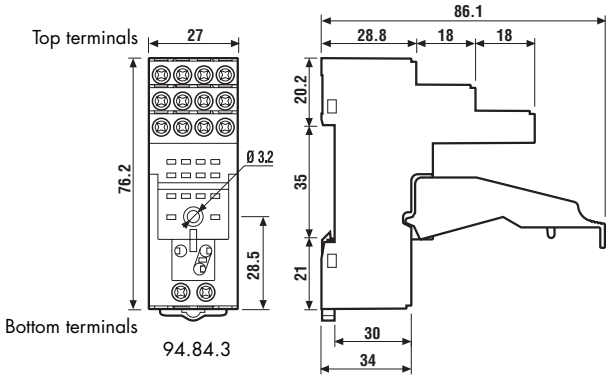
94.84.2

94 Series - Sockets and accessories for 55 series relays

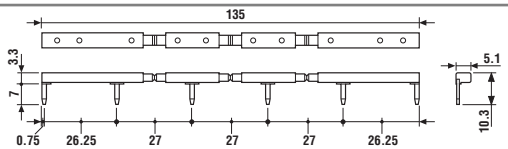
Approvals (according to type):

Screw terminal (Box clamp) socket panel or 35 mm rail mount		**94.92.3 (blue)**	**94.92.30 (black)**	**94.94.3 (blue)**	**94.94.30 (black)**
For relay type		55.32		55.32, 55.34	
Accessories					
Metal retaining clip		094.71			
Plastic retaining and release clip		094.91.3	094.91.30	094.91.3	094.91.30
6-way jumper link		094.06	094.06.0	094.06	094.06.0
Identification tag		094.80.3			
Modules (see table below page)		99.80			
Sheet of marker tags for retaining and release clip 094.91.3 plastic, 72 tags, 6x12 mm		060.72			
Technical data					
Rated values		10 A - 250 V			
Dielectric strength		2 kV AC			
Protection category		IP 20			
Ambient temperature	°C	–25...+70			
Screw torque	Nm	0.5			
Wire strip length	mm	8			
Max. wire size for 94.92.3 and 94.94.3 sockets		solid wire		stranded wire	
	mm²	1x6 / 2x2.5		1x4 / 2x2.5	
	AWG	1x10 / 2x14		1x12 / 2x14	





6-way jumper link for 94.84.2, 94.82.3, 94.84.3, 94.92.3 and 94.94.3 sockets	094.06 (blue)	094.06.0 (black)
Rated values	10 A - 250 V	



Approvals (according to type):

* Modules in Black housing are available on request.

Green LED is standard. Red LED available on request.

99.80 coil indication and EMC suppression modules for 94.84.2, 94.82.3, 94.84.3, 94.92.3 and 94.94.3 sockets		**Blue***
Diode (+A1, standard polarity)	(6...220)V DC	99.80.3.000.00
LED	(6...24)V DC/AC	99.80.0.024.59
LED	(28...60)V DC/AC	99.80.0.060.59
LED	(110...240)V DC/AC	99.80.0.230.59
LED + Diode (+A1, standard polarity)	(6...24)V DC	99.80.9.024.99
LED + Diode (+A1, standard polarity)	(28...60)V DC	99.80.9.060.99
LED + Diode (+A1, standard polarity)	(110...220)V DC	99.80.9.220.99
LED + Varistor	(6...24)V DC/AC	99.80.0.024.98
LED + Varistor	(28...60)V DC/AC	99.80.0.060.98
LED + Varistor	(110...240)V DC/AC	99.80.0.230.98
RC circuit	(6...24)V DC/AC	99.80.0.024.09
RC circuit	(28...60)V DC/AC	99.80.0.060.09
RC circuit	(110...240)V DC/AC	99.80.0.230.09
Residual current by-pass	(110...240)V AC	99.80.8.230.07

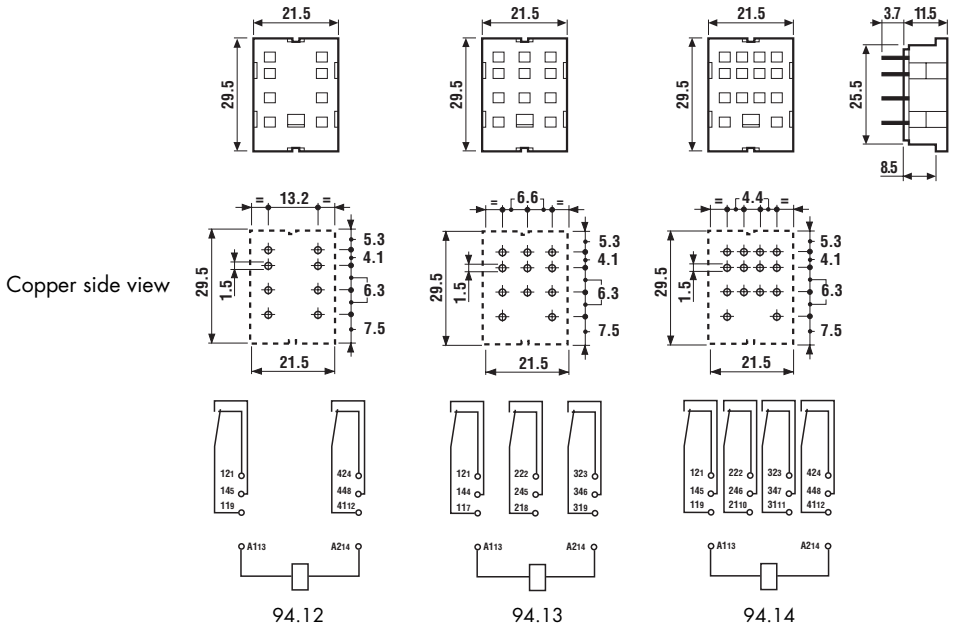
94 Series - Sockets and accessories for 55 series relays


94.14

Approvals (according to type):

PCB socket	94.12 Blue	94.12.0 Black	94.13 Blue	94.13.0 Black	94.14 Blue	94.14.0 Black
For relay type	55.32		55.33		55.32, 55.34	
Accessories						
Metal retaining clip (supplied with socket - packaging code SMA)	094.51					
Technical data						
Rated values	10 A - 250 V					
Dielectric strength	2 kV AC					
Ambient temperature °C	–40...+70					

Copper side view

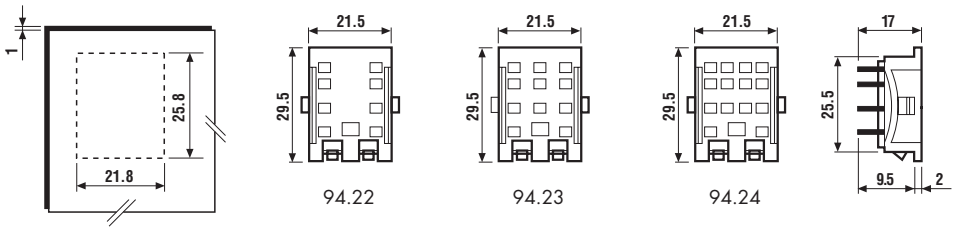


94.12 94.13 94.14


94.22

Approvals (according to type):

Panel mount solder socket 1 mm thick panel	94.22 Blue	94.22.0 Black	94.23 Blue	94.23.0 Black	94.24 Blue	94.24.0 Black
For relay type	55.32		55.33		55.32, 55.34	
Accessories						
Metal retaining clip (supplied with socket - packaging code SMA)	094.51					
Technical data						
Rated values	10 A - 250 V					
Dielectric strength	2 kV AC					
Ambient temperature °C	–40...+70					

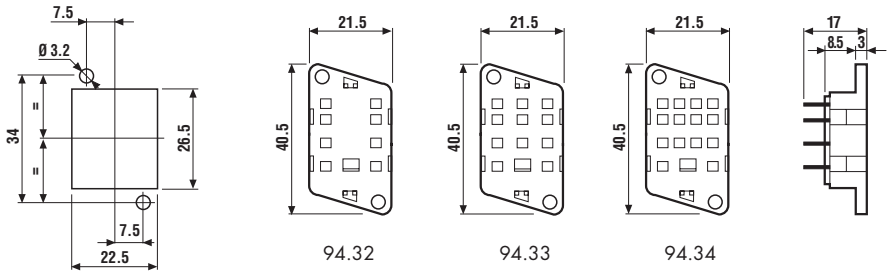


94.22 94.23 94.24

94 Series - Sockets and accessories for 55 series relays

Approvals (according to type):

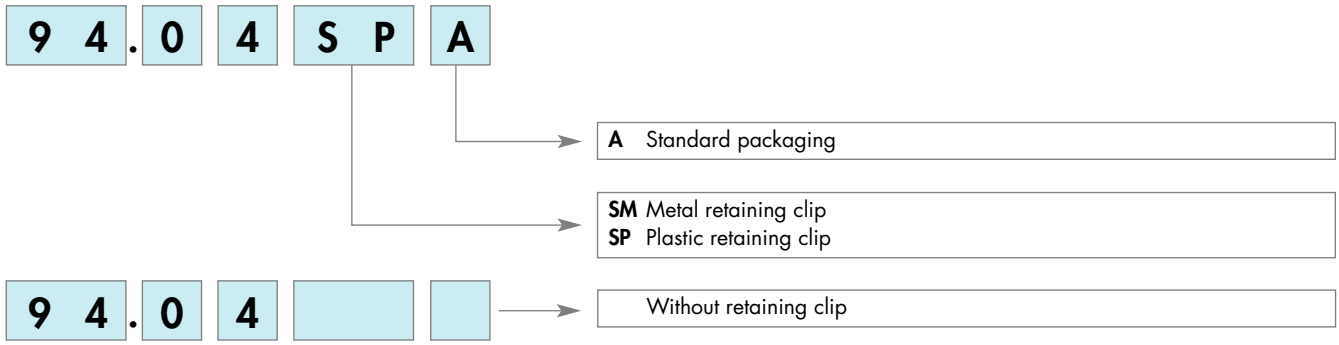
Panel mount socket M3 screw fixing - solder connections	**94.32 Blue**	**94.32.0 Black**	**94.33 Blue**	**94.33.0 Black**	**94.34 Blue**	**94.34.0 Black**
For relay type	55.32		55.33		55.32, 55.34	
Accessories						
Metal retaining clip (supplied with socket - packaging code SMA)	094.51					
Technical data						
Rated values	10 A - 250 V					
Dielectric strength	2 kV AC					
Ambient temperature °C	–40…+70					



Packaging codes

How to code and identify retaining clip and packaging options for sockets.

Example:



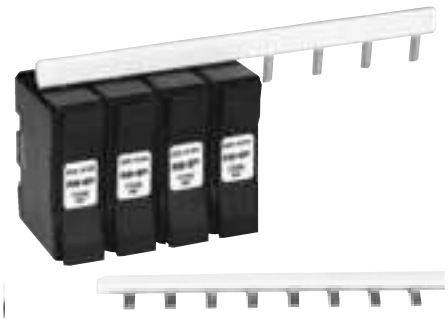
NHP COMPACT

Compact fuses
BS type

NHP

Refer Catalogue NF

- Ratings from 2 to 1250A
- Reduced dimensions
- Superior short circuit protection
- Complies with BS88
- Low watts loss



NVCB8

BS solid links

Type	To suit fuse holder	Cat. No.
Clip-in	NV32	32CLK
Clip-in	NV63	63CLK
Bolt-in	N20_	20MFNL
Bolt-in	N32_	32MFNL
Bolt-in	N63_	63MFNL
Bolt-in	N100_	100MFNL
Bolt-in	N200_	200MFNL

8 way comb busbar

NEW

- Suits NV20FW/NV32FW fuses

	Cat. No.
8 way comb busbar	NVCB8

Rating (A)	BS 88 Ref	Cat. No.
Clip-in offset tags		
2	F1	NNS 2
4	F1	NNS 4
6	F1	NNS 6
10	F1	NNS 10
16	F1	NNS 16
20	F1	NNS 20
25	F1	NNS 25
32	F1	NNS 32
20M25	F1	NNS 20M25
20M32	F1	NNS 20M32
20	F2	NES 20
25	F2	NES 25
32	F2	NES 32
40	F2	NES 40
50	F2	NES 50
63	F2	NES 63

Note: M in catalogue No. denotes motor starting type.

NNS_
NES_

NNIT_

NTIA_

Rating (A)	BS 88 Ref	Cat. No.
Bolted pattern offset tags		
2	A1	NNIT 2
4	A1	NNIT4
6	A1	NNIT 6
10	A1	NNIT 10
16	A1	NNIT 16
20	A1	NNIT 20
25	A1	NNIT 25
32	A1	NNIT 32
20M25	A1	NNIT 20M25
20M32	A1	NNIT 20M32
32M40	A1	NNIT 32M40
32M50	A1	NNIT 32M50
32M63	A1	NNIT 32M63
2	A2	NTIA 2
4	A2	NTIA 4
6	A2	NTIA 6
10	A2	NTIA 10
16	A2	NTIA 16
20	A2	NTIA 20
25	A2	NTIA 25
32	A2	NTIA 32
32M40	A2	NTIA 32M40
32M50	A2	NTIA 32M50
32M63	A2	NTIA 32M63

NHP COMPACT

Fuse replacement chart

NHP

Refer Catalogue NF

This chart is designed to help choose the correct fuse to fit a particular Strömberg switch fuse (or vice versa) and to help choose the correct replacement fuse. Some data is from other manufacturers publications and as such cannot be guaranteed by NHP. Beware that some motor start fuses are in a larger body size than a normal fuse. It is wise to consult the fuse manufacturers data to determine their particular fuse sizes (ie. A2-C3).

Fuse manufacturers part numbers - Australian/British standard

BS Ref.	Amps	NHP COMPACT FUSES	Alstrom	Holec	GEC	Dorman Smith	Federal	Brush	Siemens
F1	2…32	**NNS**	SN2	NS	NS	NSD	20/32C	F06	3NW NS
F2	20…63	**NES**	SP	NES	ES	ESD	-	-	3NW ES
A1	2…32	**NNIT**	SA2	NIT	NIT	NITD	20/32B	F21	3NW NIT
A2	2…32	**NTIA**	SB3	TIA	TIA	AAO	32B	H07	3NW TIA
A3	35…63	**NTIS**	SB4	TIS	TIS	BAO	63B	K07	3NW TIS
-	80…100	**NOS**	SO	-	OS	OSD	-	K07R	3NW OS
A4	80…100	**NTCP**	SD5	TCP	TCP	CEO	100B	L14	3NW TCP
Hybrid (A4)	125…200	**NTFP** [1]	SD6	TFP	TFP	DEO	-	M14	3NW TFP
-	2…32	**NTB**	SE3	TB	TB	AC	-	K08	-
B1	2…32	**NTBC**	SF3	TBC	TBC	AD	-	K09	3NW TBC
-	40…63	**NTB**	SE4	TB	TB	BC	-	K08	3NW TB
B1	40…63	**NTBC**	SF4	TBC	TBC	BD	63B/C	K09	3NW TBC
B1	80…100	**NTC**	SF5	TC	TC	CD	100B/C	L09	3NW TC
B2	125…200	**NTF**	SF6	TF	TF	DD	200B/C	M09	3NW TF
B3	250…315	**NTKF**	SF7	TKF	TKF	ED	315B/C	N09	3NW TKF
-	250…315	**NTKM**	SG7	TKM	TKM	-	-	N11	3NW TKM
B4	355…400	**NTMF**	SF8	TMF	TMF	ED	400B/C	P09	3NW TMF
C1	355…400	**NTM**	SH8	TM	TM	EF	404B/C	P11	3NW TM
C2	450…630	**NTTM**	SH9	TTM	TTM	FF	504B/C	R11	3NW TTM
-	450…630	**NTT**	SY9	-	TT	FG	-	R12	-
C3	710…800	**NTLM**	SH10	TLM	TLM	GF	804B/C	S12	3NW TLM
-	710…800	**NTLT**	SY10	-	TLT	GG	-	S12	3NW TLT
D1	1000…1250	**NTXU**	SJ11	-	TXU	GH	-	U44	-
Din pattern									
00	6…160	**N00**	7999	P851.00	NHG-00	-	-	-	3NA5
1	25…250	**N1**	8001	P851.1	NHG-1	-	-	-	3NA4 144
2	80…400	**N2**	8002	P851.2	NHG-2	-	-	-	3NA4 260
3	315…630	**N3**	8003	P851.3	NHG-3	-	-	-	3NA1
Fuse holders									
Clip in	20A	**NV20FW**	V20FW	J2011	SC20				3NW CM2OF
	32A	**NV32FW**	V32FW	-	SC32				3NW 32NNSF
Front wired	20A	**N20FW**	20MFB	-	RS20H				-
	32A	**N32FW**	32MFB	J3211	RS32H				3NW CM32F
	63A	**N63FW**	63MFB	J6311	RS63H				3NW CM63F
	100A	**N100FW**	100MFB	J9911	RS100H				3NW CM100F
	200A	**N200FW**	200MFB	J1991	RS200H				3NW 200DF
Stud/	20A	**N20SFW**	20MFD	-	RS20PH				-
front wired	32A	**N32SFW**	32MFD	-	RS32PH				-
	63A	**N63SFW**	63MFD	-	RS63PH				-
	100A	**N100SFW**	100MFD	-	RS100PH				-
	200A	**N200SFW**	200MFD	-	RS200PH				3NW 200DFB

Note: [1]) This hybrid type fuse is actually an A4 size fuse, but as it is over 100 amps it cannot be called an A4 fuse to AS 2005.

NHP COMPACT

HRC cartridge fuse-links

NHP Compact fuses

NHP Compact 415V fuse-links are available in ratings from 2A up to 1250A and advanced design techniques mean that watts loss figures have been substantially reduced whilst protection characteristics remain unchanged.

All NHP Compact HRC fuse-links are manufactured using precision assembly methods to ensure that their performance will conform with the published characteristics within very close tolerances.

Cartridge barrels are extruded under vacuum to prevent the occurrence of air pockets. Each fuse is then fully filled, using a vibratory method, with specially prepared, dried and graded powdered silica. The end caps are press fitted on to the precision ground barrels ensuring a very tight fit.

Fuse elements are accurately shaped and manufactured for consistency and reliability.

All NHP Compact fuse-links are subjected to a resistance test to prove correct assembly.

NHP Compact HRC fuse-links, other than motor rated patterns, have utilisation categories gG.

Schedules of equivalent fuse-links made by certain other manufacturers are included in the following pages. No claim is made of identical performance under all conditions, the schedules being provided to assist on the selection of fuse-links having similar ratings, dimensions and fixing centres. Characteristic curves and associated data are provided to aid accurate discrimination.

Motor rated fuse-links

BS88 now aligns with the international fuse specification IEC 269. The concept of "fusing factor" has been replaced with "utilisation category". Class Q1 fusing factor is now referred to as "gG" and motor rated fuse-links are referred to as "gM". Special motor rated fuse-links are also listed and are available in various barrel sizes, in each case fitted with special fuse elements. Their selection frequently permits the use of lower rated switch and/or fusegear than would be the case using Class gG fuse-links. This range of fuse-links has been ASTA certified for a breaking capacity of 80kA at 415V AC.

NHP Compact industrial bolted pattern fuse-links conform with BS 88: Part 2: 1988 and, have been ASTA certified for a breaking capacity of 80kA at 415V AC or 550V AC and have utilisation categories gG.

NHP Compact fuse-links are suitable for back-up protection in motor circuits, having excellent time delay characteristics with low fusing factor and high rupturing capacity.

Fuses for use in motor circuits should be selected in accordance with the requirements for the protection of motor control gear as specified by the control gear manufacturer.

As a guide, the following table shows the minimum fuse sizes that may be associated with motors based on the assumption that the starting conditions for typical 3 phase 4 pole 415V motors are; 8 x F.L.C. for 6 secs [D.O.L.] and 4 x F.L.C. for 12 secs [Star Delta].

Should more specific information be required to assist on individual projects please contact your nearest NHP office or distributor.

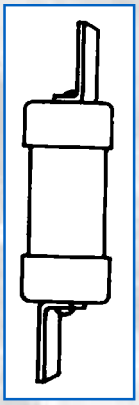
fuse-link selection for motor circuit protection

Motor rating kW	Motor rating hp	Approx f.l.c. amps	D.O.L. standard fuse-link amps	Starting motor circuit fuse-link	Assisted start standard fuse-link amps
0.19	0.25	0.7	4		2
0.37	0.5	1.3	6		4
0.55	0.75	1.6	6		4
0.75	1.0	1.8	10		4
1.1	1.5	2.6	10		6
1.5	2.0	3.4	10		10
2.2	3.0	5.0	16		10
3.0	4.0	6.5	16		10
4.0	5.5	8.0	20	20M25	16
5.5	7.5	11.0	25	20M32	16
7.5	10	15	40	32M40	25
11.0	15	22	50	32M50	32
15.0	20	28	63	32M63	40
18.5	25	36	80	63M80	50
22	30	39	80	63M80	63
30	40	52	100	63M100	63
37	50	69	160	100M160	80
45	60	79	160	100M160	100
55	75	96	200		160
75	100	125	200	200M250	160
90	125	156	250	200M250	160
110	150	189	315		200
132	175	224	355		250
150	200	255	355		250
160	220	275	400		315
185	250	318	450		315
200	270	339	500		355
220	300	374	560		400
257	350	450	630		450
295	400	500	710		500
315	430	535	710		560
355	483	580	800		630
400	545	646	800		710
450	612	725	1000		800

NHP COMPACT

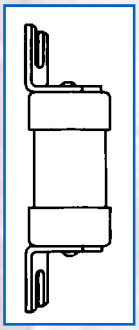
HRC cartridge fuse-links

Cross reference guide



NNS-Type staggered contacts breaking capacity 80kA at 415V AC to BS 88: Part 6: 1988 Ref. F1

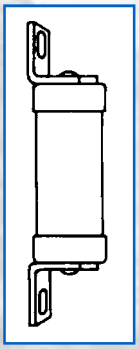
Current rating A Normal	Motor	Overall length mm	Overall dia. mm	NHP Cat No.	Cross reference MEM	GEC/Lawson	Siemens	Brush/ Hawker	Bussman/ Dorman Smith
2				NNS2	2SN2	NS2	3NW NS2	2F06	NSD2
4	-			NNS4	4SN2	NS4	3NW NS4	4F06	NSD4
6	-			NNS6	6SN2	NS6	3NW NS6	6F06	NSD6
10	-			NNS10	10SN2	NS10	3NW NS10	10F06	NSD10
16	-			NNS16	16SN2	NS16	3NW NS16	16F06	NSD16
20	-	60	14	NNS20	20SN2	NS20	3NW NS20	20F06	NSD20
20	25			NNS 20M25	20SN2M25	NS20M25	3NW M25	20M25F06	NSD20M25
20	32			NNS 20M32	20SN2M32	NS20M32	3NW M32	20M32F06	NSD20M32
25	-			NNS25	25SN2	NS25	3NW NS25	25F06	NSD25
32	-			NNS32	32SN2	NS32	3NW NS32	32F06	NSD32

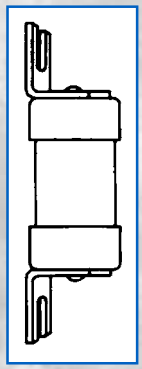


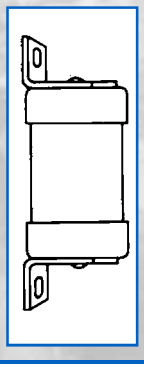
NES-Type staggered contacts breaking capacity 80kA at 415V AC to ASTA certified to BS 88: Part 6: 1988

20		68	17	NES20	20SP	-	-	-	ESD20
25				NES25	25SP	-	-	-	ESD25
32				NES32	32SP	-	-	-	ESD32
40				NES40	40SP	40ES	3NWES40	40G05	3SD40
50				NES50	50SP	50ES	3NWES50	50G05	ESD50
63				NES63	63SP	63ES	3NWES63	63G05	ESD63

Industrial bolted pattern. Offset contacts ASTA certified to BS 88: Part 2: 1988. Complies with IEC 269 Parts 1 and 2. Tested to 80kA at 415V AC







Current rating A Normal	Motor	Fixing centres	BS88 ref	NHP Cat No.	Cross reference MEM	GEC/Lawson	Siemens	Brush/ Hawker	Bussman/ Dorman Smith
2		44.5	A1	NNIT2	2SA2	NIT2	3NWNIT2	2F21	NITD2
4	-			NNIT4	4SA2	NIT4	3NWNIT4	4F21	NITD4
6	-			NNIT6	6SA2	NIT6	3NWNIT6	6F21	NITD6
10	-			NNIT10	10SA2	NIT10	3NWNIT10	10F21	NITD10
16	-			NNIT16	16SA2	NIT16	3NW NIT16	16F21	NITD16
20	-			NNIT20	20SA2	NIT20	3NWNIT20	20F21	NITD20
20	25		-	NNIT20M25	20SA2M25	NIT20M25	3NWNIT20M25	20M25F21	NITD20M25
20	32		-	NNIT20M32	20SA2M32	NIT20M32	3NWNIT20M32	20M32F21	NITD20M32
25	-		-	NNIT25	25SA2	-	3NWNIT25	25F21	NITD25
32	-		-	NNIT32	32SA2	-	3NWNIT32	32F21	NITD32
32	40		-	NNIT32M40	32SA2M40	-	3NWNIT32M40	-	-
32	50		-	NNIT32M50	32SA2M50	-	3NWNIT32M50	-	-
32	63		-	NNIT32M63	32SA2M63	-	3NWNIT32M63	-	-
2	-	73	A2	NTIA2	2SB3	TIA2	3NWTIA2	2H07	AA02
4	-			NTIA4	4SB3	TIA4	3NWTIA4	4H07	AA04
6	-			NTIA6	6SB3	TIA6	3NWTIA6	6H07	AA06
10	-			NTIA10	10SB3	TIA10	3NWTIA10	10H07	AA010
16	-			NTIA16	16SB3	TIA16	3NWTIA16	16H07	AA016
20	-			NTIA20	20SB3	TIA20	3NWTIA20	20H07	AA020
25	-			NTIA25	25SB3	TIA25	3NWTIA25	25H07	AA025
32	-			NTIA32	32SB3	TIA32	3NWTIA32	32H07	AA032
32	40			NTIA32M40	32SB3M40	TIA32M40	3NWTIA32M40	32M40H07	AA032M40
32	50			NTIA32M50	32SB3M50	TIA32M50	3NWTIA32M50	32M50H07	AA032M50
32	63			NTIA32M63	32SB3M63	TIA32M63	3NWTIA32M63	32M63H07	AA032M63
35	-	73	A3	NTIS35	35SB4	TIS35	3NWTIS35	35KO7	BAO35
40	-			NTIS40	40SB4	TIS40	3NWTIS40	40KO7	BAO40
50	-			NTIS50	50SB4	TIS50	3NWTIS50	50KO7	BAO50
63	-			NTIS63	63SB4	TIS63	3NWTIS63	63KO7	BAO63
63	80			NTIS63M80	63SB4M80	TIS63M80	3NWTIS63M80	63M80KO7	BAO63M80
63	100			NTIS63M100	63SB4M100	TIS63M100	3NWTIS63M100	63M100KO7	BAO63M100
80	-	73		N0S80	80SO	OS80	3NW0S80	80KO7R	OSD80
100	-			N0S100	100SO	OS100	3NW0S100	100KO7R	OSD100
100	125			NOS100M125	-	OS100M125	-	100M125KO7R	OSD100M125
100	160			NOS100M160	-	OS100M160	-	100M160KO7R	OSD100M160
80	-	94	A4	NTCP80	80SD5	TCP80	3NWTCP80	80L14	CEO80
100	-			NTCP100	100SD5	TCP100	3NWTCP100	100L14	CEO100
100	125			NTCP100M125	100SD5M125	TCP100M125	3NWTCP100M125	100M125L14	CEO100M125
100	160			NTCP100M160	100SD5M160	TCP100M160	3NWTCP100M160	100M160L14	CEO100M160
125	-			NTFP125	125SD6	TFP125	3NWTFP125	125M14	DEO125
160	-			NTFP160	160SD6	TFP160	3NWTFP160	160M14	DEO160
200	-			NTFP200	200SD6	TFP200	3NWTFP200	200M14	DEO200
200	250	94		NTFP200M250	200SD6M250	TFP200M250	-	200M250M14	DEO200M250

NHP COMPACT

HRC cartridge fuse-links

Cross reference guide

NHP Compact industrial bolted pattern. Centre contacts, ASTA certified to BS 88: Part 2: 1988. Complies with IEC 269 parts 1 and 2. Tested to 80kA at 415V AC. *550V AC.

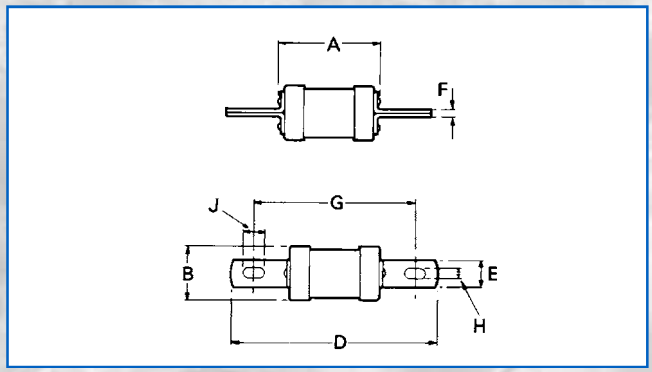
Current rating A		Fixing	BS88	NHP	Cross reference				
Normal	Motor	centres	ref	Cat No.	MEM	GEC/Lawson	Siemens	Brush/ Hawker	Bussman/ Dorman Smith
2	-			**NTB2***	2SE3	TB2	3NWTB2	2KO8	AC2
4	-			**NTB4***	4SE3	TB4	3NWTB4	4KO8	AC4
6	-			**NTB6***	6SE3	TB6	3NWTB6	6KO8	AC6
10	-			**NTB10***	10SE3	TB10	3NWTB10	10KO8	AC10
16	-			**NTB16***	16SE3	TB16	3NWTB16	16KO8	AC16
20	-			**NTB20***	20SE3	TB20	3NWTB20	20KO8	AC20
25	-	97	–	**NTB25***	25SE3	TB25	3NWTB25	25KO8	AC25
32	-			**NTB32***	32SE3	TB32	3NWTB32	32KO8	AC32
40	-			**NTB40***	40SE3	TB40	3NWTB40	40KO8	BC40
50	-			**NTB50***	50SE3	TB50	3NWTB50	50KO8	BC50
63	-			**NTB63***	63SE3	TB63	3NWTB63	63KO8	BC63
63	80			**NTB63M80**	63SE4M80	TB63M80	3NWTB63M80	-	-
63	100			**NTB63M100**	63SE4M100	TB63M100	3NWTB63M100	-	-
2	-			**NTBC2**	2SF3	TBC2	3NW TBC2	2KO9	AD2
4	-			**NTBC4**	4SF3	TBC4	3NW TBC4	4KO9	AD4
6	-			**NTBC6**	6SF3	TBC6	3NW TBC6	6KO9	AD6
10	-			**NTBC10**	10SF3	TBC10	3NW TBC10	10KO9	AD10
16	-			**NTBC16**	16SF3	TBC16	3NW TBC16	16KO9	AD16
20	-			**NTBC20**	20SF3	TBC20	3NW TBC20	20KO9	AD20
25	-	111	B1	**NTBC25**	25SF3	TBC25	3NW TBC25	25KO9	AD25
32	-			**NTBC32**	32SF3	TBC32	3NW TBC32	32KO9	AD32
40	-			**NTBC40**	40SF3	TBC40	3NW TBC40	40KO9	AD40
50	-			**NTBC50**	50SF3	TBC50	3NW TBC50	50KO9	AD50
63	-			**NTBC63**	63SF3	TBC63	3NW TBC63	63KO9	AD63
63	80			**NTBC63M80**	63SF4M80	TBC63M80	3NW TBC63M80	-	-
63	100			**NTBC63M100**	63SF4M100	TBC63M100	3NW TBC63M100	-	-
80	-			**NTC80**	80SF5	TC80	3NW TC80	80LO9	CD80
100	-	111	B1	**NTC100**	100SF5	TC100	3NW TC100	100LO9	CD100
100	125			**NTC100M125**	100SF5M125	TC100M125	3NW TC100M125	100M125LO9	CD100M125
100	160			**NTC100M160**	100SF5M160	TC100M160	3NW TC100M160	100M160LO9	CD100M160
100	200			**NTC100M200**	100SF5M200				
125	-			**NTF125**	125SF6	TF125	3NW TF125	125MO9	DD125
160	-	111	B2	**NTF160**	160SF6	TF160	3NW TF160	160MO9	DD160
200	-			**NTF200**	200SF6	TF200	3NW TF200	200MO9	DD200
200	250			**NTF200M250**	200SF6M250	TF200M250	3NW TF200M250	200M250MO9	DD200M250
200	315			**NTF200M315**	200SF6M315	TF200M315	3NW TF200M315	200M315M09	
250	-	111	B3	**NTKF250**	250SF7	TKF250	3NW TKF250	250NO9	ED250
315	-			**NTKF315**	315SF7	TKF315	3NW TKF315	315NO9	ED315
315	400			**NTKF315M400**	315SF7M400		3NW TKF315M400		
250	-	133	–	**NTKM250**	250SG7	TKM250	3NW TKM250	250N11	EFS250
315	-			**NTKM315**	315SG7	TKM315	3NW TKM315	315N11	EFS315
355	-	111	B4	**NTMF355**	355SF8	TMF355	3NW TMF355	355PO9	ED355
400	-			**NTMF400**	400SF8	TMF400	3NW TMF400	400PO9	ED400
355	-	133/ 184	C1	**NTM355**	355SH8	TM355	3NW TM355	355P11	EF355
400	-			**NTM400**	400SH8	TM400	3NW TM400	400P11	EF400
450	-			**NTTM450**	450SH9	TTM450	3NW TTM450	450R11	FF450
500	-	133/ 184	C2	**NTTM500**	500SH9	TTM500	3NW TTM500	500R11	FF500
560	-			**NTTM560**	560SH9	TTM560	3NW TTM560	560R11	GF550
630	-			**NTTM630**	630SH9	TTM630	3NW TTM630	630R11	GF630
450		165/ 229	–	**NTT450**	450SY9	TT450	3NWTT450	450R12	FG450
500				**NTT500**	500SY9	TT500	3NWTT500	500R12	FG500
560				**NTT560**	560SY9	TT560	3NWTT560	560R12	FG560
630				**NTT630**	630SY9	TT630	3NWTT630	630R12	FG630
710		165/ 229	–	**NTLT710**	710SY10	TLT710	3NWTLT710	710S12	GG710
800				**NTLT800**	800SY10	TLT800	3NWTLT800	800S12	GG800
710	-	133/ 184	C3	**NTLM710**	710SH10	TLM710	3NW TLM710	700S11	GF710
800	-			**NTLM800**	800SH10	TLM800	3NW TLM800	800S11	GF800
1000	-	149	D1	**NTXU1000**	1000SJ11	TXU1000	-	1000U44	GH1000
1250	-			**NTXU1250**	1250SH11	TXU1250	-	1250U44	GH1250

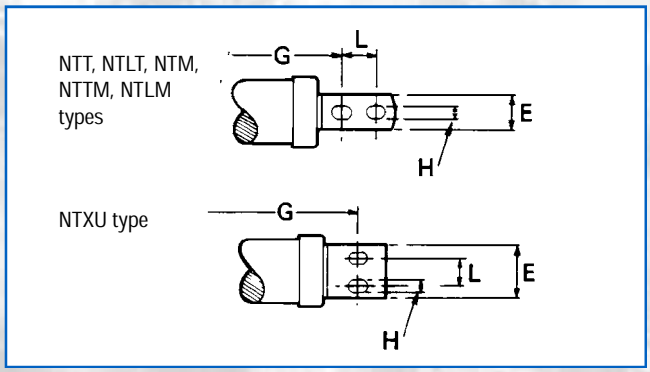
NHP COMPACT

HRC cartridge fuse-links

Dimensions (mm)

Fuse link type	A max. mm	B max. mm	D max. mm	E mm	F mm	G nom. mm	H mm	J mm	L mm
NNIT	36	14	55	11	0.8	44.5	4.8	-	-
NTIA } NTIS	56	21	86	9	1.2	73	5.5	7.5	-
NTIS(M)	45	27	90	13	1.6	73	5.8	10	-
NOS	45	27	90	13	1.6	73	5.8	10	-
NTCP	48	27	111	16	3.2	94	9	-	-
NTCP(M)	48	30	111	19	3.2	94	9	-	-
NTFP	48	30	111	19	3.2	94	9	-	-
NTFP(M)	48	40	111	19	3.2	94	9	-	-
NTB	57	21	114	13	1.6	97	7.2	11	-
NTB...M...	57	26	116	13	1.6	97	7.2	11	-
NTBC	57	21	134	16	2.0	111	8.7	16	-
NTBC...M...	58	26	136	16	3.2	111	8.7	16	-
NTC	48	27	134	16	3.2	111	9	12.5	-
NTF	48	30	137	19	3.2	111	9	12.5	-
NTKF	48	40	137	19	3.2	111	9	12.5	-
NTMF	51	40	138	25	5.0	111	9	12.5	-
NTKM	48	40	159	19	3.2	133	10.5	14	-
NTM	51	40	211	25	5.0	133/184	10.5	14	25.4
NTTM	59	53	212	25	6.3	133/184	10.5	14	25.4
NTLM	84	82	210	26	10	133/184	10.3	16	25.4
NTT	83	74	267	38	6.5	165	10.3	16	32
NTLT	84	82	267	38	10	165	10.3	16	32
NTXU	83	100	198	63.5	9.5	149	14.3	19	32





NHP COMPACT

I^2t characteristics

BS fuses I^2t data

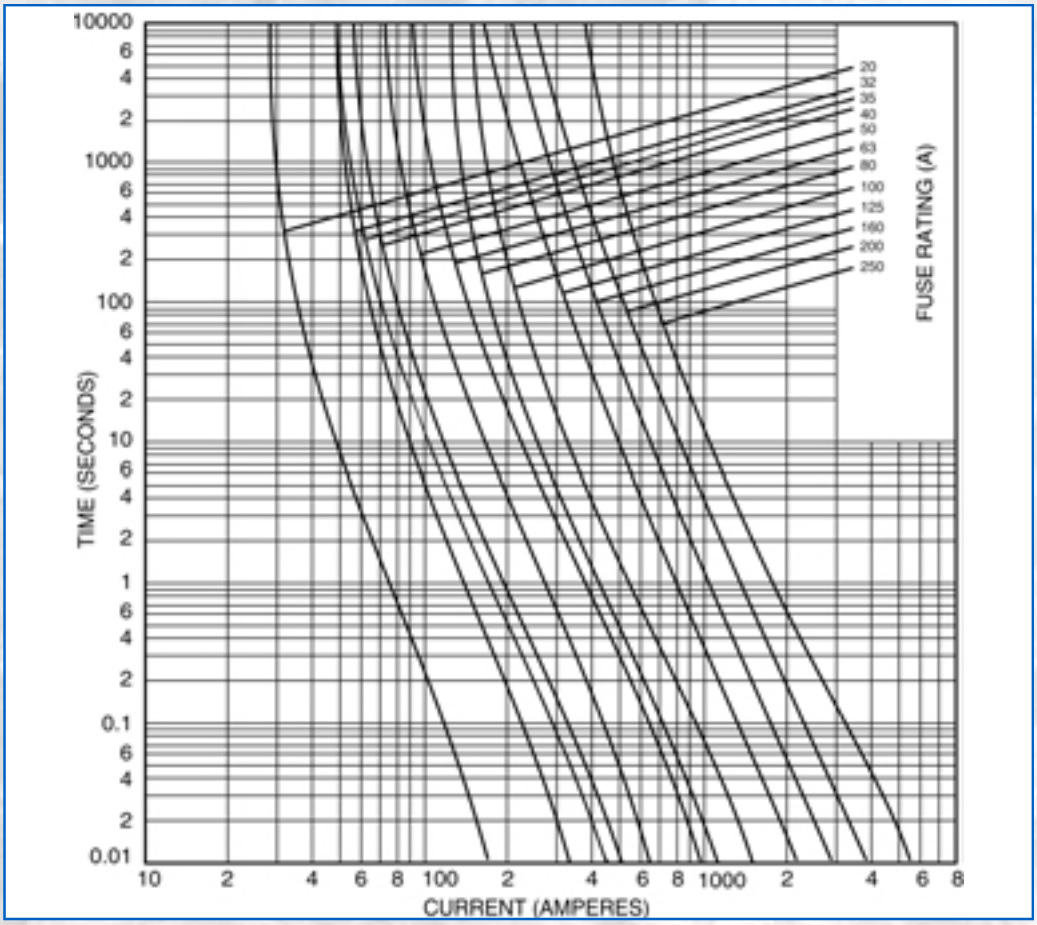
I^2t characteristics

Rating (amperes)	I^2t pre-arcing	I^2t total @ 240 volts	I^2t total @ 415 volts
2	2	2	4
4	10	15	21
6	34	52	74
10	188	289	408
16	92	211	412
20	155	355	690
20M25	574	1084	1809
20M32	574	1561	2605
25	826	1084	1809
32	826	1561	2605
35	1200	2400	4100
32M40	2482	4416	7019
32M50	3305	5879	9345
32M63	5875	10452	16612
40	2482	4416	7019
50	3305	5879	9345
63	5875	10452	16612
80 & 63M80	7800	15500	26000
100 & 63M100	14000	28000	46000
125 & 100M125	30000	51000	75500
160 & 100M160	58500	99000	145000
200 & 100M200	120000	205000	300000
250 & 200M250	210000	360000	530000
315 & 200M315	270000	460000	680000
355	365000	620000	915000
400 & 315M400	480000	820000	1200000
450	755000	1300000	1900000
500	1100000	1850000	2700000
560	1200000	2400000	4000000
630	1550000	3100000	5150000
710	1903565	2992861	4306813
800	3820349	6006505	8643534
1000	7000000	1500000	16000000
1250	12000000	20500000	30000000

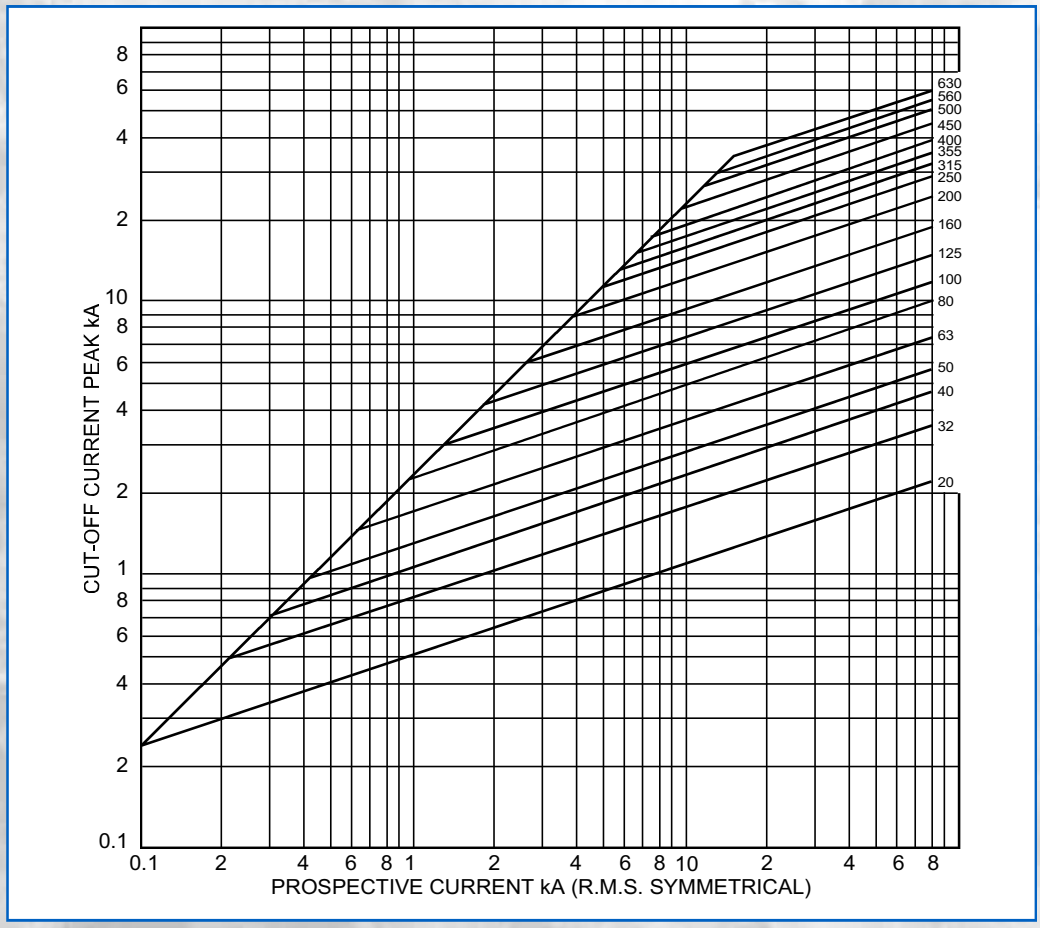
NHP COMPACT

Fuse curves

BS fuse curves



NHP Compact BS fuses from 20 to 250 amps



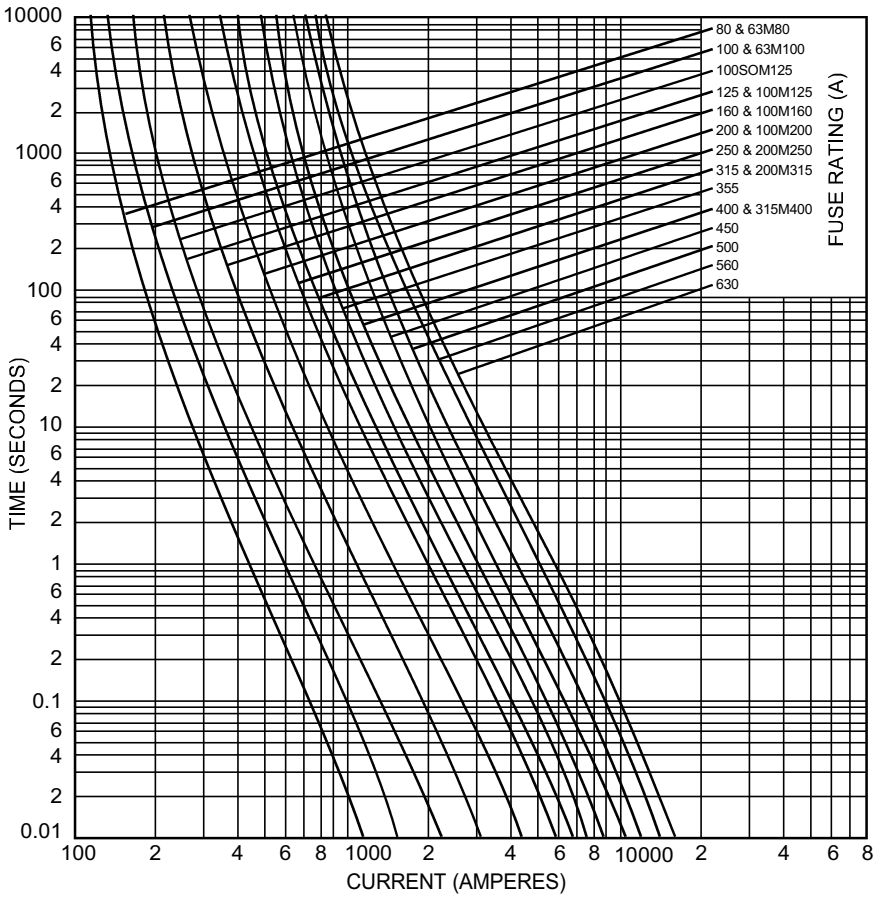
NHP Compact BS fuses cut-off current data from 20 to 630 amps

NHP COMPACT

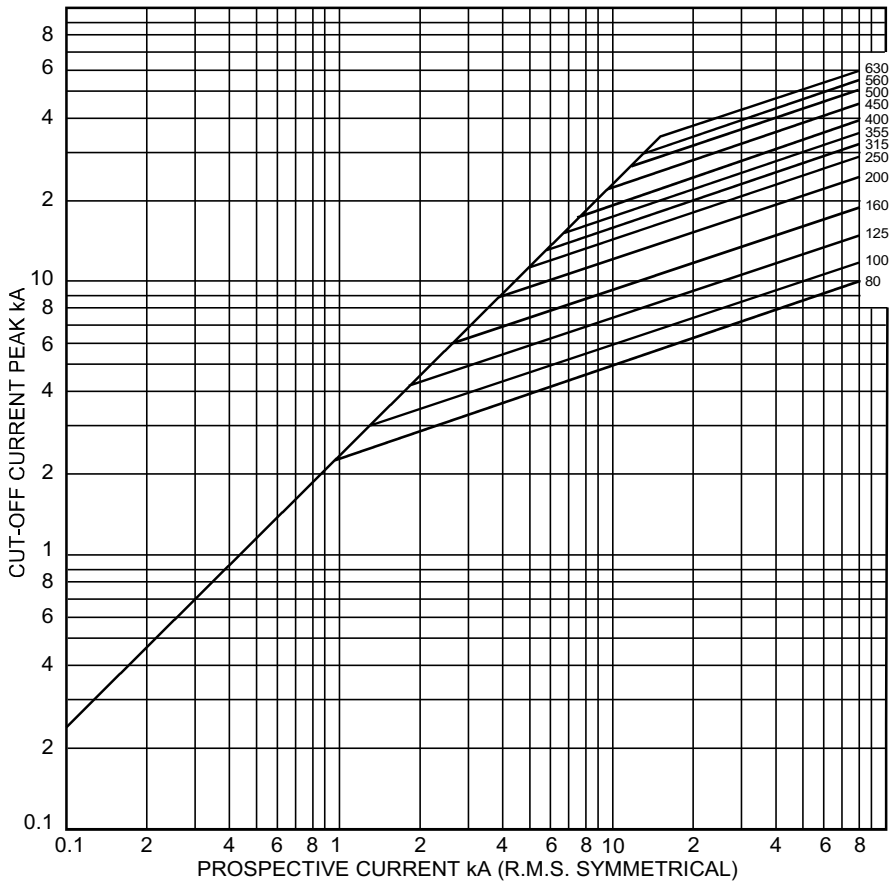
Fuse curves

BS fuse curves

NHP Compact BS fuses from 80A to 630 amps (including motor rated fuses)

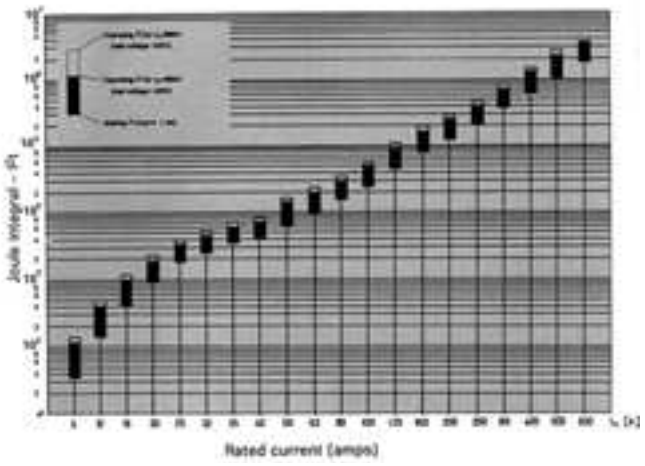


NHP Compact BS fuses cut-off current data from 80 to 630 amps



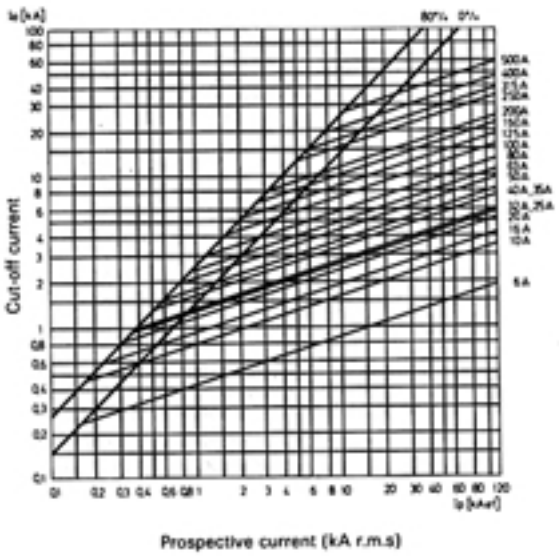
NHP COMPACT

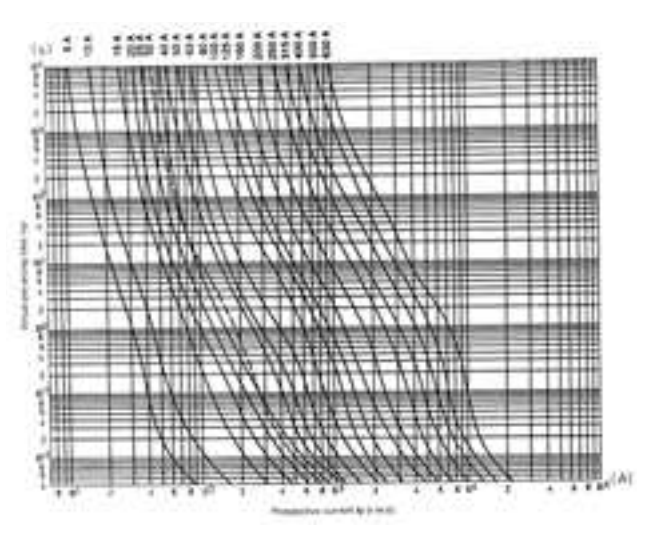
DIN fuses curves and data



NHP Compact DIN fuses
Pre-arcing and Total I²t energies, from 6 to 630 amps

NHP Compact DIN fuses
cut-off current data from 6 to 500 amps





NHP Compact DIN fuses
Fuse curves from 6 to 630 amps

3.3 SOFT STARTER

- DANFOSS – **FC-202P75KT4E55H1TGCXXXSXXXXAXBXCXXXXDX (131L0262) + LCP KIT (130B1117)** Variable Speed Drive

VLT® AQUA Drive Type FC 202

Key features, product benefits and value summary

Danfoss Drives' unsurpassed experience in advanced drive technologies for water and wastewater applications makes VLT® AQUA Drive the perfect match for pumps and blowers in modern water, wastewater and irrigation systems.

The perfect match for:

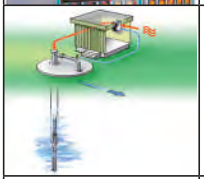
- Water supply
- Wastewater treatment
- District heating
- Irrigation

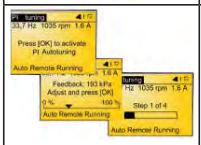
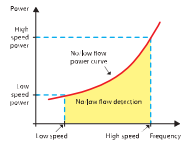
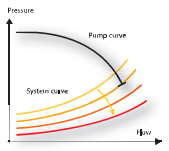
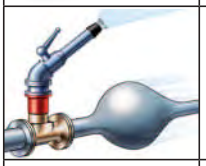
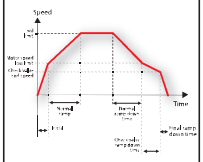
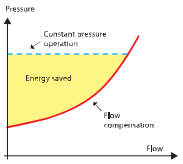
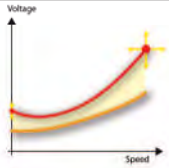
Power range:

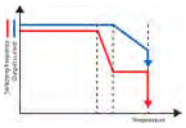
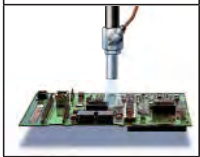
1 x 200 – 240 V AC: ..... 1.1 – 22 kW
1 x 380 – 480 V AC: ..... 7.5 – 37 kW
3 x 200 – 240 V AC: .....0.25 – 45 kW
3 x 380 – 480 V AC: .....0.37 – 1000 kW
3 x 525 – 690 V AC: .....11 – 1400 kW

Features	Benefits
Dedicated features	
• Dry run detection	• Protects the pump
• Flow compensation function	• Saves energy
• 2 step ramps (initial ramp)	• Protects deep well pumps
• Pipe fill mode	• Eliminates water hammering
• Built-in motor alternation feature	• Duty-stand by operation, cost reduction
• Sleep Mode	• Saves energy
• No/low flow detection	• Protects the pump
• End of pump-curve detection	• Protects the pump, leakage detection
• Pump cascade controller	• Lower equipment cost
• Master/f llower control	• High performance pump systems
Energy saving	**– Less operation cost**
• VLT® efficiency (98%)	• Saves energy
• Automatic Energy Optimisation (AEO)	• Saves 5–15% energy
• Sleep Mode function	• Saves energy
Reliable	**– Maximum uptime**
• IP 20 – IP 66 enclosures	• Outdoor mounting
• All power sizes available in IP 54/55 enclosures	• Broad usability
• Password protection	• Reliable operation
• Mains disconnect switch	• No need for external switch
• Optional, built-in RFI suppression	• No need for external modules
• Built-in Smart Logic Controller	• Often makes PLC omissible
• One Wire safe stop	• Safe operation/less wiring
• Max. ambient temperature up to 50° C without derating	• Reduced need for cooling
User-friendly	**– Save initial and operation cost**
• Award winning control panel (LCP)	• Effective commissioning and operation
• One drive type for the full power range	• Less learning required
• Intuitive user interface	• Time saved
• Integrated Real Time Clock	• Lower equipment cost
• Modular design	• Enables fast installation of options
• Auto tuning of PI-controllers	• Time saved
• Payback time indication	• Less worries

VLT®
THE REAL DRIVE

	Feature	Function / benefit	Value
	Extension of high power range up to 1.4 MW	• Now possible to provide solution for high power applications (including MV using step up/step down transformers)	• One drive / supplier for all applications = less confusion & lower spares / inventory cost
	Full range of IP55/IP66 and NEMA Type 4X enclosure up to 90 kW	• Directly wall mounted in any environment	• No requirement for panels
	More compact IP55/IP66 and NEMA Type 4X enclosure (A4) for 0.37 – 4.0 kW	• 32% smaller than existing A5 enclosure • Tested outdoor installation • Easier installation • Continuous operation at 50° C	• No need for additional panel of outdoor installation • No need for additional cooling in hot environments
	0.37 – 7.5 kW units are now available in IP20 book style enclosures	• Less panel space required	• Smaller panels & lower panel cost
	1.1 – 22 kW single phase 200 – 240 V units available for remote locations	• Simple conversion from single phase to three phase without transformer	• Reduced installation cost
	Mains disconnect switch and fuses are available as factory option	• Local mains isolation now possible where required, without the need for separate isolator switch, fuses, enclosure & wiring	• Reduces total installation / wiring cost & simplifies isolation process
	Local control panel now with graphical display plus "Info" & fault log buttons	• Simplifies set-up and status / fault diagnostics through graphical means, on board manual and fault data logger	• Lower set-up & fault diagnostic time / cost, plus increases drive availability
	New plug-in options now include I/O, Modbus TCP, Ethernet IP & connection of external 24 V dc supply etc.	• Increased interface flexibility + universal communication compatibility with enhanced security via back-up supply	• No external interface options / gateways required = lower system / integration cost
	Smart Logic Controller is built-in as standard	• Now possible to incorporate control using basic sequential user-defined actions determined by user-defined events • Example: Automatic deragging of wastewater pumping stations	• Save on external PLC / relays, comparators, timers, panel space and wiring cost, etc.

	Feature	Function / benefit	Value
	3/2 pump cascade controller is standard (6 or 8 pump controller are plug-in options, including master/follower operation)	• Basic 3 pump standard cascade control or 2 pump cascade control with lead pump alternation is now possible as standard	• Save on external pump controller and wiring cost on basic 3/2 pump applications • Increased energy savings using master/follower functionality
	PI Controllers now include auto-tuning function	• Functions by introducing step-wise changes whilst operating at steady state & then monitoring the feedback to tune PI	• Save on set-up time / cost + potentially improve system performance and efficiency
	Low flow / dry run detection now includes automatic set-up option to generate no flow power curve	• When enabled automatically runs pump to ~50% & 85% speed, storing measured power with shut off valve closed	• Save set-up time / cost + potentially improve pump protection
	End of curve monitoring / broken pipe detection now available in closed loop mode	• Shuts system down if feedback signal is below setpoint for user- defined period, with output frequency at maximum	• Protects pump impeller from damage & potentially reduces piping damage & water loss
	Horizontal pipe fill mode is now available in addition to vertical pipe fill mode (closed loop)	• Now functions with fill speed for user-defined time on horizontal pipes, in addition to fill rate on vertical pipes	• Protects piping from mechanical shock /water hammer damage & water loss
	Check valve ramp & initial/final ramp down functions are now available	• Initial and final ramp secures cooling flow in pump and prevents over heating • Independent ramp for slow closing of check valve allows the use of standard check valves	• Protects check valve & thrust bearings from damage / reduces water hammer damage • Using a standard check valve in stead of special soft-close valve will save 60% on the valve cost or up to 16% of the drive cost
	Flow Compensation	• Programs the system curve • Closed loop PID decreases the speed depending on pressure • Flow compensation decreases the setpoint	• Energy saving can be up to 40%
	Automatic Energy Optimiser is available in constant torque mode as well as variable torque	• Ensures the motor is optimally magnetised at all speeds / loads, for maximum efficiency	• Improves system efficiency and reduces operating cost, in particular on lightly loaded motors
	Sleep mode	• Saves energy when pump is in standby	• Reduced energy cost

	Feature	Function / benefit	Value
	Real time clock is now incorporated as standard with user definable text	• It is possible to program 10 x time-based functions and 20 x preventative maintenance actions (Battery backup optional)	• Saves cost for external timers & controls & improves system reliability
	MCT10 now includes Wizard function for Cascade Controller	• Provides simple step by step graphic procedure to set-up cascade controller to match number of pumps, feedback etc.	• Save on set-up time / cost + improve system security with back-up of all settings
	Programming and monitoring via USB port	• Standard USB port for PC connectivity	• No cost for adaptors • Reduced time for setup
	Standard DC link coils or optional Low Harmonics Drive (LHD) and Advanced Harmonics Filters (AHF) for optimum harmonics mitigation	• Selectable active or passive harmonics mitigation • Optimised installation cost and performance	• Reduce transformer and cable cost
	Built-in RFI filters as standard and operation with long motor cables up to 300 m unscreened motor cable or 150 m screened cable	• Operation of deepwell pumps without output transformer • Central mounting in large plants • No problems with high frequency noise in the installation	• Reduced installation cost • Improved reliability of communications
	Back channel cooling on full product range • Panel through mount from 0.25 to 90 kW • Factory designed back channel cooling from 110 kW to 1.4 MW	• Reduced requirement for panel cooling • Control room air conditioning can be reduced	• 80% reduction of heating in panels
	High drive efficiency	• Reduced heat loss from drives in panels and motor control centres	• 20% lower heat loss than previous generation of VLT® drives
	High ambient temperature	• 50° C ambient temperature without derating the drive • Reduced risk of nuisance tripping	• Reduced cost for air conditioning in high temperature areas
	Corrosion resistant as standard in compliance with level 3C2 according to IEC 60721-3-3. Protection level 3C3 is factory option.	• Reduced risk of corrosion of boards and terminals	• Longer life time of drives

Danfoss Drives, Ulsnaes 1, DK-6300 Graasten, Denmark, Tel. +45 74 88 22 22, Fax +45 74 65 25 80, www.danfoss.com/drives • E-mail: info@danfoss.com

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MAKING MODERN LIVING POSSIBLE

VLT® AQUA Drive

The ultimate solution for Water, Wastewater & Irrigation

VLT® THE REAL DRIVE

The VLT® AQUA Drive is innovative

– Reduces system, installation and operating costs

Danfoss VLT® AQUA Drive is dedicated to water and wastewater applications. With a wide range of powerful standard and optional features, the VLT® AQUA Drive provides the lowest overall cost of ownership for water and wastewater applications.

Protects the environment

The growing need for clean water and energy conservation is rapidly increasing the pressure on global fresh water resources, wastewater treatment, recycling and power generation. VLT® AQUA Drive is designed to enhance system operation, protect equipment, reduce chemical consumption and water loss, while providing significant energy savings. VLT® AQUA Drive is the ultimate solution for all water, wastewater and recycling processes.

Save energy

The VLT® AQUA Drive offers considerable energy savings:

- VLT® efficiency (up to 98%)
  Sleep Mode
  Automatic Energy Optimisation
  AEO: Typically 3-5% energy saving
  Flow compensation, lowering pressure set point and thus energy consumption under low flow conditions

Save space

The compact design of the VLT® AQUA Drive makes it easily fit in even small installation spaces.

Built-in DC coils for harmonic suppression. No need for external AC coils

- Optional, built-in RFI filters in the whole power range
  Intelligent cooling concept reduces need for installation space.

Save cost and protect your system

with a series of pump-specific features:

Cascade controller
Dry run detection
End of curve detection
Motor alternation

2-step ramps
(initial and final ramp)
Check valve protection
Safe stop
Low flow detection
Pipe fill mode
Sleep mode
Real-time clock
Password protection
Overload trip protection
Smart Logic Controller

Can be set to either variable or constant torque operation in the full speed range.

Save panel space
NEMA/UL Type 12 (IP 54/55) enclosure solution is available in the whole power range.

Up to 90 kW, the VLT® AQUA Drive can even be delivered in an IP 66 version.

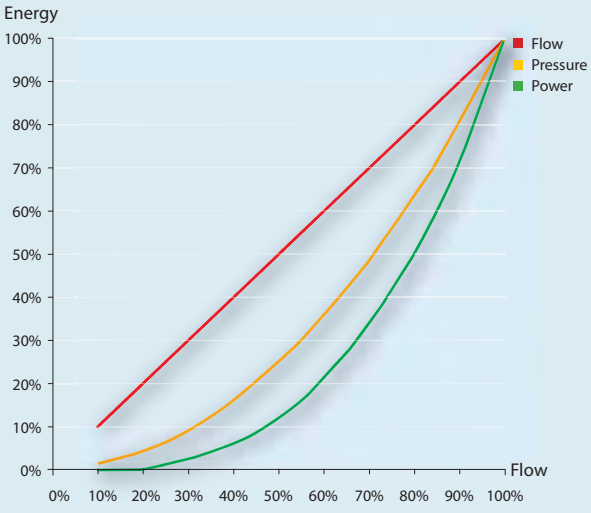
Save time
VLT® AQUA Drive is designed with the installer and operator in mind in order to save time on installation, commissioning and maintenance.

Intuitive user interface with the award-winning control panel (LCP)
Same user interface for the full power range
Modular VLT® design enables fast installation of options
Auto tuning of PI controllers
Robust design and efficient monitoring make the VLT® AQUA Drive maintenance free.

Dedicated to water and wastewater
Danfoss Drives' unequalled experience was used to make the VLT® AQUA Drive the perfect match for AC motor driven applications in modern water and wastewater systems – also for retrofitting.

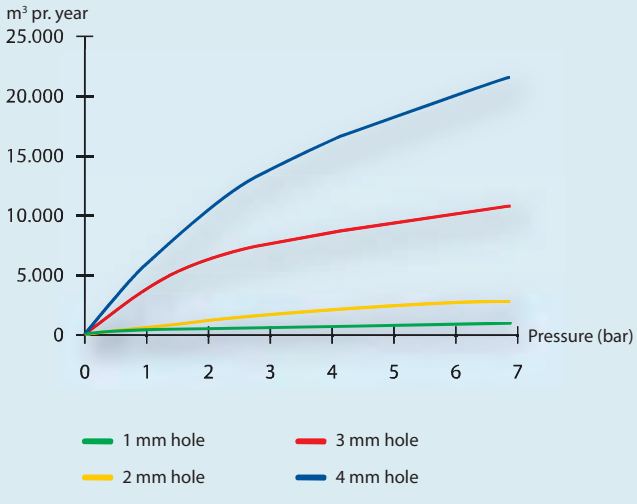
Water and Wastewater is a global business area for Danfoss Drives and you will find our dedicated sales and service staff all over the world 24 hours a day.

Ideal Energy Consumption at Varying Speed



Energy savings using a VLT® AQUA Drive are achieved even with a modest reduction in speed.

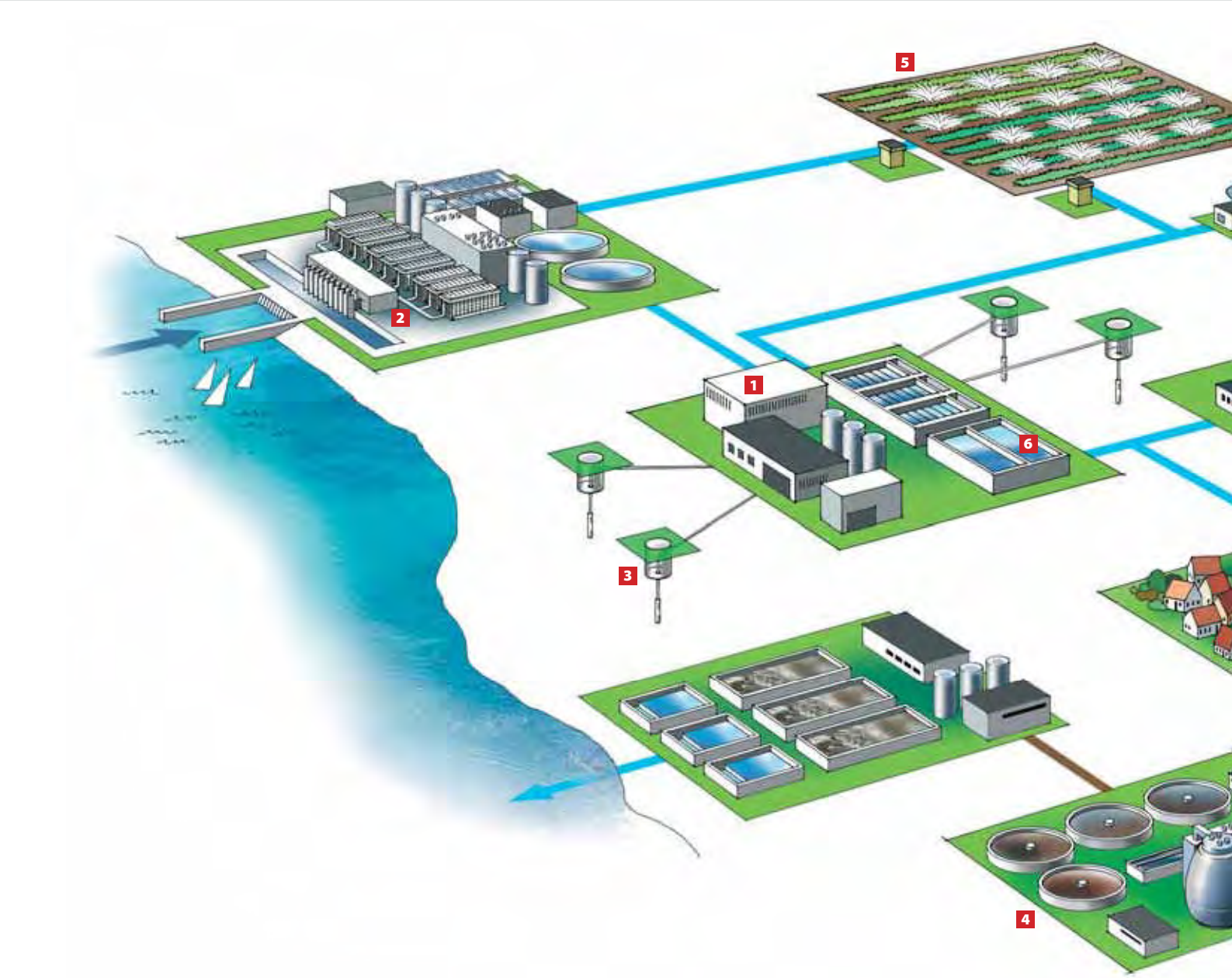
Distribution System Water Losses



Reducing water losses by lowering system pressure becomes increasingly effective as the size of line breaks increase.

Water and Wastewater processes

– Improved control using less energy

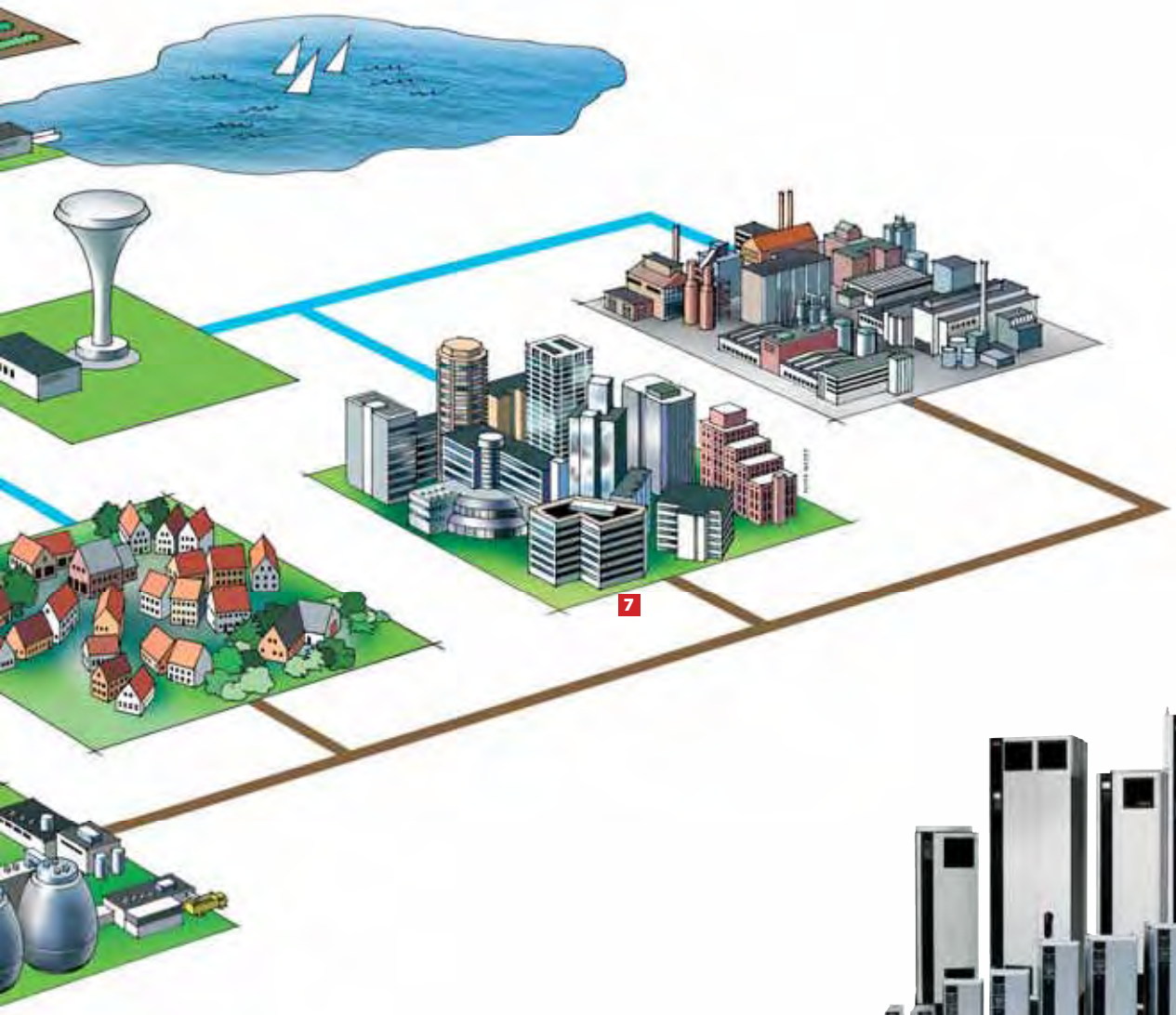


1 Water treatment plants
Meeting the varying flow demands on a daily or hourly basis requires reliable control. The VLT® AQUA Drive software provides unique pump control features that will help control even the most demanding applications.

2 Desalination plants
Desalination plants are used to provide clean drinking water from sea water or brackish water. In desalination plants saline environments often requires good protection against corrosion. The optional high grade PCB coating and a mechanical design, which separates the electronics from the cooling air, makes the VLT® AQUA Drive the perfect solution for this application.

3 Groundwater pumps
Submersible deep well pumps need fast start and stop capability, precise control and protection against running dry. The built-in dry run detection and the initial and final ramp ramps make the VLT® AQUA Drive handle such applications to perfection.

4 Wastewater plants
Fluctuations in flow can disrupt efficient process control, increase costs and equipment wear due to a higher number of starts and stops, and adversely affect effluent quality. Using the VLT® AQUA Drive on pumps, blowers and other equipment will lead to better process control and reduce energy consumption. The VLT® AQUA Drive can also provide



tighter control of chemical feed pumps, mixers and other equipment.

5 Irrigation systems
The irrigation market is focusing more and more on efficiency and energy savings for water management. Meeting these demands requires precise pressure and flow control. The built-in pump control features makes VLT® AQUA Drive a perfect match for irrigation in rural areas. It even offers a special pipe fill function that prevents water hammering and reduces leakage when empty pipes are filled.

6 Distribution
As areas become more populated, the increasing demand for reliable and precise pressure control becomes a challenge to many communities. The VLT® AQUA Drive has innovative pumping functions to assist in maintaining precise pressure and flow while reducing system leakage and energy consumption. In many cases, it can also provide a cost-effective alternative to water towers. The Cascade Controller has advanced distribution functions built-in.

7 Water fountains and pools
Water fountains are used to enhance the aesthetics of buildings and parks nearly everywhere. In these applications, the VLT® AQUA Drive can provide energy efficiency, accurate control and even meticulously timed sequencing for a dramatic effect.

The modular VLT® AQUA Drive

Extremely compact panel mount cabinets

C3 – frame IP 20 compact panel mounting drive.

Mains and motor cable terminals are located in the bottom of the cabinet for fast and easy installation.

The IP 20 enclosure has two individually controlled fans for maximum reliability.

Only a minimum of external cooling air passes the electronic components, which increases the lifetime.

The aluminium front hinged door ensures easy access to additional I/O options and control wiring.

IP 21/Type 1 protection can be delivered as a kit solution or as a specific IP 21 drive with easy access plastic cover with snap locks.

Extremely robust cabinets for harsh environments

The Danfoss IP 55/NEMA 12 or IP 66 are designed for use in harsh environments with gas, pollution and dust. The electronics are completely separated from the cooling air in order to increase the lifetime.

All terminals and EMC connections are located inside the drive under the robust metal cover for maximum protection.

If ordered as IP 66 the heat sink is protected against corrosion (IP 66 rating is available up to 90 kW).

1 Fieldbus option
- Modbus RTU (std.)
- Modbus TCP IP
- PROFIBUS
- DeviceNet
- EtherNet/IP
- PROFINET

2 Local Control Panel (LCP)
Choose numerical, graphical or no display

3 I/O option
- General Purpose I/O (3DI + 2AI + 2DO + 1AO)
- Cascade controller (2 – 8 pumps)
- Sensor input (3 x PT100/1000 + 1AI)
- Relay output (3 x relays)

4 24 V supply option

5 RFI filter
Built-in RFI Filter for long motor cables according to the IEC 61800-3 and EN 55011 standards.

6 AC mains disconnect
(Factory mounted option)

7 Input mains option
V late configurations are available including fuses, mains switch (disconnect), or RFI filter.Input plates are field adaptable if options need to be added after installation.

8 Coated PCB's

Durable in aggressive environments
In water and wastewater applications it is often recommended to protect the drive with coated PCB's. As standard the VLT® AQUA Drive complies with level 3C2 according to IEC 60721-3-3. Protection level 3C3 is optionally delivered from factory.

The option protects significantly better against chlorine, hydrogen sulphide, ammonia and other gasses.

9 Unique cooling concept
- No ambient air flow over electronics up to 90 kW
- Above 90 kW designed with back channel cooling (85% heat dissipated via back channel)

10 Advanced cascade controller option
Controls up to 9 pumps

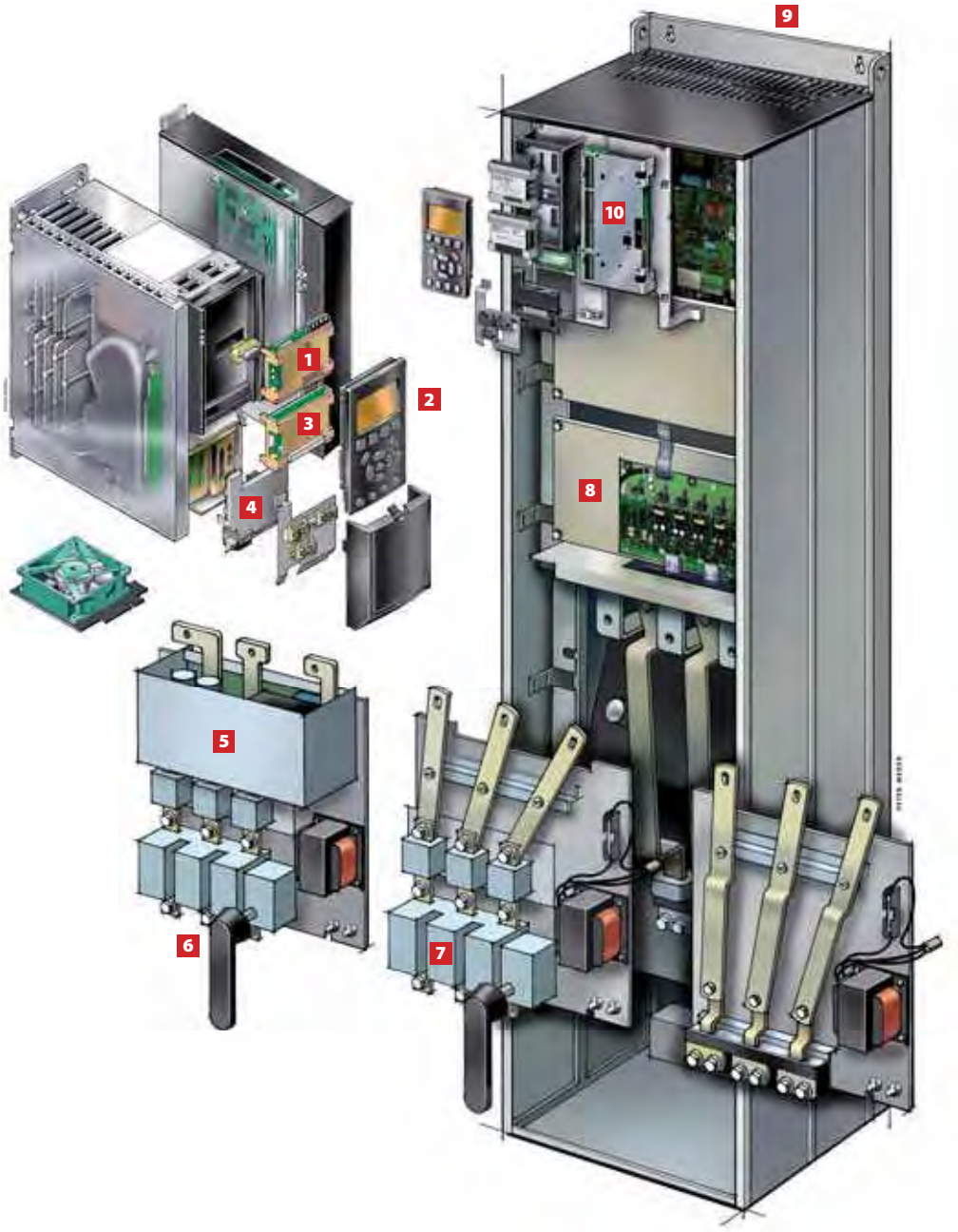
VLT® quality up to 1.4 MW
The VLT® AQUA Drive is available from 0.25 kW to 1.4 MW.

Drive experience since 1968 lies behind the clever design of VLT® drives. All enclosures are mechanically designed with focus on:

Robustness
Easy access and installation
Intelligent cooling
High ambient temperatures
Long service life

All VLT® AQUA Drives share technology, user interface and basic features with the rest of the new VLT® generation to assure well documented and proven quality.

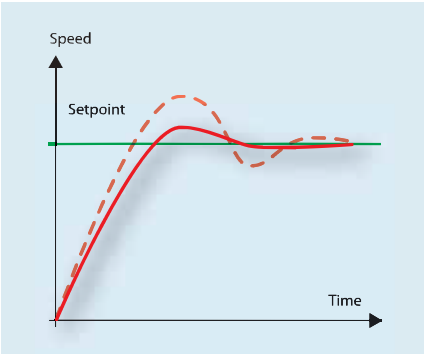
The modular design of the VLT® AQUA Drive allows even highly customised drives to be mass produced and factory tested.



Remote access via fieldbus and USB cable. VLT® Set up Software MCT 10 gives intuitive access to all parameters and has scope features with graphs showing feedback, current, frequency etc. for easy fault finding and documentation.

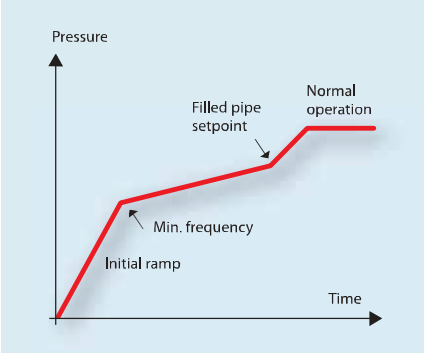
DC coils reduce harmonic noise and protect the drive. Also EMC filters are integrated (meets EN 55011 A2, A1 or B).

Dedicated water features



Auto tuning of the PI controllers
With auto tuning of the PI controllers, the drive monitors how the system reacts on corrections made by the drive – and learns from it, so that precise and stable operation is achieved quickly.

Gain factors for PI are continuously changed to compensate for changing characteristics of the loads.
This applies to each PI controller in the 4-menu sets individually.
Exact P and I settings at start-up will not be necessary – which lowers the commissioning costs.

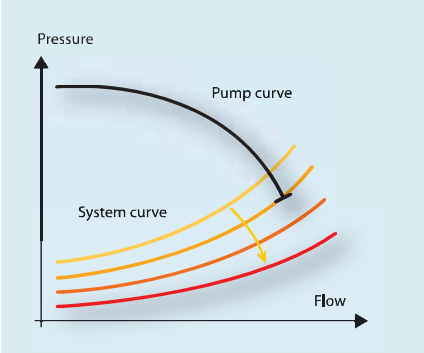


Pipe Fill Mode
Enables controlled (closed loop) filling of pipes.

Prevents water hammering, bursting water pipes or blowing off sprinkler heads.

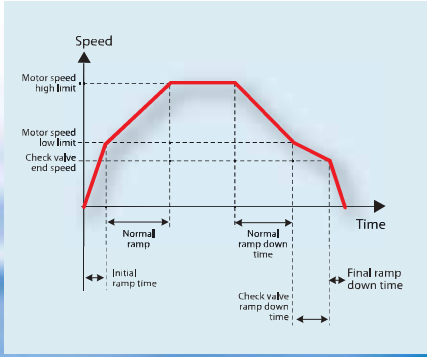
The new pipe fill mode is usable in both vertical and horizontal pipe systems.

Useful in all applications where controlled pipe filling is demanded, such as irrigation systems, water supply systems, etc.



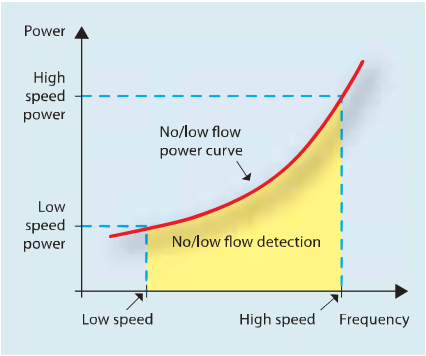
End of Pump Curve detects breaks and leakage
The feature detects breaks and leakage. End of curve triggers an alarm, shuts off the pump, or performs another programmed action

whenever a pump is found running at full speed without creating the desired pressure – a situation that can arise when a pipe breaks or leakage occurs.



Check Valve Ramp
The Check Valve Ramp prevents water hammering as the pump stops and the check valve closes.

The Check Valve Ramp slowly ramps down the pump speed around the value where the check valve ball is about to shut.

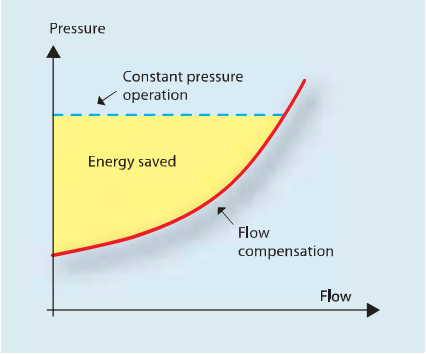


Dry Run Detection lowers maintenance costs
The VLT® AQUA Drive constantly evaluates the condition of the pump, based on internal frequency/power measurements.

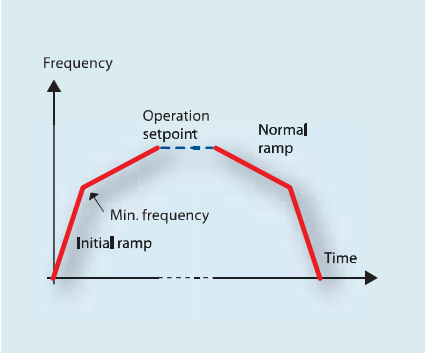
In case of a too low power consumption – indicating a no or low flow situation – the VLT® AQUA Drive will stop.

Sleep Mode
Sleep Mode keeps pump wear and power consumption to an absolute minimum. In low flow situations, the pump will boost the system pressure and then stop.

Monitoring the pressure, the VLT® AQUA Drive will restart when the pressure falls below the required level.



Flow compensation
The flow compensation feature in VLT® AQUA Drive exploits the fact that flow resistance decreases with reduced flow. The pressure set point is accordingly reduced – which saves energy.



Initial/Final Ramp
The initial ramp provides fast acceleration of pumps to minimum speed, from where the normal ramp takes over. This prevents damage to the thrust bearings on the pump.

The final ramp decelerates pumps from min. speed to stop.

Payback time indication
One of the major reasons for applying a VLT® drive is the very short payback time due to energy savings. The VLT® AQUA drive comes with a unique feature which continuously shows the remaining payback time for the investment.

Motor Alternation
This built-in logic controls alternation between two pumps in duty/stand-by applications. Motion of the stand-by pump prevents sticking of the pump. An internal timer assures equal usage of the pumps.

With an option card it is possible to control alternations between 8 pumps.

AQUA users participated in developing the user interface

1 Graphical display
- International letters and signs
- Graphical display with bar-charts
- Easy overview
- Possible to select 27 languages
- iF awarded design

2 Menu structure
- Based on the well known matrix-system in today's VLT® drives
- Easy shortcuts for the experienced user
- Edit and operate in different set-ups simultaneously

3 Other benefits
- Removable during operation
- Up- and download functionality
- IP 65 rating when mounted in a panel door
- Up to 5 different variables visible at a time

4 Illumination
- Relevant buttons are illuminated when active

5 Quick Menus
- A Danfoss defined Quick Menu
- A personal defined Quick Menu
- A Changes Made menu lists the parameters unique to your application
- A Function Setup menu provides quick and easy set-up for specific applications
- A Logging menu provides access to operation history

6 Intuitive functions
- Info ("on board manual")
- Cancel ("undo")
- Alarm log (quick access)

design award winner 2004

The VLT® AQUA Drive has an award-winning Local Control Panel and a well structured menu system that ensures fast commissioning and trouble-free operation of the many powerful functions.

VLT® Low Harmonic Drives

Danfoss Low Harmonic Drives offer well known features while reducing strain on the power grid.

Where the performance of other low harmonic technologies depends on the stability of the grid and load or affects the controlled motor, the new Danfoss VLT® Low Harmonic Drive continuously regulates the network and load conditions without affecting the connected motor.

VLT® Low Harmonic Drive are motor friendly, with output impulse & shaft voltages compatible with motors conforming to IEC 60034-17/25 & NEMA-MG1-1998 part 31.4.4.2), as per standard VLT® Drives.

The VLT® Low Harmonic Drive has the same modular build-up as Danfoss' standard high power drives and shares similar features: high energy efficiency, back-channel cooling and user-friendly operation.

The VLT® Low Harmonic Drive meets the toughest harmonic recommendations and gives the user full readout of the unit performance with regard to the grid, including a graphical overview of grid behavior.

The perfect solution for

Meeting the toughest harmonics recommendations/standards
Generator-powered installations
Installations with generator backup
Soft power grids
Installation of drives in grids with limited excess power capacity

Voltage range
380 – 480 V AC 50 – 60 Hz

Power Range
132 – 630 kW High Overload/
160 – 710 kW Normal Overload
(Matching drive frames D, E and F)

Enclosure degree
IP 21 / NEMA 1, IP 54 hybrid

Specifications

Mains supply (L1, L2, L3)	
Supply voltage	1 or 3 x 200 – 240 V ±10% 1 or 3 x 380 – 480 V ±10% 3 x 525 – 600 V ±10% 3 x 525 – 690 V ±10%
Supply frequency	50/60 Hz
True power factor (λ)	≥ 0.9
Switching on input supply L1, L2, L3	1-2 times/min.

Output data (U, V, W)	
Output voltage	0 – 100% of supply voltage
Switching on output	Unlimited
Ramp times	1 – 3600 sec
Closed loop	0 – 132 Hz

VLT® AQUA Drive can provide 110% current for 1 minute.
Higher overload rating is achieved by oversizing the drive.

Digital inputs	
Programmable digital inputs	6*
Logic	PNP or NPN
Voltage level	0–24 V
Thermistor inputs	1

**2 can be used as digital outputs*

Analog input	
Analog inputs	2
Modes	Voltage or current
Voltage level	0 – 10 V (scaleable)
Current level	0/4 – 20 mA (scaleable)

Pulse inputs	
Programmable pulse inputs	2
Voltage level	0-24 VDC (PNP positive logic)
Pulse input accuracy	(0.1 – 110 kHz)
Utilize some of the digital inputs	

Analog output	
Programmable analog outputs	1
Current range at analog output	0/4 – 20 mA
Max. load (24 V)	130 mA

Relay outputs	
Programmable relay outputs (240 VAC, 2 A and 400 VAC, 2 A)	2

Fieldbus communication	
Standard built in: FC Protocol Modbus RTU	Optional: PROFIBUS DeviceNet EtherNet/IP Modbus TCP IP PROFINET

Temperature	
Ambient temperature	Up to 55° C

Global Marine

Application options

A wide range of integrated water application options can be fitted into the drive:

Real time clock with battery back-up

General purpose I/O option:

3 digital inputs, 2 digital outputs, 1 analog current output, 2 analog voltage inputs

Relay option/cascade controller option:

3 relay outputs

External 24 VDC supply option:

24 VDC external supply can be connected to supply control and option cards

Brake chopper option:

Connected to an external brake resistor, the brake chopper limits the load on the intermediate circuit in case the motor acts as generator.

Extended cascade control of up to a total of 6 pumps

Advanced cascade control of up to a total of 9 pumps

Analogue sensor input option with up to 3 temperature sensor inputs

Power options

Danfoss Drives offers a wide range of external power options for use together with our drive in critical networks or applications:

Advanced Harmonic Filters: for applications where reducing harmonic distortion is critical

dU/dt filters: For providing motor isolation protection

Sine filters (LC filters): For noiseless motor

Complementary products

A broad range of soft starters

Decentral drive solutions

PC software

MCT 10
Ideal for commissioning and servicing the drive including guided programming of cascade controller, real time clock, smart logic controller and preventive maintenance.
The software is available for free on www.danfoss.com

VLT® Energy Box
Comprehensive energy analysis tool, shows the drive payback time

MCT 31
Harmonics calculations tool

Power, currents and enclosures ratings

		T2 200 – 240 V								T4 380 – 480 V										T6 525 – 600 V						T7 525 – 690 V				
		1 ph				3 ph				1 ph			3 ph																	
		Amp.								Amp.			Amp.							A						A.				
FC 202	kW	Amp.	IP 20	IP 55	IP 66	IP 20	IP 21	IP 55	IP 66	≤440 V	>440 V	All IP cl.*	≤440 V	>440 V	IP 00	IP 20	IP 21	IP 54	IP 55	IP 66	≤550 V	>550 V	IP 20	IP 21	IP 55	IP 66	550 V	690 V	IP 00	IP 21	IP 54/55
PK25	0.25	1.8																												
PK37	0.37	2.4											1.3	1.2																
PK55	0.55	3.5											1.8	1.6																
PK75	0.75	4.6											2.4	2.1							1.8	1.7								
P1K1	1.1	6.6	A3	A5	A5	A2	A2	A5	A5				3	2.7		A2	A2		A5	A5	2.6	2.4								
P1K5	1.5	7.5											4.1	3.4							2.9	2.7	A3	A3	A5	A5				
P2K2	2.2	10.6		B1	B1								5.6	4.8							4.1	3.9								
P3K0	3	12.5				A3	A3						7.2	6.3							5.2	4.9								
P3K7	3.7	16.7																												
P4K0	4.0												10	8.2		A2	A2		A5	A5	6.4	6.1								
P5K5	5.5	24.2		B1	B1								13	11		A3	A3		A5	A5	9.5	9	A3	A3	A5	A5				
P7K5	7.5	30.8		B2	B2	B3	B1	B1	B1	33	30	B1	16	14.5							11.5	11								
P11K	11	46.2								48	41	B2	24	21							19	18								
P15K	15	59.4		C1	C1	B4	B2	B2	B2				32	27		B3	B1		B1	B1	23	22	B3	B1	B1	B1				
P18K	18	74.8								37.5	34	C1	37.5	34							28	27								
P22K	22	88		C2	C2	C3	C1	C1	C1				44	40		B4	B2		B2	B2	36	34								
P30K	30	115											61	52							43	41	B4	B2	B2	B2				
P37K	37	143				C4	C2	C2	C2	151	135	C2	73	65							54	52								
P45K	45	170											90	80		C3	C1		C1	C1	65	62	C3	C1	C1	C1	54	52	D3	D1	D1
P55K	55												106	105							87	83					65	62			
P75K	75												147	130							105	83					87	83			
P90K	90												212	160		C4	C2		C2	C2	137	131	C4	C2	C2	C2	105	100			
P110	110												212	190	D3		D1	D1									137	131			
P132	132												260	240													162	155			
P160	160												315	302													201	192			
P200	200												395	361	D4		D2	D2									253	242			
P250	250												480	443													303	290	D4	D2	D2
P315	315												600	540													360	344			
P355	355												658	590	E2		E1	E1													
P400	400												745	678													418	400	D4	D2	D2
P450	450												800	730													470	450			
P500	500												880	780													523	500	E2	E1	E1
P560	560												990	890			F1/F3	F1/F3									596	570			
P630	630												1120	1050													630	630			
P710	710												1260	1160													763	730		F1/F3	F1/F3
P800	800												1460	1380			F2/	F4									889	850			
P900	900																										988	945			
P1M0	1000												1720	1530			F2/	F4									1108	1060		F2/F4	F2/F4
P1M2	1200																										1317	1260			
P1M4	1400																										1479	1415			

F3 is a F1 frame with options cabinet; F4 is a F2 frame with options cabinet

IP 00/Chassis | IP 20/Chassis | IP 21/NEMA Type 1 | With upgrade kit** | IP 54/NEMA Type 12 | IP 55/NEMA Type 12 | IP 66/NEMA Type 4X

** Available in all IP classes. ** MCF 101 – IP 21 upgrade kit*

Dimensions [mm]

	A2	A3	A5	B1	B2	B3	B4	C1	C2	C3	C4	D1	D2	D3	D4
H	268		420	480	650	399	520	680	770	550	660	1209	1589	1046	1327
W	90	130	242			165	230	308	370	308	370	420		408	
D	205		200	260		249	242	310	335	333		380		375	
H+	375					475	670			755	950				
W+	90	130				165	255			329	391				

H and W dimensions are with back-plate. H+ and W+ are with IP upgrade kit. D dimensions are without option A/B.

Choose configurations freely

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]		[12]	[13]	[14]	[15]	[16]	[17]	[18]
FC-202	–	–	–	–	–	–	–	–	–	–	X – SXX X –	X	–	–	– CX	–	– XX	–

[1] Application	
202	VLT® AQUA Drive FC 202

[2] Power Size	
P1K1	
P1K5	
P2K2	
P3K0	
P3K7	
P4K0	
P5K5	
P7K5	
P11K	
P15K	
P18K	
P22K	
P30K	
P37K	
P45K	
P55K	
P75K	
P90K	*See ratings data on page 12*
P110	*for power ratings*
P132	
P160	
P200	
P250	
P315	
P355	
P400	
P450	
P500	
P560	
P630	
P710	
P800	
P900	
P1M0	
P1M2	
P1M4	

[3] AC Line Voltage	
T2	1 x 200/240 V AC *(1.1 – 45 kW)*
T2	3 x 200/240 V AC *(1.1 – 45 kW)*
T4	1 x 380/480 V AC
T4	3 x 380/480 V AC
T6	3 x 525/600 V AC *(1.1 – 90 kW)*
T7	3 x 525/690 V AC *(45 kW – 1.2 MW)*

[4] Enclosure	
For cabinet mounting:	
E00	IP 00 (enclosure D3, D4)
E20	IP 20 (enclosure A2, A3, B3, B4, C3, C4)
Standalone:	
E21	IP 21 (enclosure B1, B2, C1, C2, D1, D2, E, F)
E54	IP 54 (enclosure D1, D2, E, F)
E55	IP 55 (enclosure A5, B1, B2, C1, C2)
E66	IP 66 (enclosure A5, B1, B2, C1, C2)
Special designs:	
C00	IP 00 (enclosure E00 – air duct in stainless steel)
P20	IP 20 (enclosure B4, C3, C4 – Back Plate)
E2M	IP 21 (enclosure D1, D2 – protective cover)
P21	IP 21 (enclosure as E21 – Back Plate)
E5M	IP 54 (enclosure D1, D2 – protective cover)
P55	IP 55 (enclosure as E55 – Back Plate)
E5H	Special LHD enclosure IP 54 electronic IP 21 magnetics

[5] RFI Filter (EN/IEC 61800-3)	
H1	RFI-Filter Class C1/C2 (enclosure A, B, C)
H2	RFI-Filter, Class C3 (enclosure A, B, C, D, E, F)
H3	RFI -Filter Class C1/C2 (enclosure A, B, C)
H4	RFI-Filter, Class C2 (enclosure D, E, F)
H6	RFI-Filter for Marine
HX	No RFI-Filter (enclosure A, B, C, 525 – 600 V)
L2	Low Harmonic Drive with RFI Class C3
L4	Low Harmonic Drive with RFI Class C2

[6] Braking & Safety	
X	No brake IGBT
B	Brake IGBT mounted
T	Safe stop without brake
U	With brake and Safe Stop

[7] Display (Local Control Panel)	
X	Blank faceplate, no LCP installed
G	LCP 102 – Numeric LCP installed
N	LCP 101 – Graphic LCP installed

[8] Conformal Coating (IEC 721-3-3)	
X	No conformal coating
C	Conformal coating on all PCBs

[9] Mains Input	
X	No option
1	Mains disconnect
3	Mains disconnect and fuses
5	Mains disconnect, fuses and load sharing
7	Fuses
A	Fuses & load sharing terminals
D	Load sharing terminals

[10] Cable	
X	Standard Cable Entries
O	Metric Cable Entries

[13] A Option (Fieldbus)	
AX	No fieldbus option
A0	MCA 101 – PROFIBUS DPV1
A4	MCA 104 – DeviceNet
AL	MCA 120 – PROFINET RT
AN	MCA 121 – Ethernet I/P
AQ	MCA 122 – Modbus TCP

[14] B Option (Application)	
BX	No application option
BK	MCB 101 – General Purpose I/O
BP	MCB 105 – Relay Expansion
B0	MCB 109 – Analog I/O
B4	MCB 114 – Sensor Input Option

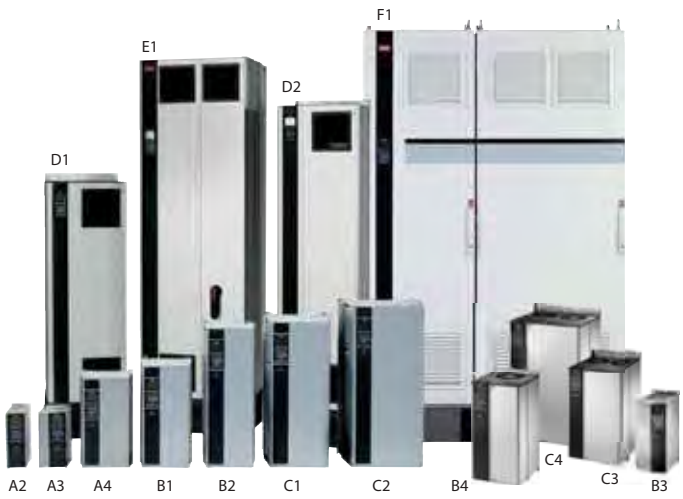
[16] C1 Option (Extended Relay)	
X	No application option
5	MCO 102 – Advanced Cascade Controller

[18] D Option (Control Power Backup Input)	
DX	No DC input installed
D0	MCB 107 24 VDC backup input

Please beware that not all combinations ar le. Find help configuring your drive with the online configurator found under: dr g.danfoss.com

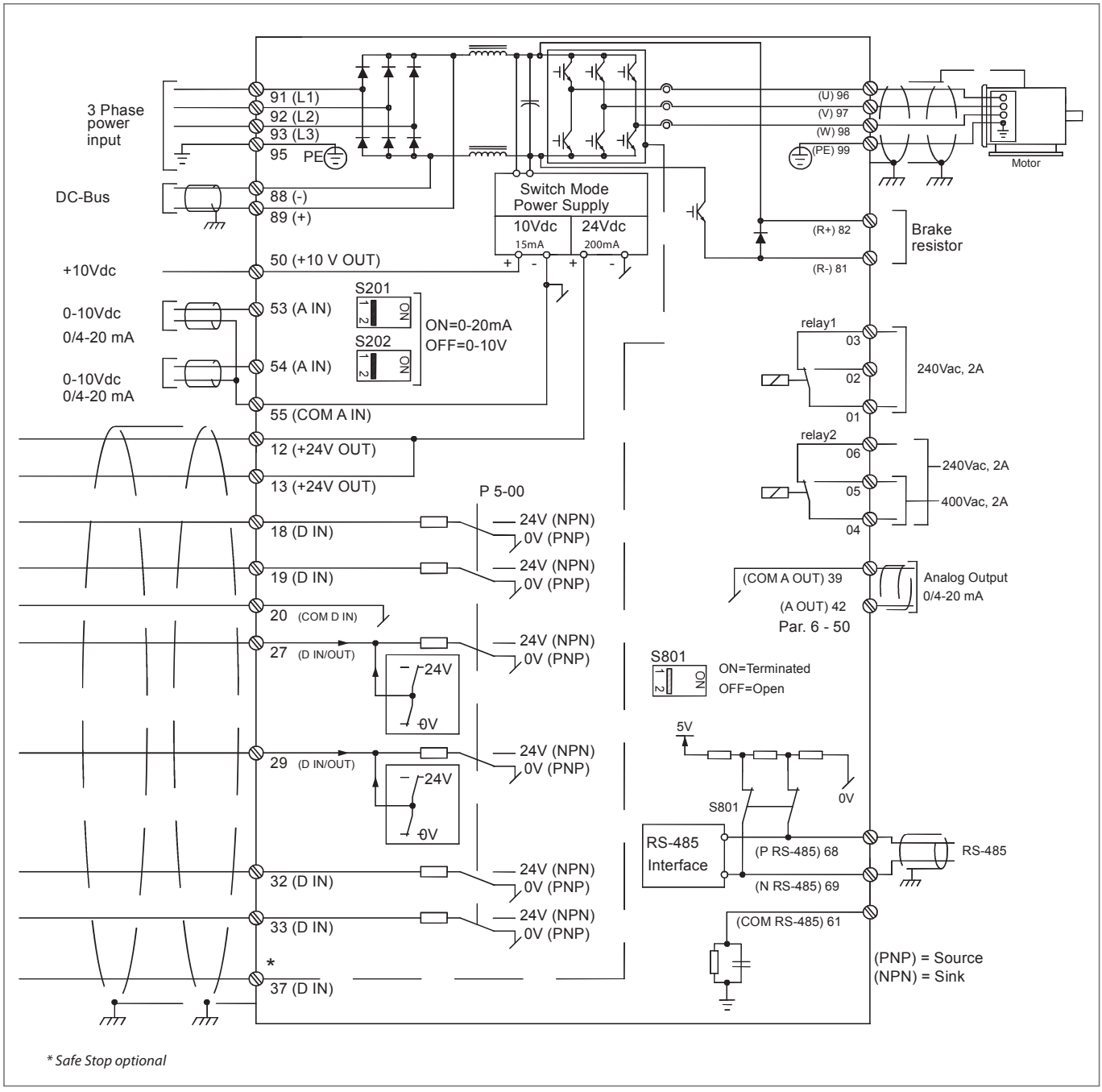
An overview showing the many ways to configure a VLT® AQUA Drive
Select the options required for your application to determine the type code for your drive. The factory then uses this type code to build the drive to your exact specifications.

You can configure online at www.danfoss.com/drives – choose "Online Configurator" – or contact your local Danfoss Drives office.



Connection examples

The numbers represent the terminals on the drive



** Safe Stop optional*

This diagram shows a typical installation of the VLT® AQUA Drive. Power is connected to the terminals 91 (L1), 92 (L2) and 93 (L3) and the motor is connected to 96 (U), 97 (V) and 98 (W).

Terminals 88 and 89 are used for load sharing between drives.
Analogue inputs can be connected to the 53 (V or mA), 54 (V or mA) terminals.

These inputs can be set up to either reference, feedback or thermistor. There are 6 digital inputs to be connected to terminals 18, 19, 27, 29, 32, and 33. Two digital input/output terminals (27 and 29) can be set up as digital outputs to show an actual status or warning. The terminal 42 analogue output can show process values such as 0 - I_{max}.

On the 68 (P+) and 69 (N-) terminals' RS 485 interface, the drive can be controlled and monitored via serial communication.

Proven AQUA Experience – world wide

Freshwater supply for the city Novi Sad, Serbia
In the city of Novi Sad in Serbia, Danfoss Drives has installed 5 x 315 kW VLT® AQUA Drives in JKP Vodovod. The company JKP Vodovod is using water from the Danube River and after purification it is provided to people of Novi Sad and local area which counts around 350,000 inhabitants. Before investments they used an old regulation with valves and there was no central monitoring of the water system. Poor regulation and high maintenance costs have forced local management for investments. Now they have seen huge savings in electrical energy, even within a short period of usage.

VLT® drives make 70 billion litres of Sydney's wastewater drinkable
Authorities in Australia hope to recycle 70 billion litres of Sydney's wastewater every year by 2015 – and Danfoss is playing a key role in helping them hit this ambitious target. Danfoss Drives will deliver 11 x 200 – 400 kW High Power drives and AHF filters for the Western Sydney Replacement Flows Project. The Aus $250 million project is Sydney's largest water recycling scheme and is a key part of the state's Metropolitan Water Plan.

Changi Water Reclamation Plant, Singapore
The Changi Water Reclamation plant is the cornerstone of the first phase of the Singapore Deep Tunnel Sewerage System. The plant is to replace six existing water reclamation plants in the long term. Danfoss VLT® drives and AHF filters were supplied for chemical and carbon scrubbers for the odour control, sedimentation tanks, bio-reactors, sedimentation tanks and solids building.

Perth Seawater Desalination Plant, Australia
VLT® drives and soft starters were chosen to run pumps when The Water Corporation of Western Australia – one of Australia's largest and most successful water service providers – invested $387 million Australian dollars in Perth Seawater Desalination Plant – the largest of its type in the Southern Hemisphere. The company provides water and wastewater services to the burgeoning city of Perth and hundreds of towns and communities spread over 2.5 million square kilometres.

Wastewater Pumping in Cartagena, Colombia
Huge energy savings and a significant carbon reduction were achieved in the preliminary water treatment stage, where solids are separated from the sewage inflow. By applying Danfoss VLT® AQUA Drives to control the levels in the holding tanks, variable speed operation of the 4 x 370 kW pumps realised a return on investment within 6 months, and ongoing energy and carbon savings for the future. The additional operation result is a more constant flow through the subsequent processes, improving overall process efficiency

Xi'An No.3 Waste Water treatment, China
Danfoss provided VLT® AQUA drives and MCD soft starters for Xi'An No.3 Wastewater treatment plant. It is one of three bundles of a retrofit project to improve the environment in Xi'An City of Shanxi province, China. The treatment capacity is 100,000 tons of sewage and 50,000 tons of recycled water per day.

Athens Wastewater Treatment Plant, Greece
VLT® drives up to 315 kW handle wastewater from a population of 5 million in Athens. VLT® operation saves approx. 25% energy. The Psyttalia Wastewater Treatment Plant treats daily 750.000 m^3 of sewage and has a nominal daily capacity of 1.000.000 m^3.

Vienna's Main Sewage Treatment Plant, Austria
At Vienna's lowest point, where the Danube Canal meets the Danube, lies Vienna's Main Sewage Treatment Plant. Here around 90% of Vienna's wastewaters is purified. VLT® drives were chosen to operate the pumps that handle more than 500,000 cubic metres per day, which corresponds to a flow of a medium-size river.

Izmir Geothermal District Heating System, Turkey
VLT® drives operate the deep well and supply pumps in Izmir geothermal district heating. Applying VLT® drives leads to a very low electricity cost.

1 x 200 – 240 VAC and 1 x 380 – 480 VAC

1 x 200 – 240 VAC

Enclosure			IP 20 /Chassis	A3								
			IP 55 + IP 66 /NEMA 12	A5	B1					B2	C1	C2
				P1K1	P1K5	P2K2	P3K0	P3K7	P5K5	P7K5	P15K0	P22K0
Typical Shaft Output		[kW]		1.1	1.5	2.2	3	3.7	5.5	7.5	15	22
Typical Shaft Output at 240 V		[HP]		1.5	2.0	2.9	4.0	4.9	7.5	10	20	30
Output Current (1 x 200 – 240 V)	Continuous	[A]		6.6	7.5	10.6	12.5	16.7	24	30.8	59.4	88
	Intermittent	[A]		7.3	8.3	11.7	13.8	18.4	26.6	33.4	65.3	96.8
Output Power (208 V AC)	Continuous	[kVA]							5.00	6.40	12.27	18.30
Max. cable size (Mains, motor, brake)		[mm²] ([AWG])		0.2-4/4-10					10/7	35/2	50/1/0	95/4/0
Max. Input Current (1 x 200 – 240 V)	Continuous	[A]		12.5	15	20.5	24	32	46	59	111	172
	Intermittent	[A]		13.8	16.5	22.6	26.4	35.2	50.6	64	122	189.2
Max. pre-fuses		[A]		20	30	40		60	80	100	150	200
Environment												
Estimated power loss at rated max. load		[W]		44	30	44	60	74	110	150	300	440
Weight												
IP 20		[kg]		4.9								
IP 21		[kg]			23					27	45	65
IP 55, IP 66		[kg]			23					27	45	65
Efficiency				0.968	0.98							

1 x 380 – 480 VAC

Enclosure		IP 20 (IP 21*)/Chassis IP 21/NEMA 1, IP 55 + IP 66/NEMA 12	B1	B2	C1	C2
			P7K5	P11K	P18K	P37K
Typical Shaft Output		[kW]	7.5	11	18.5	37
Typical Shaft Output at 460 V		[HP]	10	15	25	50
Output Current (1 x 380 – 440 V)	Continuous	[A]	33	48	78	151
	Intermittent	[A]	36	53	85.8	166
Output Current (1 x 441 – 480 V)	Continuous	[A]	30	41	72	135
	Intermittent	[A]	33	46	79.2	148
Output Power (208 V AC)	Continuous	[kVA]	11.1	16.6	26.9	51.5
Max. cable size Mains, motor, brake		[mm²] ([AWG])	10/7	35/2	50/1/0	120/4/0
Max. Input Current (1 x 380 –440 V)	Continuous	[A]	33	48	78	151
	Intermittent		36	53	85.8	166
Max. Input Current (1 x 441 –480 V)	Continuous	[A]	30	41	72	135
	Intermittent		33	46	79.2	148
Max. pre-fuses		[A]	63	80	160	250
Environment						
Estimated power loss at rated max. load		[W]	300	440	740	1480
Weight						
IP 20, IP 21, IP 55, IP 66		[kg]	23	27	45	65
Efficiency			0.96			

3 x 200 – 240 VAC

Enclosure	IP 20 (IP 21*)/Chassis		A2							A3	
	IP 55 + IP 66 /NEMA 12		A5								
			PK25	PK37	PK55	PK75	P1K1	P1K5	P2K2	P3K0	P3K7
Typical Shaft Output		[kW]	0.25	0.37	0.55	0.75	1.1	1.5	2.2	3	3.7
Typical Shaft Output at 208 V		[HP]	0.25	0.37	0.55	0.75	1.5	2.0	2.9	4.0	4.9
Output Current (3 x 200 – 240 V)	Continuous	[A]	1.8	2.4	3.5	4.6	6.6	7.5	10.6	12.5	16.7
	Intermittent	[A]	1.98	2.64	3.85	5.06	7.3	8.3	11.7	13.8	18.4
Output Power (208 V AC)	Continuous	[kVA]	0.65	0.86	1.26	1.66	2.38	2.70	3.82	4.50	6.00
Max. cable size (Mains, motor, brake)		[mm²] ([AWG])	4 (10)								
Max. Input Current (3 x 200 – 240 V)	Continuous	[A]	1.6	2.2	3.2	4.1	5.9	6.8	9.5	11.3	15.0
	Intermittent	[A]	1.7	2.42	3.52	4.51	6.5	7.5	10.5	12.4	16.5
Max. pre-fuses		[A]	10				20			32	
Environment											
Estimated power loss at rated max. load		[W]	21	29	42	54	63	82	116	155	185
Weight											
IP 20		[kg]	4.9							6.6	
IP 21		[kg]	5.5							7.5	
IP 55, IP 66		[kg]	13.5								
Efficiency			94		95		0.96				

Enclosure	IP 20 (IP 21*)/Chassis		B3			B4		C3		C4	
	IP 21/NEMA 1, IP 55 + IP 66/NEMA 12		B1			B2	C1			C2	
			P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K
Typical Shaft Output		[kW]	5.5	7.5	11	15	18.5	22	30	37	45
Typical Shaft Output at 208 V		[HP]	7.5	10	15	20	25	30	40	50	60
Output Current (3 x 200 – 240 V)	Continuous	[A]	24.2	30.8	46.2	59.4	74.8	88.0	115	143	170
	Intermittent	[A]	26.6	33.9	50.8	65.3	82.3	96.8	127	157	187
Output Power (208 V AC)	Continuous	[kVA]	8.7	11.1	16.6	21.4	26.9	31.7	41.4	51.5	61.2
Max. cable size Mains, motor, brake		[mm²] ([AWG])	10 (7)			35 (2)	50 (1/0) (B4 = 35 (2))			95 (4/0)	120 (250 MCM)
Max. cable size mains With mains disconnect switch included		[mm²] ([AWG])	16 (6)			35 (2)				70 (3/0)	185 (kcmil 350)
Max. Input Current (3 x 200 – 240 V)	Continuous	[A]	22.0	28.0	42.0	54.0	68.0	80.0	104.0	130.0	154.0
	Intermittent		24.2	30.8	46.2	59.4	74.8	88.0	114.0	143.0	169.0
Max. pre-fuses		[A]	63	63	63	80	125	125	160	200	250
Environment											
Estimated power loss at rated max. load		[W]	269	310	447	602	737	845	1140	1353	1636
Weight											
IP 20		[kg]	12			23.5		35		50	
IP 21, IP 55, IP 66		[kg]	23			27	45			65	
Efficiency			0.96					0.97			

* *(A2, A3, B3, B4, C3 and C4 may be converted to IP21 using a conversion kit.*
(Please see also items Mechanical mounting in Operating Instructions and IP 21/ Type 1 Enclosure kit in the Design Guide.))

380 – 480 VAC

Enclosure		IP 20 (IP 21*)/Chassis	A2					A3	
		IP 55 + IP 66 /NEMA 12	A5						
			P1K1	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5
Typical Shaft Output		[kW]	1.1	1.5	2.2	3	4	5.5	7.5
Typical Shaft Output at 460 V		[HP]	1.5	2.0	2.9	4.0	5.0	7.5	10
Output Current (3 x 380 – 440 V)	Continuous	[A]	3	4.1	5.6	7.2	110	13	16
	Intermittent	[A]	3.3	4.5	6.2	7.9	11	14.3	17.6
Output Current (3 x 441 – 480 V)	Continuous	[A]	2.7	3.4	4.8	6.3	8.2	11	14.5
	Intermittent	[A]	3.0	3.7	5.3	6.9	9.0	12.1	15.4
Output Power (400 V AC)	Continuous	[kVA]	2.1	2.8	3.9	5.0	6.9	9.0	11.0
Output Power (460 V AC)	Continuous	[kVA]	2.4	2.7	3.8	5.0	6.5	8.8	11.6
Max. cable size (Mains, motor, brake)		[mm²] ([AWG])	4 (10)						
Max. Input Current (3 x 380 – 440 V)	Continuous	[A]	2.7	3.7	5.0	6.5	9.0	11.7	14.4
	Intermittent	[A]	3.0	4.1	5.5	7.2	9.9	12.9	15.8
Max. Input Current (3 x 441 – 480 V)	Continuous	[A]	2.7	3.1	4.3	5.7	7.4	9.9	13.0
	Intermittent	[A]	3.0	3.4	4.7	6.3	8.1	10.9	14.3
Max. pre-fuses		[A]	10	10	20	20	20	32	32
Environment									
Estimated power loss at rated max. load		[W]	58	62	88	116	124	187	255
Weight									
IP 20		[kg]	4.8	4.9				6.6	
IP 55, IP 66		[kg]	13.5					14.2	
Efficiency			0.96	0.97					

Enclosure		IP 20 (IP 21*)/Chassis	B3			B4			C3		C4	
		IP 21/NEMA 1, IP 55 + IP 66/NEMA 12	B1			B2		C1			C2	
			P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Typical Shaft Output		[kW]	11	15	18.5	22	30	37	45	55	75	90
Typical Shaft Output at 460 V		[HP]	15	20	25	30	40	50	60	75	100	125
Output Current (3 x 380 – 439 V)	Continuous	[A]	24	32	37.5	44	61	73	90	106	147	177
	Intermittent	[A]	26.4	35.2	41.3	48.4	67.1	80.3	99	117	162	195
Output Current (3 x 440 – 480 V)	Continuous	[A]	21	27	34	40	52	65	80	105	130	160
	Intermittent	[A]	23.1	29.7	37.4	44	61.6	71.5	88	116	143	176
Output Power (400 V AC)	Continuous	[kVA]	16.6	22.2	26	30.5	42.3	50.6	62.4	73.4	102	123
Output Power (460 V AC)	Continuous	[kVA]	16.7	21.5	27.1	31.9	41.4	51.8	63.7	83.7	104	128
Max. cable size Mains, motor, brake		[mm²] ([AWG])	10 (7)			35 (2)		50 (1/0) (B4 = 35 (2))			95 (4/0)	120 (250 MCM)[1]
Max. cable size mains With mains disconnect switch included		[mm²] ([AWG])	16 (6)					35 (2)			70 (3/0)	185 (kcmil 350)
Max. Input Current (3 x 380 – 439 V)	Continuous	[A]	22	29	34	40	55	66	82	96	133	161
	Intermittent		24.2	31.9	37.4	44	60.5	72.6	90.2	106	146	177
Max. Input Current (3 x 440 – 480 V)	Continuous	[A]	19	25	31	36	47	59	73	95	118	145
	Intermittent		20.9	27.5	34.1	39.6	51.7	64.9	80.3	105	130	160
Max. pre-fuses		[A]	63	63	63	63	80	100	125	160	250	250
Environment												
Estimated power loss at rated max. load		[W]	278	392	465	525	698	739	843	1083	1384	1474
Weight												
IP 20		[kg]	12			23.5			35		50	
IP 21, IP 55, IP 66		[kg]	23			27		45			65	
Efficiency			0.98									0.99

* *(A2, A3, B3, B4, C3 and C4 may be converted to IP21 using a conversion kit. Please contact Danfoss.*
(Please see also items Mechanical mounting in Operating Instructions and IP 21/ Type 1 Enclosure kit in the Design Guide.))
1) With brake and load sharing 95 (4/0)

380 – 480 VAC

Enclosure			IP 21, IP 54	D1		D2		
			IP 00	D3		D4		
				P110	P132	P160	P200	P250
Typical Shaft Output at 400 V		[kW]		110	132	160	200	250
Typical Shaft Output at 460 V		[HP]		150	200	250	300	350
Output Current								
Continuous (3 x 380 – 400 V)		[A]		212	260	315	395	480
Intermittent (3 x 380 – 400 V)		[A]		233	286	347	435	528
Continuous (3 x 441 – 480 V)		[A]		190	240	302	361	443
Intermittent (3 x 441 – 480 V)		[A]		209	264	332	397	487
Output Power								
Continuous (400 VAC)		[kVA]		147	180	218	274	333
Continuous (460 VAC)		[kVA]		151	191	241	288	353
Max. Input Current								
Continuous (3 x 380 – 400 V)		[A]		204	251	304	381	463
Continuous (3 x 441 – 480 V)		[A]		183	231	291	348	427
Max. cable size Mains motor, brake and load share		[mm²] ([AWG])		2 x 70 (2 x 2/0)		2 x 150 (2 x 300 mcm)		
Max. external pre-fuses		[A]		300	350	400	500	630
Estimated power loss at rated max. load – 400 V		[W]		2907	3358	3915	4812	5517
Estimated power loss at rated max. load – 460 V		[W]		2600	3079	3781	4535	5024
Weight	IP 21, IP 54	[kg]		96	104	125	136	151
	IP 00	[kg]		82	91	112	123	138
Efficiency				0.98				
Output Frequency		[Hz]		0 – 800				

Enclosure			IP 21, IP 54	E1				F1/F3				F2/F4	
			IP 00	E2									
				P315	P355	P400	P450	P500	P560	P630	P710	P800	P1M0
Typical Shaft Output at 400 V		[kW]		315	355	400	450	500	560	630	710	800	1000
Typical Shaft Output at 460 V		[HP]		450	500	550/600	600	700	750	900	1000	1200	1350
Output Current													
Continuous (3 x 380 – 400 V)		[A]		600	658	745	800	880	990	1120	1260	1460	1720
Intermittent (3 x 380 – 400 V)		[A]		660	724	820	880	968	1089	1232	1386	1606	1892
Continuous (3 x 441 – 480 V)		[A]		540	590	678	730	780	890	1050	1160	1380	1530
Intermittent (3 x 441 – 480 V)		[A]		594	649	746	803	858	979	1155	1276	1518	1683
Output Power													
Continuous (at 400 V)		[kVA]		416	456	516	554	610	686	776	873	1012	1192
Continuous (at 460 V)		[kVA]		430	4770	540	582	621	709	837	924	1100	1219
Max. Input Current													
Continuous (3 x 380 – 400 V)		[A]		590	647	733	787	857	964	1090	1227	1422	1675
Continuous (3 x 441 – 480 V)		[A]		531	580	667	718	759	867	1022	1129	1344	1490
Max. cable size Motor		[mm²] ([AWG])		4 x 240 (3 x 500 mcm)				8 x 150 (8 x 300 mcm)				12 x 150 (12 x 300 mcm)	
Max. cable size Mains		[mm²] ([AWG])						8 x 240 (8 x 500 mcm)					
Max. cable size Loadsharing		[mm²] ([AWG])						4 x 120 (4 x 250 mcm)					
Max. cable size Brake		[mm²] ([AWG])		1 x 185 (2 x 350 mcm)				4 x 185 (4 x 350 mcm)				6 x 185 (6 x 350 mcm)	
Max. external pre-fuses		[A]		700	900			1600		2000		2500	
Estimated power loss at rated max. load – 400 V		[W]		6706	7532	8677	9473	10161	11822	12514	14671	17294	19280
Estimated power loss at rated max. load – 460 V		[W]		5930	6725	7820	8527	8877	10424	11595	13215	16228	16625
Weight	IP 54	[kg]		263	270	272	313	1299				1541	
	IP 21	[kg]						1004				1246	
	IP 00	[kg]		221	234	236	277	–					
Efficiency				0.98									
Output Frequency		[Hz]		0 – 800									

525 – 690 VAC

Enclosure																		
IP 20 Chassis		A3							B3			B4		C3		C4		
IP 21/NEMA 1									B1			B2		C1			C2	
IP 55, IP 66/NEMA 12		A5																
		P1K1	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Typical Shaft Output	[kW]	1.1	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90
Output Current																		
Continuous (3 x 525 – 550 V)	[A]	2.6	2.9	4.1	5.2	6.4	9.5	11.5	19	23	28	36	43	54	65	87	105	137
Intermittent (3 x 525 – 550 V)	[A]	2.9	3.2	4.5	5.7	7.0	10.5	12.7	21	25	31	40	47	59	72	96	116	151
Continuous (3 x 525 – 600 V)	[A]	2.4	2.7	3.9	4.9	6.1	9.0	11.0	18	22	27	34	41	52	62	83	100	131
Intermittent (3 x 525 – 600 V)	[A]	2.6	3.0	4.3	5.4	6.7	9.9	12.1	20	24	30	37	45	57	68	91	110	144
Output Power																		
Continuous (525 V AC)	[kVA]	2.5	2.8	3.9	5.0	6.1	9.0	11.0	18.1	21.9	26.7	34.3	41	51.4	61.9	82.9	100	130.5
Continuous (575 V AC)	[kVA]	2.4	2.7	3.9	4.9	6.1	9.0	11.0	17.9	21.9	26.9	33.9	40.8	51.8	61.7	82.7	99.6	130.5
Max. cable size IP 21/55/66 (mains, motor, brake)	[mm²] ([AWG])	4 (10)							10 (7)			35 (2)			50 (1/0)		95 (4/0)	120 (250 MCM)
Max. cable size IP 20 (mains, motor, brake)	[mm²] ([AWG])	4 (10)							10 (7)			35 (2)		50 (1/0)			95 (4/0)	150 (250 MCM)[1]
Max. cable size mains With mains disconnect switch included	[mm²] ([AWG])	4 (10)							16 (6)					35 (2)			70 (3/0)	185 (kcmil 350)
Max. Input Current																		
Continuous (3 x 525 – 600 V)	[A]	2.4	2.7	4.1	5.2	5.8	8.6	10.4	17.2	20.9	25.4	32.7	39	49	59	78.9	95.3	124.3
Intermittent (3 x 525 – 600 V)	[A]	2.7	3.0	4.5	5.7	6.4	9.5	11.5	19	23	28	36	43	54	65	87	105	137
Max. pre-fuses	[A]	10		20			32		63				80	100	125	160	250	250
Environment																		
Estimated power loss at rated max. load	[W]	50	65	92	122	145	195	261	300	400	475	525	700	750	850	1100	1400	1500
Weight																		
IP 20	[kg]	6.5					6.6		12			23.5			35		50	
IP 21, IP 55, IP 66	[kg]	13.5					14.2		23			27			45		65	
Efficiency		0.97							0.98									

1) With brake and load sharing 95 (4/0)

525 – 690 VAC

Enclosure	IP 21, IP 54		D1							D2	
	IP 00		D3							D4	
			P45K	P55K	P75K	P90K	P110	P132	P160	P200	P250
Typical Shaft Output at 550 V		[kW]	37	45	55	75	90	110	132	160	200
Typical Shaft Output at 575 V		[HP]	50	60	75	100	125	150	200	250	300
Typical Shaft Output at 690 V		[kW]	45	55	75	90	110	132	160	200	250
Output Current											
Continuous (at 3 x 525 – 550 V)		[A]	56	76	90	113	137				
Continuous (at 550 V)		[A]						162	201	253	303
Intermittent (60 sec overload) (at 550 V)		[A]	62	84	99	124	151	178	221	278	333
Continuous (at 3 x 551 – 690 V)		[A]	54	73	86	108	131				
Continuous (at 575/690 V)		[A]						155	192	242	290
Intermittent (60 sec overload) (at 575/690 V)		[A]	59	80	95	119	144	171	211	266	319
Output Power											
Continuous (at 550 V)		[kVA]	53	72	86	108	131	154	191	241	289
Continuous (at 575 V)		[kVA]	54	73	86	108	130	154	191	241	289
Continuous (at 690 V)		[kVA]	65	87	103	129	157	185	229	289	347
Max. Input Current											
Continuous (at 550 V)		[A]	60	77	89	110	130	158	198	245	299
Continuous (at 575 V)		[A]	58	74	85	106	124	151	189	234	286
Continuous (at 690 V)		[A]	58	77	87	109	128	155	197	240	296
Max. cable size Mains, motor, load share and brake		[mm²] ([AWG])	2 x 70 (2 x 2/0)					2 x 70 (2 x 2/0)		2 x 150 (2 x 300 mcm)	
Max. external pre-fuses		[A]	125	160	200	200	250	315	350	350	400
Estimated power loss at rated max. load – 600 V		[W]	1398	1645	1827	2157	2533	2963	3430	4051	4867
Estimated power loss at rated max. load – 690 V		[W]	1458	1717	1913	2262	2662	3430	3612	4292	5156
Weight	IP 21, IP 54	[kg]	96						104	125	136
	IP 00	[kg]	82						91	112	123
Efficiency			0.97		0.98						
Output Frequency		[Hz]	0 – 600								

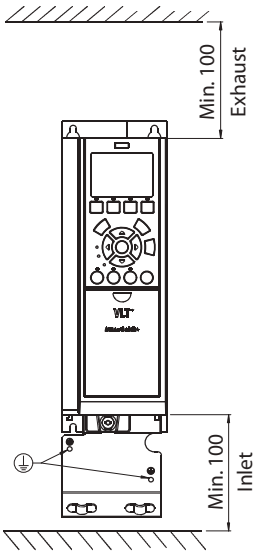
Enclosure	IP 54/NEMA 12		D2		E1				F1/F3 [1]			F2/F4[1]		
	IP 21/NEMA 1													
	IP 00		D4		E2				–					
			P315	P400	P450	P500	P560	P630	P710	P800	P900	P1M0	P1M2	P1M4
Typical Shaft Output at 550 V		[kW]	250	315	355	400	450	500	560	670	750	850	1000	1100
Typical Shaft Output at 575 V		[HP]	350	400	450	500	600	650	750	950	1050	1150	1350	1500
Typical Shaft Output at 690 V		[kW]	315	400	450	500	560	630	710	800	900	1000	1200	1400
Output Current														
Continuous (3 x 550 V)		[A]	360	418	470	523	596	630	763	889	988	1108	1317	1479
Intermittent (3 x 550 V)		[A]	396	460	517	575	656	693	839	978	1087	1219	1449	1627
Continuous (3 x 690 V)		[A]	344	400	450	500	570	630	730	850	945	1060	1260	1415
Intermittent (3 x 690 V)		[A]	378	440	495	550	627	693	803	935	1040	1166	1386	1557
Output Power														
Continuous (at 550 VAC)		[kVA]	343	398	448	498	568	600	727	847	941	1056	1255	1409
Continuous (at 575 VAC)		[kVA]						627						
Continuous (at 690 VAC)		[kVA]	411	478	538	598	681	753	872	1016	1129	1267	1506	1691
Max. Input Current														
Continuous (3 x 550 V)		[A]	355	408	453	504	574	607	743	866	962	1079	1282	1440
Continuous (3 x 575 V)		[A]	339	390	434	482	549	607	711	828	920	1032	1227	1378
Continuous (3 x 690 V)		[A]	352	400										
Max. cable size Mains		[mm²] ([AWG])	2 x 185 (2 x 300 mcm)		4 x 240 (4 x 500 mcm)				8 x 240 (8 x 500 mcm)					
Max. cable size Motor		[mm²] ([AWG])							8 x 150 (8 x 300 mcm)			12 x 150 (12 x 300 mcm)		
Max. cable size Brake		[mm²] ([AWG])			2 x 185 (2 x 350 mcm)				4 x 185 (4 x 350 mcm)			6 x 185 (6 x 350 mcm)		
Max. mains pre-fuses		[A]	500	550	700		900		2000					2500
Estimated power loss at rated max. load – 600 VAC		[W]	4308	4757	4974	5622	7018	7792	8933	10310	11692	12909	15358	17602
Estimated power loss at rated max. load – 690 VAC		[W]	4486	4925	5128	5794	7221	8017	9212	10659	12080	13305	15865	18173
Weight	IP 21, IP 54	[kg]	151	165	263		272	313	1004			1246		1280
	IP 00	[kg]	138	151	221		236	277	–					
Efficiency			0.98											
Output Frequency		[Hz]	0 – 500											

1) Adding the F-enclosure option cabinet (resulting in the F3 and F4 enclosure sizes) adds 295 kg to the estimated weight.

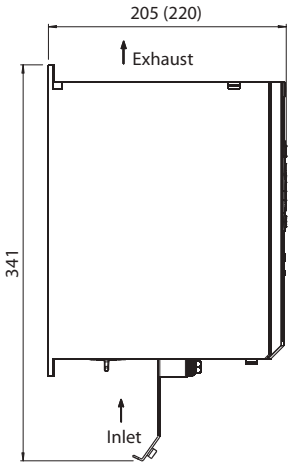
Dimensions VLT® AQUA Drive

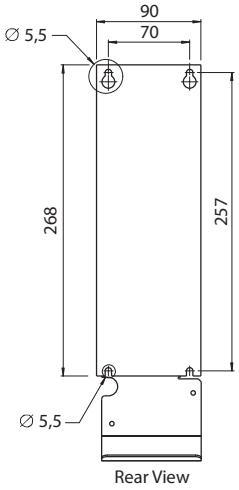
In mm

A2 Enclosures



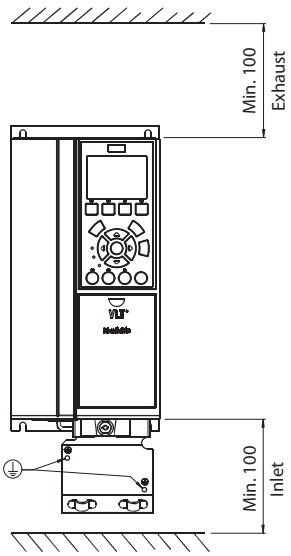
Depth 220 mm with A/B-Options



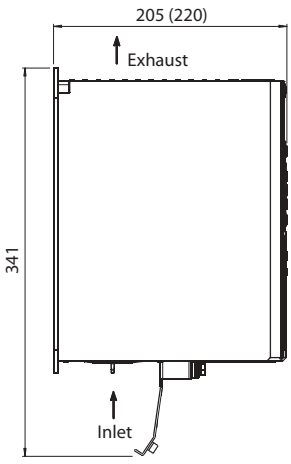


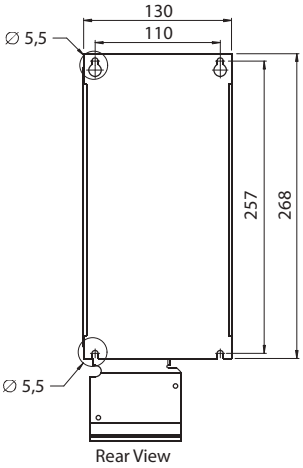
Rear View

A3 Enclosures



Depth 220 mm with A/B-Options

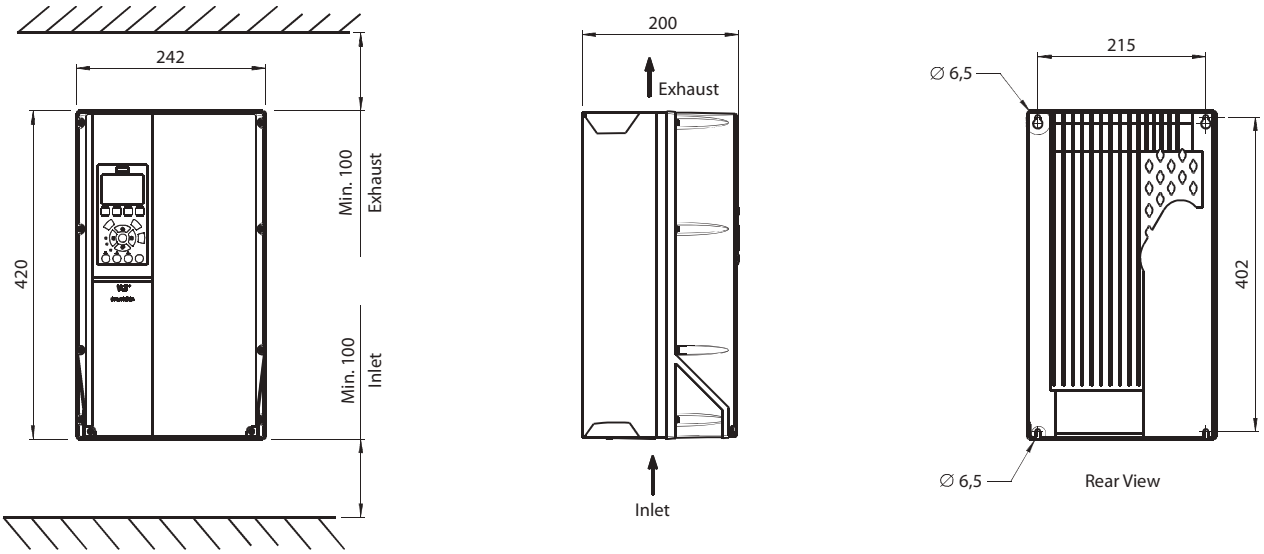


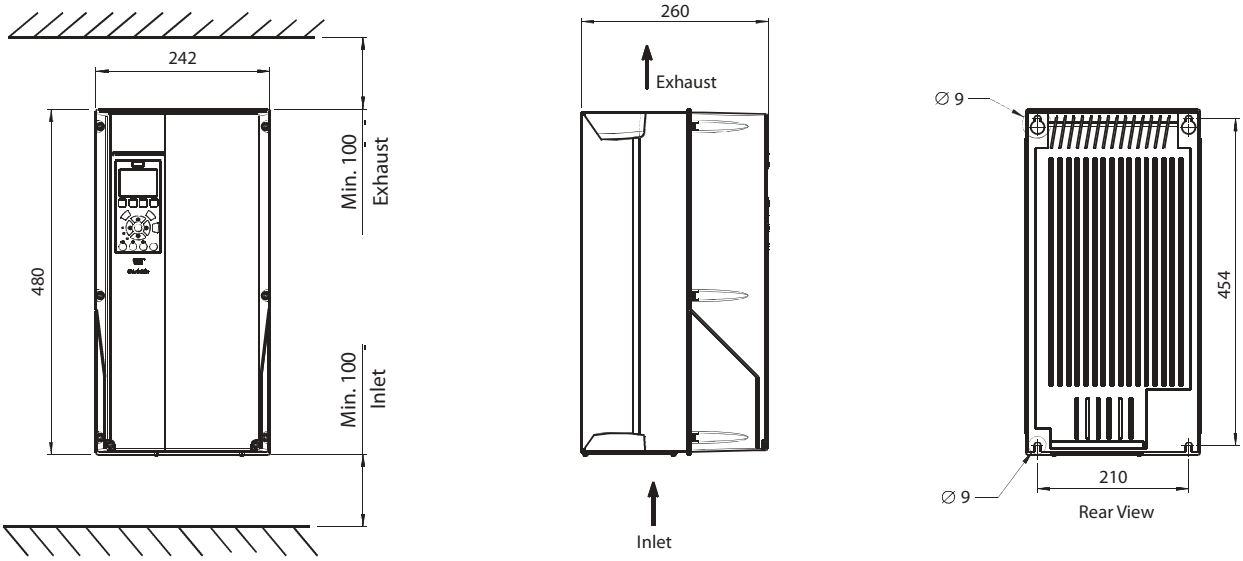


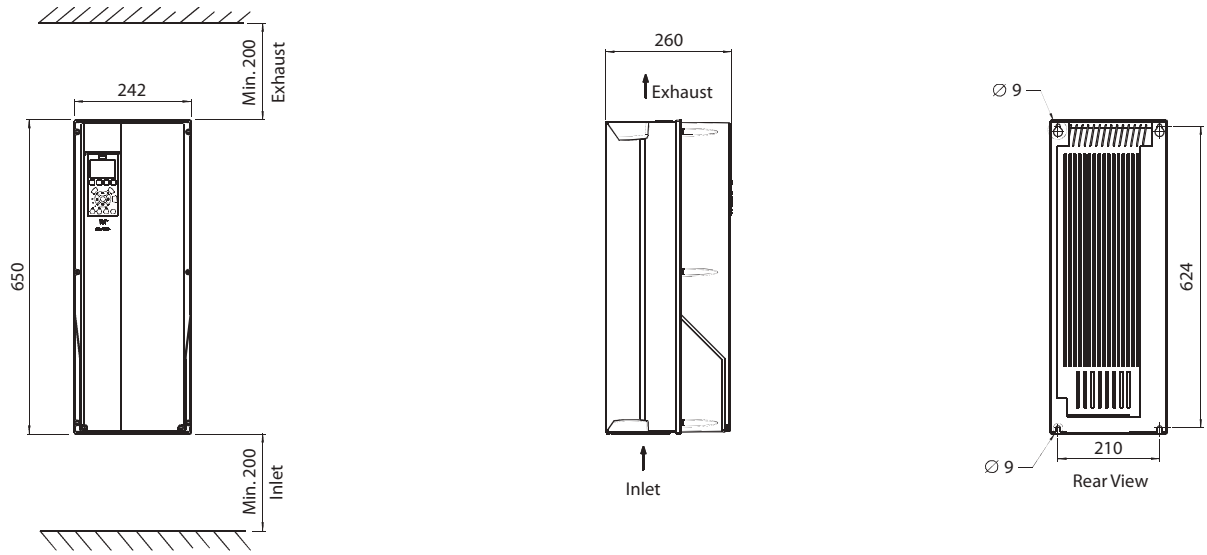
Rear View

Dimensions VLT® AQUA Drive

In mm



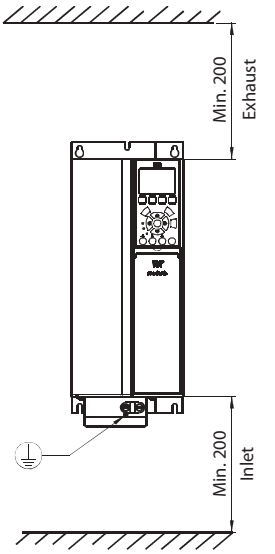




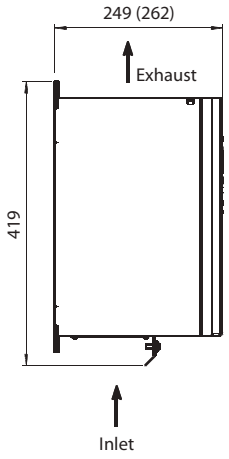
Dimensions VLT® AQUA Drive

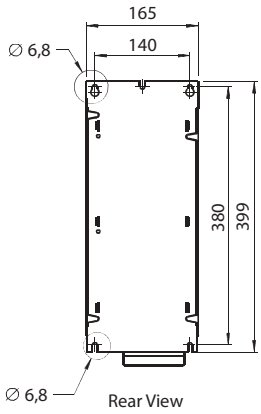
In mm

B3 Enclosures

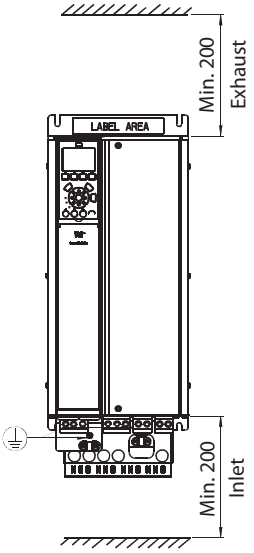


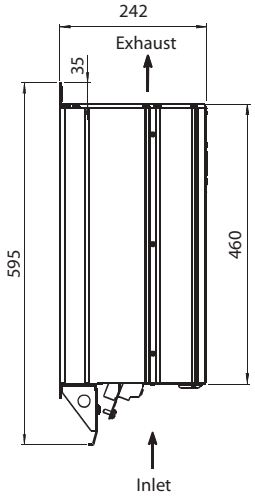
Depth 262 mm with A/B-Options

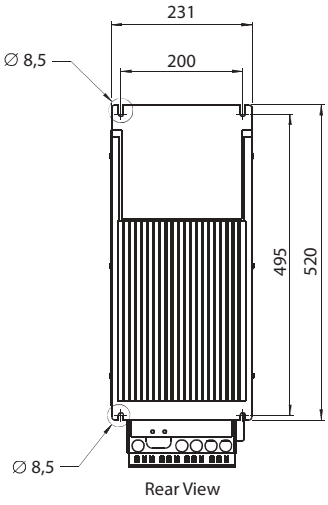




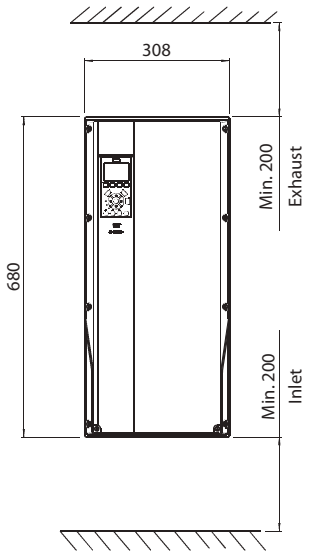
B4 Enclosures

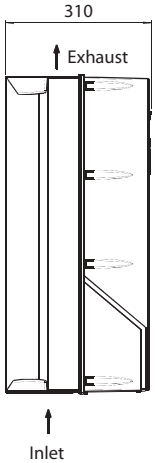


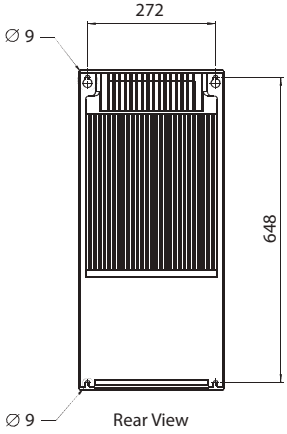




C1 Enclosures

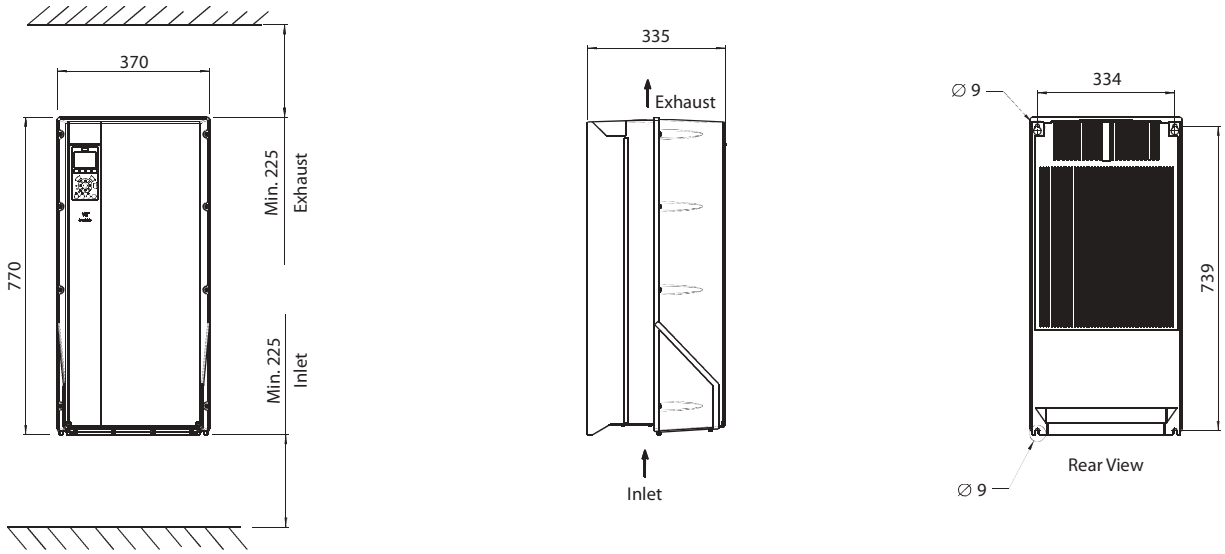


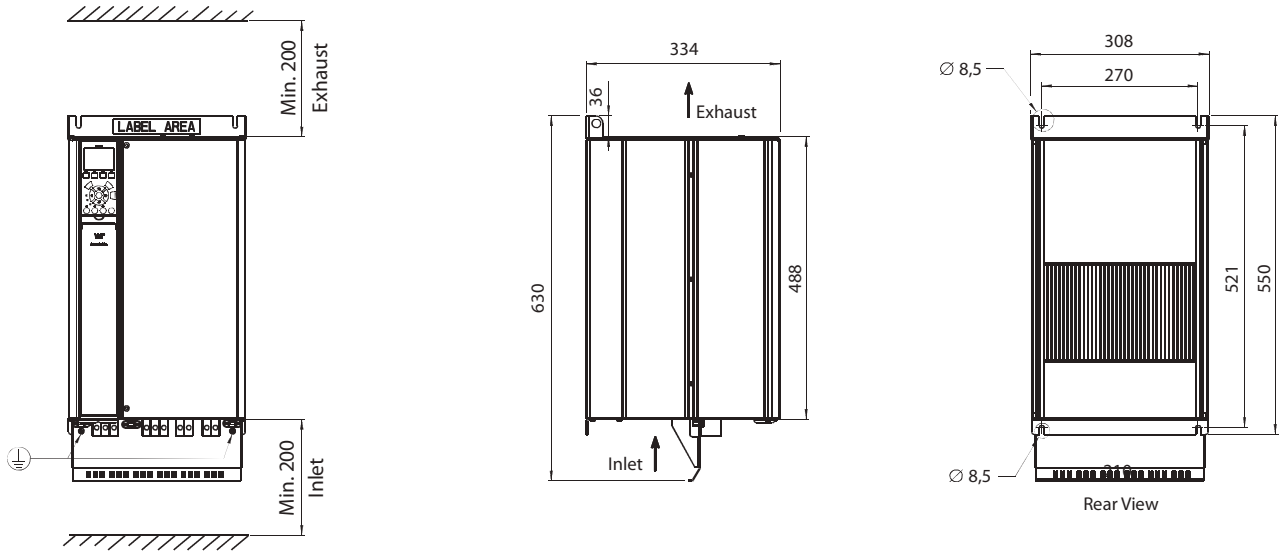


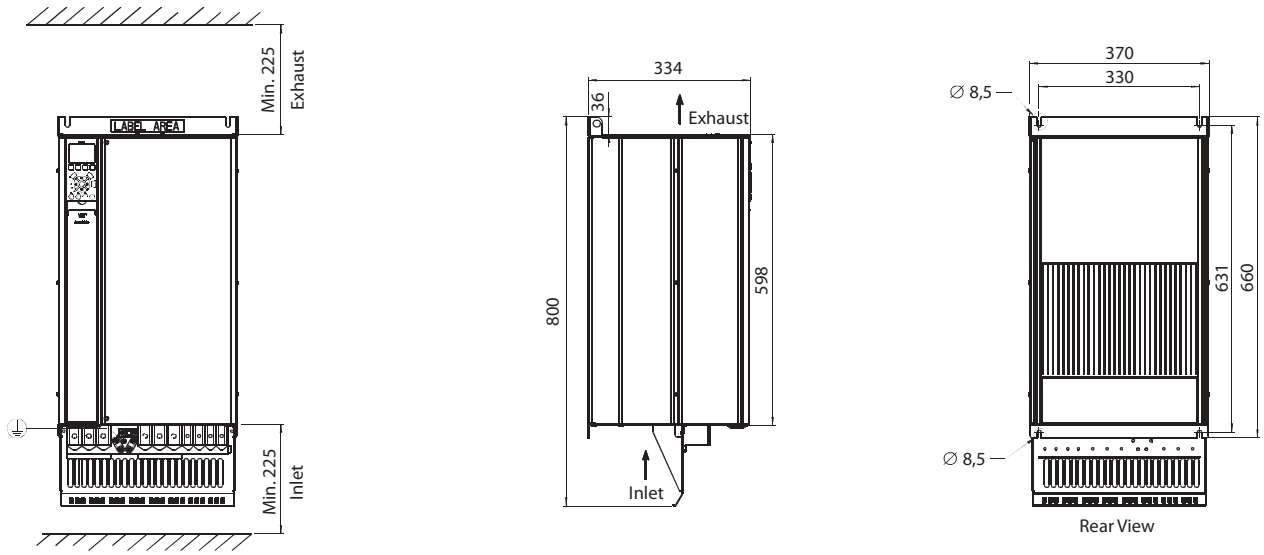


Dimensions VLT® AQUA Drive

In mm



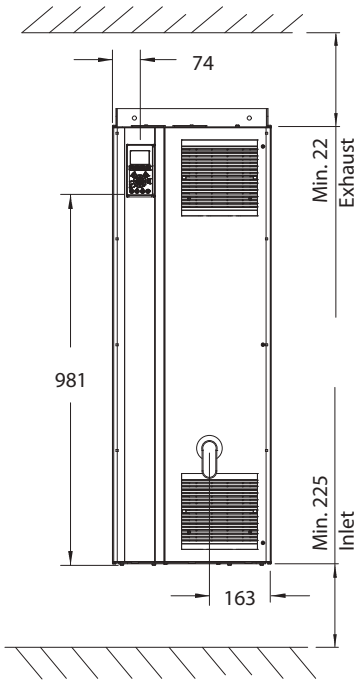


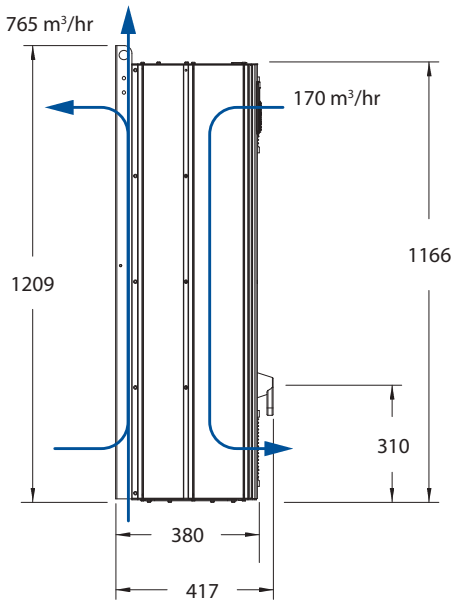


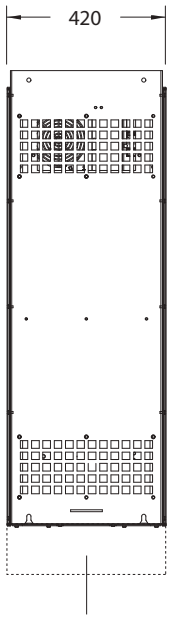
Dimensions VLT® AQUA Drive

In mm

D1 Enclosures (Floor- or cabinet Mount)

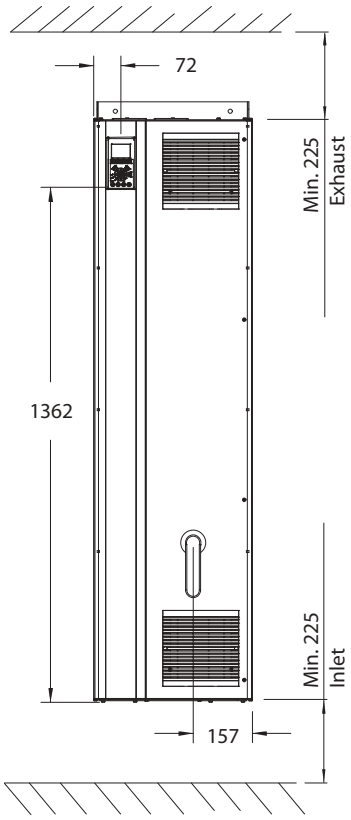


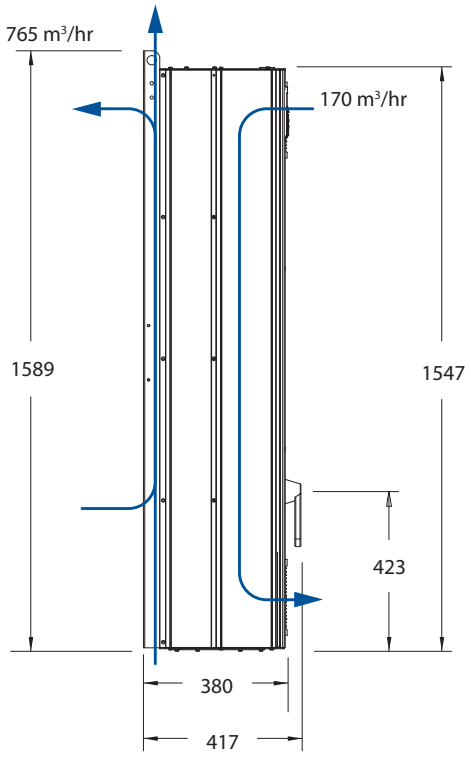


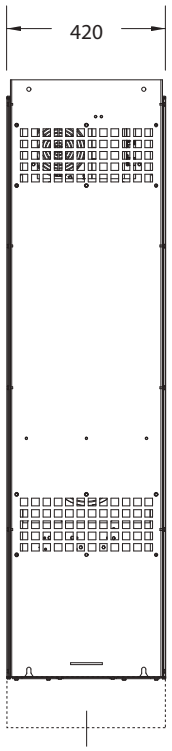


Optional pedestal 176F1827 available for stand-alone floor mount installations (adds 200 mm to height)

D2 Enclosures (Floor- or cabinet Mount)





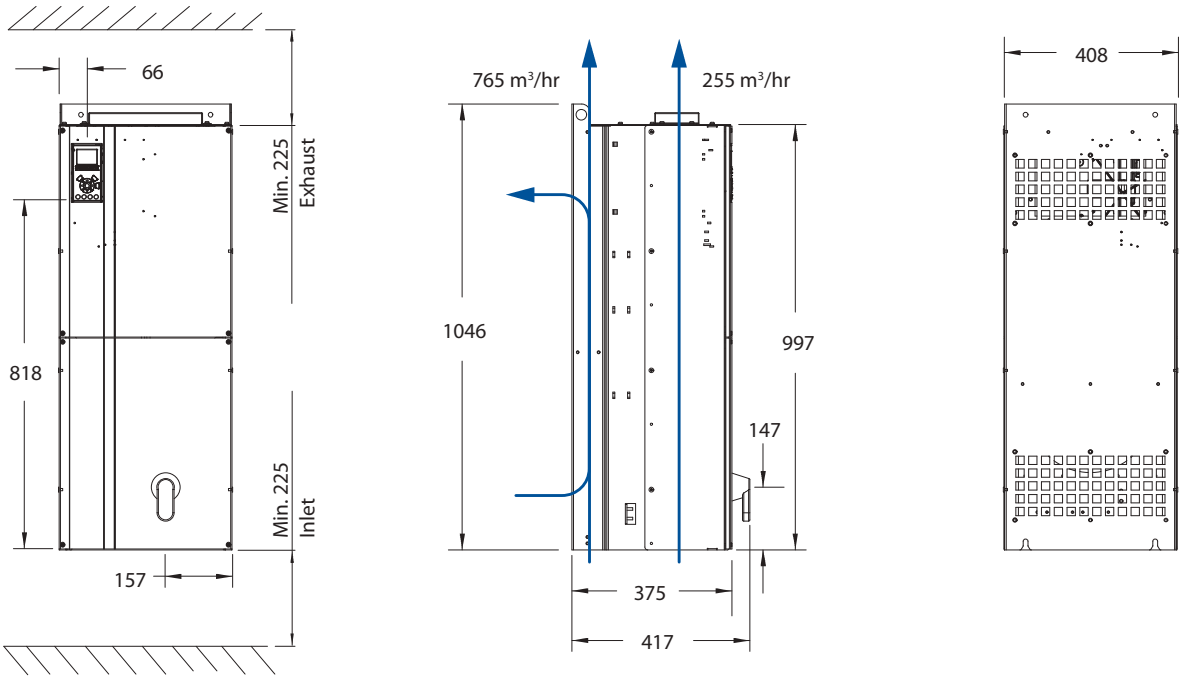


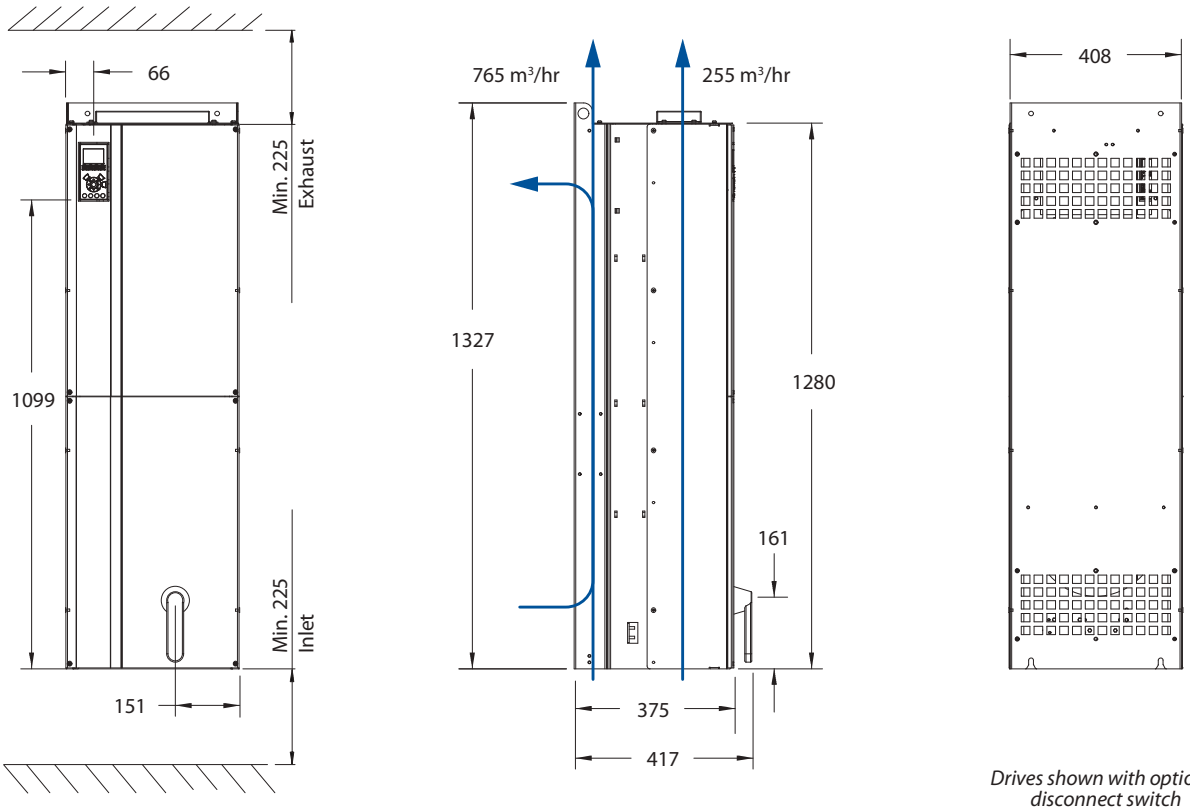
Optional pedestal 176F1827 available for stand-alone floor mount installations (adds 200 mm to height)

Drives shown with optional disconnect switch

Dimensions VLT® AQUA Drive

In mm



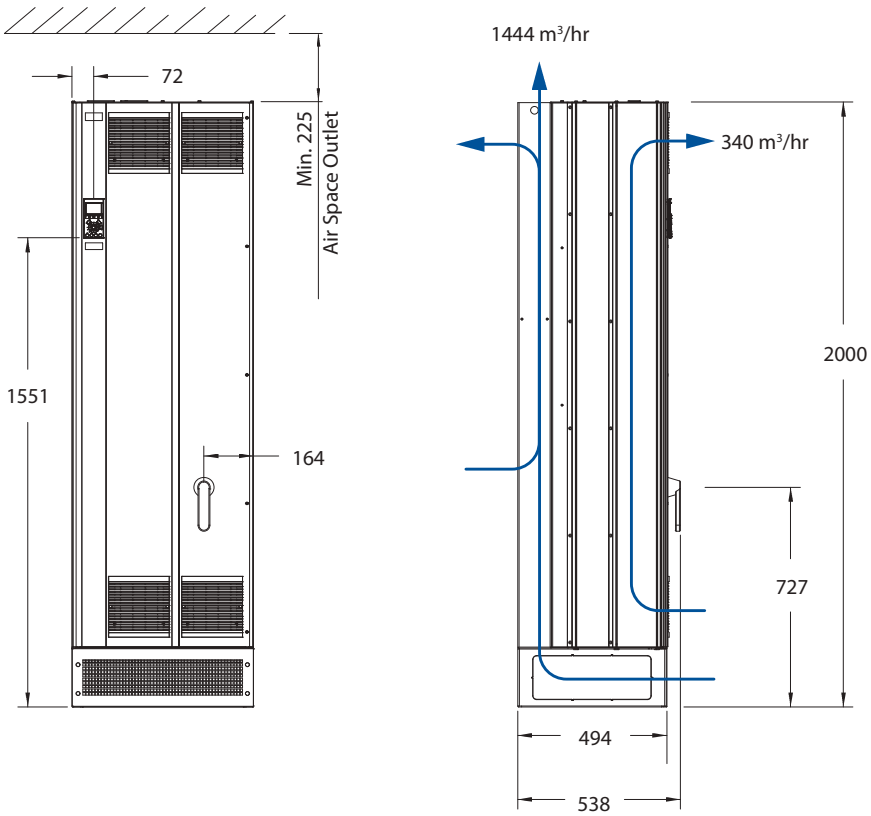


Drives shown with optional disconnect switch

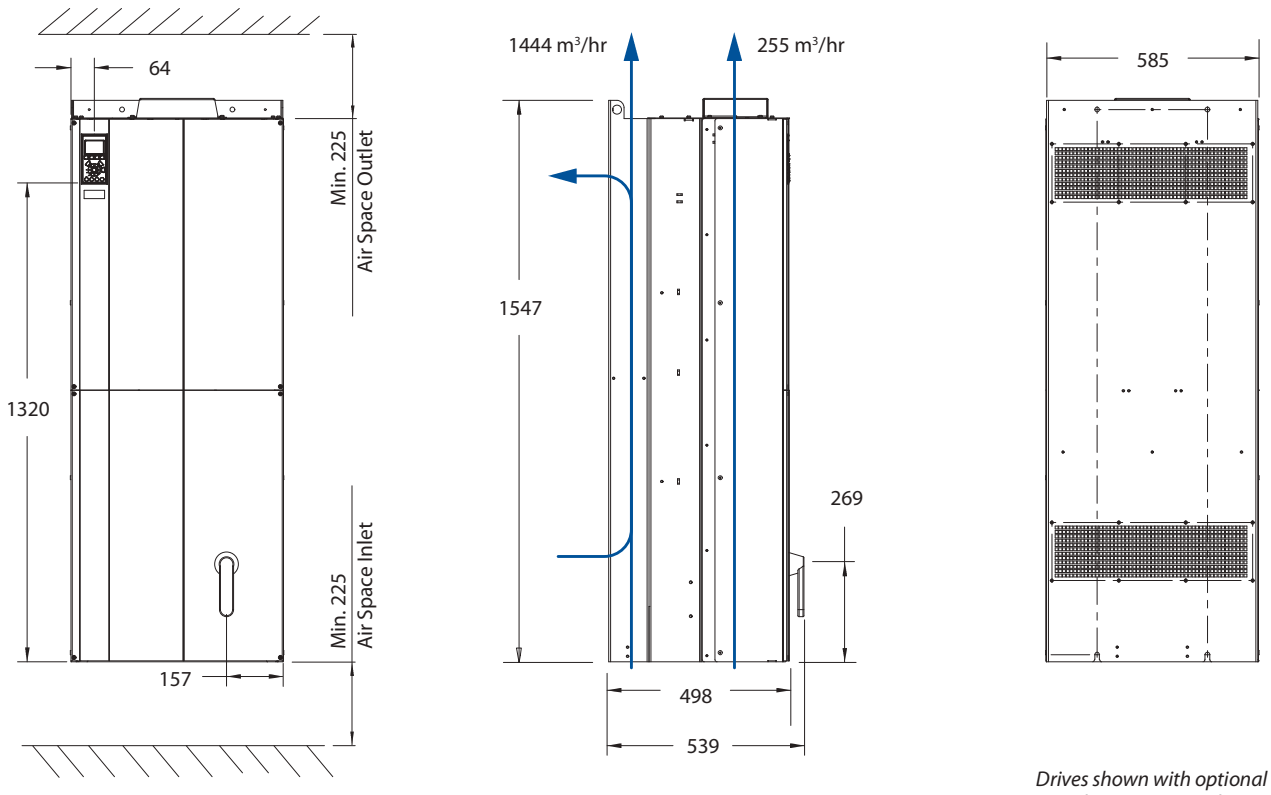
Dimensions VLT® AQUA Drive

In mm

E1 Enclosures (Floor Mount)



E2 Enclosures (Cabinet Mount)

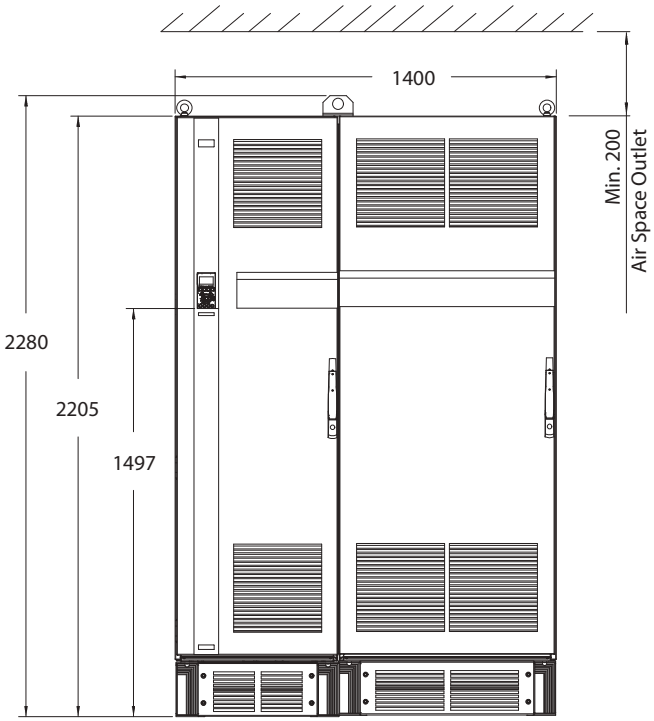


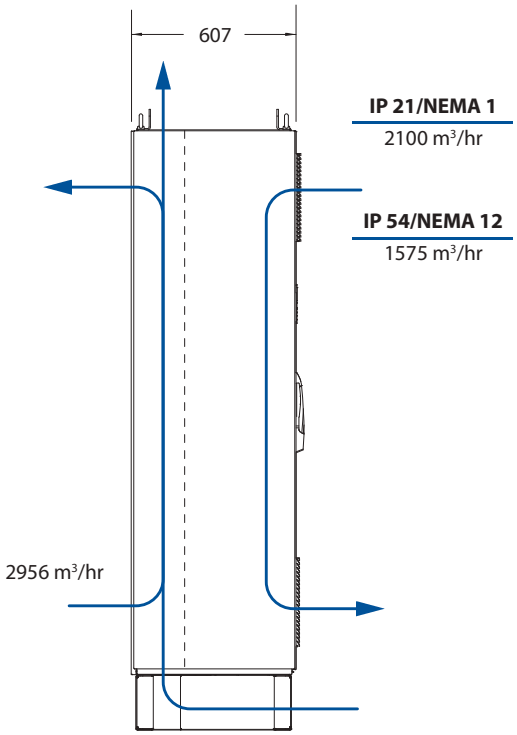
Drives shown with optional disconnect switch

Dimensions VLT® AQUA Drive

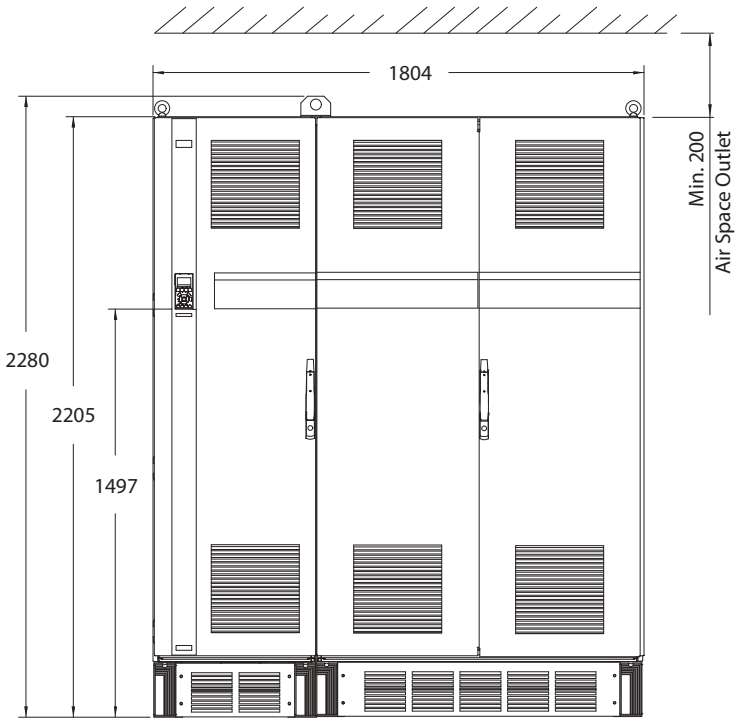
In mm

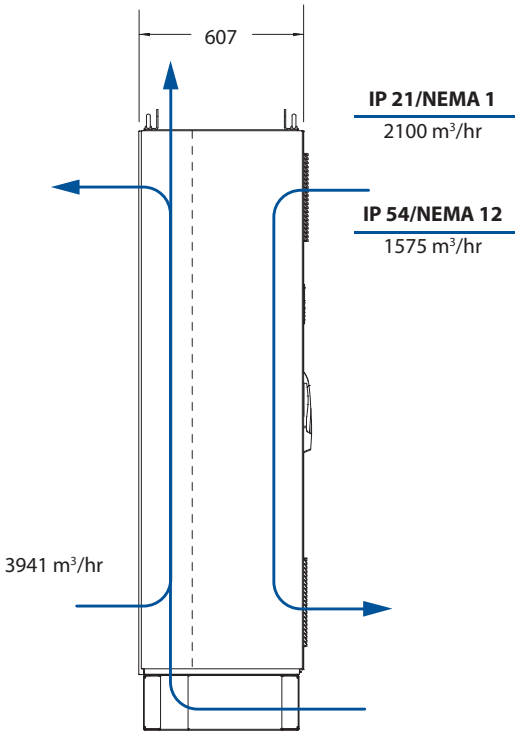
F1 Enclosures (Floor Mount)





F2 Enclosures (Floor Mount)

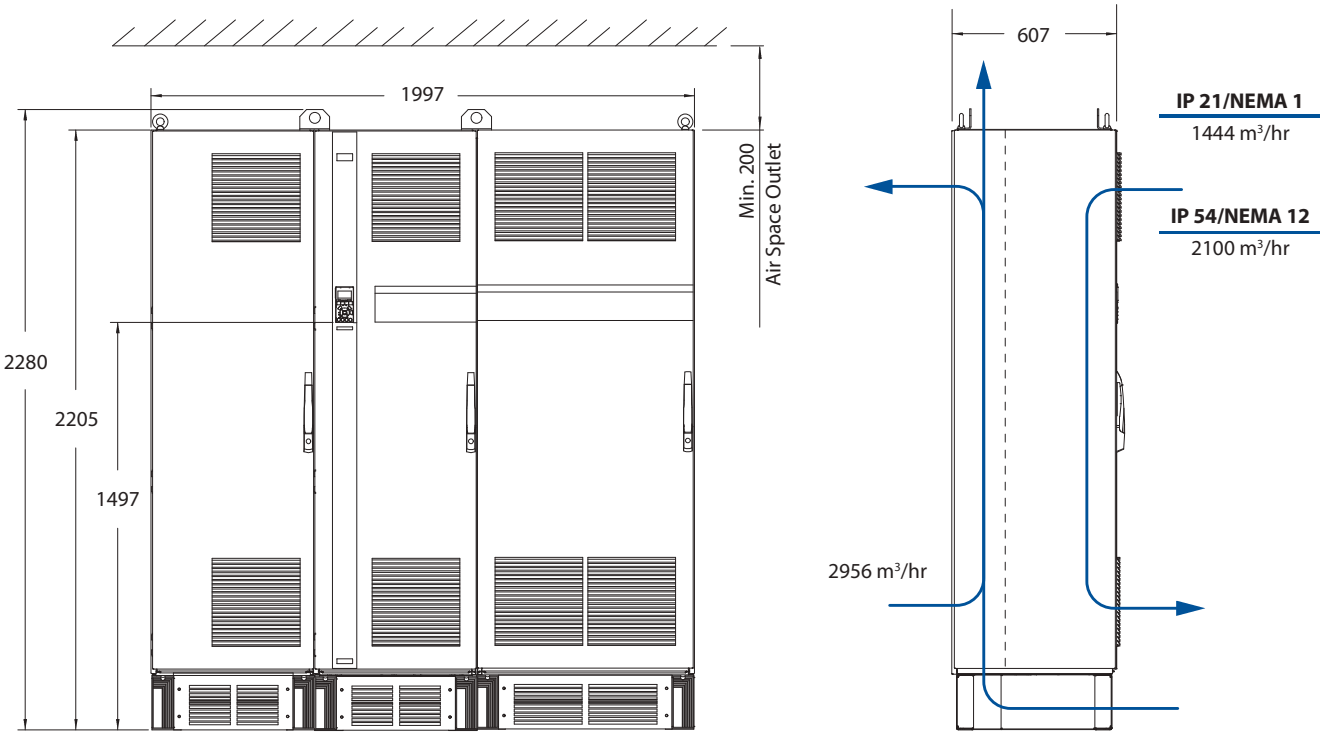




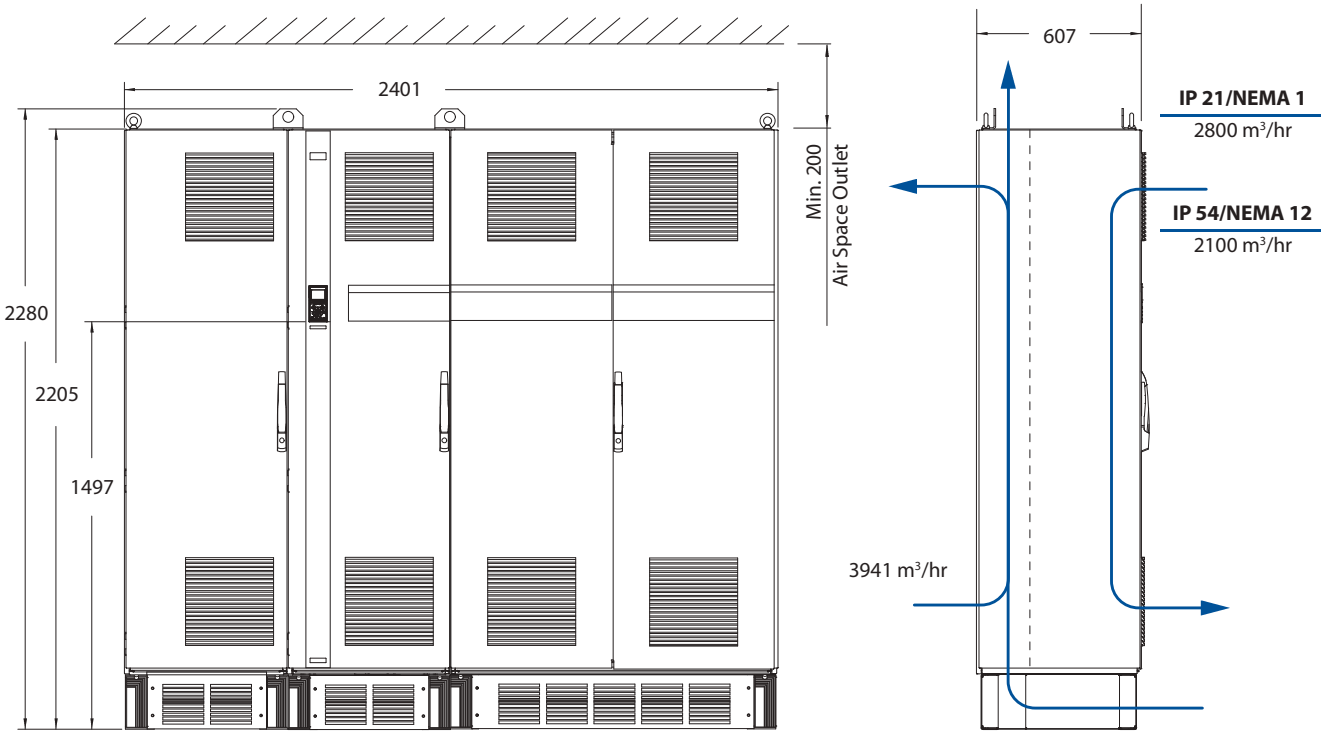
Dimensions VLT® AQUA Drive

In mm

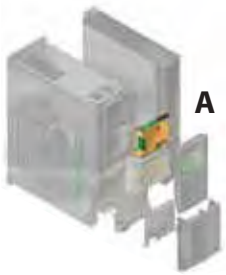
F3 Enclosures (Floor Mount)



F4 Enclosures (Floor Mount)



VLT® AQUA Drive Options



Typecode Position

VLT® PROFIBUS DP V1 MCA 101

PROFIBUS DP V1 gives you wide compatibility, a high level of availability, support for all major PLC vendors, and compatibility with future versions

- Fast, efficient communication, transparent installation, advanced diagnosis and parameterisation and auto-configuration of process data via GSD-file
- A-cyclic parameterisation using PROFIBUS DP V1, PROFIdrive or Danfoss FC profile state machines, PROFIBUS DP V1, Master Class 1 and 2

Ordering number 130B1100 uncoated – 130B1200 coated (Class 3C3/IEC 60721-3-3)

13

VLT® DeviceNet MCA 104

- This modern communications model offers key capabilities that let you effectively determine what information is needed and when
- You will also benefit from ODVA's strong conformance testing policies, which ensure that products are interoperable

Ordering number 130B1102 uncoated – 130B1202 coated (Class 3C3/IEC 60721-3-3)

13

VLT® PROFINET RT MCA 120

The VLT® PROFINET Option offers connectivity to PROFINET based networks via the PROFINET Protocol. The option is able to handle a single connection with an Actual Packet Interval down to 1 ms in both directions, positioning it among the fastest performing PROFINET devices in the market.
Built-in web server for remote diag-nosis and reading out of basic drive parameters

- An e-mail notificator can be configured for sending an e-mail message to one or several receivers, if certain warnings or alarms occur, or have cleared again
- T IP for easy access to Drive configuration data from MCT 10
- FTP (File Transfer Protocol) file up- and download
- Support of DCP (discovery and configuration protocol)

13

VLT® EtherNet IP MCA 121

EtherNet will become the future standard for communication at the factory floor.
The EtherNet Option is based on the newest technology available for the Industrial use and handles even the most demanding requirements. EtherNet/IP extends commercial off-the-shelf EtherNet to the Common Industrial Protocol (CIP™) – the same upper-layer protocol and object model found in DeviceNet.
The VLT® MCA 121 offers advanced features as:
Built-in high performance switch enabling line-topology, and eliminating the need for external switches
Advanced switch and diagnoses functions
Built-in web server

- E-mail client for service notification

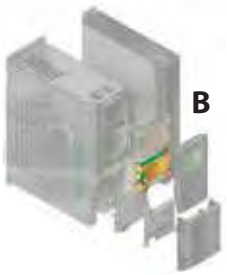
13

VLT® Modbus TCP MCA 122

The VLT® Modbus Option offers connectivity to Modbus TCP based networks, such as Groupe Schneider PLC system via the Modbus TCP Protocol. The option is able to handle a single connection with an Actual Packet Interval down to 5 ms in both directions, positioning it among the fastest performing Modbus TCP devices in the market.
Built-in web-server for remote diagnosis and reading out basic drive parameters
An e-mail notificator can be configured for sending an e-mail message to one or several receivers, if certain warnings or alarms occur, or have cleared again
Two Ethernet ports with built-in switch
FTP (File Transfer Protocol) file up- and download
Protocol – automatic – IP address configuration

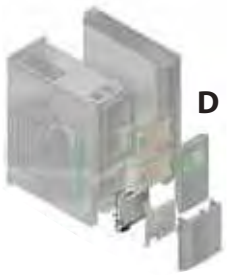
13

VLT® AQUA Drive Options

Typecode Position		
	 B  C	
14-B		**VLT® General Purpose I/O MCB 101** The I/O option offers an extended number of control inputs and outputs. 3 digital inputs 0-24 V: Logic '0' < 5 V; Logic '1' > 10V 2 analogue inputs 0-10 V: Resolution 10 bit plus sign 2 digital outputs NPN/PNP push pull 1 analogue output 0/4-20 mA Spring loaded connection Separate parameter settings *Ordering number 130B1125 uncoated – 130B1212 coated (Class 3C3/IEC 60721-3-3)*
14-B		**VLT® Relay Option MCB 105** Lets you extend relay functions with 3 additional relay outputs. Max. terminal load: AC-1 Resistive load ..... 240 V AC 2 A • AC-15 Inductive load @cos ϕ 0.4 .....240 V AC 0.2 A DC-1 Resistive load ..... 24 V DC 1 A • DC-13 Inductive load @cos ϕ 0.4 .....24 V DC 0.1 A Min. terminal load: DC 5 V..... 10 mA Max switch rate at rated load/min. load ..... 6 min^{-1}/20 sec^{-1} *Ordering number 130B1110 uncoated – 130B1210 coated (Class 3C3/IEC 60721-3-3)*
14-B		**VLT® Analog I/O Option MCB 109** This analogue input/output option is easily fitted in the frequency converter for upgrading to advanced performance and control using the additional in/outputs.This option also upgrades the frequency converter with a battery back-up supply for the clock built into the frequency converter. This provides stable use of all frequency converter clock functions as timed actions etc. • 3 analogue inputs, each configurable as both voltage and temperature input Connection of 0-10 V analogue signals as well as PT1000 and NI1000 temperature inputs • 3 analogue outputs each configurable as 0-10 V outputs Incl. back-up supply for the standard clock function in the frequency converter The back-up battery typically lasts for 10 years, depending on environment. *Ordering number 130B1143 uncoated – 130B1243 coated (Class 3C3/IEC 60721-3-3)*
14-B		**VLT® Sensor Input Option MCB 114** The option protects the motor from being overheated by monitoring the bearings and windings temperature in the motor. The limits as well as the action are adjustable and the individual sensor temperature is visible as a read out in the display or by field bus. Protects the motor from overheating Three self-detecting sensor inputs for 2 or 3 wire PT100/PT1000 sensors One additional analogue input 4-20mA
14-B		**VLT® Extended Cascade Controller MCO 101** Easily fitted and upgrades the built-in cascade controller to operate more pumps and more advanced pump control in master/follower mode. Up to 6 pumps in standard cascade setup Up to 6 pumps in master/follower setup • Technical specification: See MCB 105 Relay Option
16-C		**VLT® Advanced Cascade Controller MCO 102** Easily fitted and upgrades the built-in cascade controller to operate up to 8 pumps and more advanced pump control in master/follower mode. The same cascade controller hardware goes for for the entire power range up to 1.2 MW. Up to 9 pumps in standard cascade setup Up to 8 pumps in master/follower setup

Installation of options is a matter of plug-and-play

VLT® AQUA Drive Options



Typecode Position

VLT® 24 V DC Supply Option MCB 107

The option is used to connect an external DC supply to keep the control section and any installed option active when mains power is down.

Input voltage range24 V DC +/- 15% (max. 37 V in 10 sec.)
Max. input current .....2.2 A
Max. cable length .....75 m
Input capitance load .....< 10 uF
Power-up delay .....< 0.6 s
Easy to install in drives in existing machines
Keeps the control board and options active during power cuts
- Keeps fieldbuses active during power cuts

Ordering number 130B1108 uncoated – 130B1208 coated (Class 3C3/IEC 60721-3-3)

18

Typecode Position

LCP 102 Graphical Local Control Panel

Multi-language display
Status messages
Quick Menu for easy commissioning
Parameter setting and explanation of parameter function
Adjustment of parameters
Full parameter backup and copy function
Alarm logging
Info button – explains the function of the selected item on display
Hand-operated start/stop, or automatic mode selection
Reset function
Trend graph

Ordering number 130B1107

7

LCP 101 Numerical Local Control Panel

The numerical control panel offers an excellent MMI interface to the drive.

Status messages
Quick menu for easy commissioning
Parameter setting and adjustment
Hand-operated start/stop function or automatic mode select
Reset function

Ordering number 130B1124

7

LCP Panel Mounting Kit

For easy installation of the LCP 101 and LCP 102 in e.g. a cabinet.

IP65 (front)
Thumb screws for tool-free installation
Incl. 3 meters of cables in industry quality (also available separately)
With or without LCP operating unit
Each time easy to install

Ordering number 130B1117 (Mounting kit for all LCP's including fasteners, 3 m cable and gasket)
Ordering number 130B1113 (Incl. graphical LCP, fasteners, 3 m cable and gasket)
Ordering number 130B1114 (Incl. numerical LCP, fasteners and gasket)
Ordering number 130B1129 (LCP front mounting IP55/IP66) – Ordering number 175Z0929 (cable only)
Ordering number 130B1170 (Panel Mouting Kit for all LCP w.o. cable)

Installation of options is a matter of plug-and-play

VLT® AQUA Drive Accessories

Profibus Adapter Sub-D9 Connector

The adapter makes linking of fieldbus connections pluggable. For use with option A.
- Option to use prefabricated Profibus cabling
- For retrofit

Ordering number 130B1112 for frame size A, B and C
Ordering number 176F1742 for frame D and E

Screw terminals

Screw terminals as an alternative to the standard springloaded terminals.
Pluggable
Terminal name is described

Ordering number 130B1116

IP 21/Type 12 (NEMA1) Kit

The IP 21/Type 12 (NEMA1) kit is used for installation of VLT® drives in dry environments.
The enclosure kits are available for frame sizes A1, A2, A3, B3, B4, C3 and C4
Supports VLT® drives from 1.1 to 90 kW
Used on standard VLT® drives with or without mounted option modules
IP 41 on top side
PG 16 and PG 21 holes for glands

130B1122 for frame size A2, 130B1123 for frame size A3, 130B1187 for frame size B3, 130B1189 for frame size B4, 130B1191 for frame size C3, 130B1193 for frame size C4

Kit for panel through mount

Mounting kit for external cooling of the heatsink for appliances with A5, B1, B2, C1 and C2 housing.
The air conditioned installation space can be reduced.
Additional cooling may be omitted
No contamination of electronics by forced ventilation
Facilitates integrated assembly
Reduced cabinet depth/less space

VLT® Brake Resistors

Energy generated during braking is absorbed by the resistors, protecting electrical components from heating up.
Danfoss brake resistors cover the full power range.
Quick braking of heavy loads
Braking energy is only absorbed into the brake resistor
External mounting makes it possible to use the generated heat
All necessary approvals are available

USB Extension

USB extension for IP 55 and IP 66 enclosures. Makes the USB connector available outside the drive. The USB extension is designed for mounting in a cable gland in the bottom of the drive, which makes PC communication very easy even in drives with high IP rating.

USB extension for A5-B1, D and E enclosures, 350 mm cable, ordering number 130B1155
USB extension for B2-C enclosures, 650 mm cable, ordering number130B1156
USB extension for F enclosures, ordering number176F1784

Please refer to the product and design manuals for selection and dimensioning

VLT® AQUA Drive Accessories

VLT® Harmonic Filter AHF 005/010 MCE

Easy, effective harmonic distortion reduction by connecting the AHF 005/010 harmonic filter in front of a Danfoss frequency converter.

AHF 005 reduces total harmonic current distortion to 5%
AHF 010 reduces total harmonic current distortion to 10%

- Small compact housing that can be fitted into a panel
- Easy to use in retrofit applications

User-friendly start-up – no adjustment necessary
No routine maintenance required

VLT® Sine-Wave Filters MCC 101

Sine-wave filters are placed between the frequency converter and the motor to optimise the motor power current. It provides a sinusoidal phase-to-phase motor voltage. The filters reduce motor insulation stress, acoustic noise from the motor, and bearing currents (especially in large motors).

Reduces motor insulation stress
Reduces acoustic noise from the motor
Reduces bearing currents (especially in large motors)
Enables use of longer motor cables
Reduces losses in the motor
Prolongs service lifetime
IP 20 or IP 21

VLT® dU/dt filter MCC 102

VLT® dU/dt filters are placed between the frequency converter and the motor to eliminate very fast voltage changes. The motor terminal phase-to-phase voltage is still pulse shaped but its dU/dt values are reduced.

- These filters reduce stress on the motor's insulation and are recommended in applications with older motors, aggressive environments or frequent braking which cause increased DC link voltage.

IP 20 or IP 21

SVCD – regenerative braking

Transferring the generated power from a decelerating motor back into the power supply enables braking of virtually unlimited duration.

- Energy efficient braking

Self-synchronisation
DC-DC coupling of multiple drives possible

- High efficiency through IGBT technology

Simple operation
Overload protection in regenerative operation

Note: *Missing numbers can be found in the design manual or can be delivered on request*

Environmentally responsible

VLT® products are manufactured with respect for the safety and well-being of people and the environment.

All activities are planned and performed taking into account the individual employee, the work environment and the external environment. Production takes place with a minimum of noise, smoke or other pollution and environmentally safe disposal of the products is pre-prepared.

UN Global Compact
Danfoss has signed the UN Global Compact on social and environmental responsibility and our companies act responsibly towards local societies.

EU Directives
All f tories are certified according to ISO 14001 standard. All products fulfil the EU Directives for General Product Safety and the Machinery directive. Danfoss Drives is, in all product series, implementing the EU Directive concerning Hazardous Substances in Electrical and Electrical Equipment (RoHS) and is designing all new product series according to the EU Directive on Waste Electrical and Electronic Equipment (WEEE).

Impact on energy savings
One year's energy savings from our annual production of VLT® drives will save the energy equivalent to the energy production from a major power plant. Better process control at the same time improves product quality and reduces waste and wear on equipment.

What VLT® is all about

Danfoss Drives is the world leader among dedicated drives providers – and still gaining market share.

Dedicated to drives
Dedication has been a key word since 1968, when Danfoss introduced the world's first mass produced variable speed drive for AC motors – and named it VLT®.

Twenty five hundred employees develop, manufacture, sell and service drives and soft starters in more than one hundred countries, focused only on drives and soft starters.

Intelligent and innovative
Developers at Danfoss Drives have fully adopted modular principles in development as well as design, production and configuration.

Tomorrow's features are developed in parallel using dedicated technology platforms. This allows the development of all elements to take place in parallel, at the same time reducing time to market and ensuring that customers always enjoy the benefits of the latest features.

Rely on the experts
We take responsibility for every element of our products. The fact that we develop and produce our own features, hardware, software, power modules, printed circuit boards, and accessories is your guarantee of reliable products.

Local backup – globally
VLT® motor controllers are operating in applications all over the world and Danfoss Drives' experts located in more than 100 countries are ready to support our customers with application advice and service wherever they may be.

Danfoss Drives experts don't stop until the customer's drive challenges are solved.

3.4 POWER SUPPLY

- PULS – **SL5.100** 24VDC 5A Power Supply

Data sheet

5 A with power boost

SL5.100

- Input: AC 230V / 115V
- Output: 24V / 5A
- Power boost up to 6A
- High overload current, no switch-off
- Quasi-Wide-Range Input
- Robust mechanics and EMC

CB Scheme IEC60950

UL508 LISTED IND. CONT. EQ. 18 WM, 60°C

UL60950 E137006 CUL/CSA-C22.2 No 60950

EMC and Low Volt. Directive

Input

Input voltage	AC100-120/200-240 V (switchable), 47-63 Hz (85-132 VAC / 176-264 VAC, 210-375 VDC, see also „Output: Continuous Loading“)

Quasi-Wide-Range Input: With the switch in the 230V position the power-supply unit operates at low and moderate loads (until 3 A) at any input voltage between 95 and 264 V AC (see 'Output' below).
Note: At DC input, always leave the switch in the 230V position

Input current	< 2.6 A (switch in 115V position) < 1.4 A (switch in 230V position)
• DCin at open output	typ. 5 mA (preserves battery sources)
Inrush current	typ. 15 A at 264 V AC and cold start

To be fused with a 10A, B-type 'circuit-breaker' switch based on the usual thermomagn. overload sensing principle (used anyway to fuse the input lines). In addition, the unit contains an internal fuse (not accessible)

EN 61000-3-2 (harmonic current emissions) is fulfilled

Transient handling	Transient resistance acc. to VDE 0160 / W2 (750 V / 1.3 ms), for *all* load conditions.
Hold up time	> 37 ms at 196 VAC, 24 V / 5 A (see Diagram overleaf)

Efficiency, Reliability etc.*

Efficiency	typ. 90 % (230 VAC, 24 V / 5 A)
Losses	typ. 13,3 W (230 VAC, 24 V / 5 A)
MTBF	520,000 h acc. to Siemensnorm SN 29500 (24 V/5 A, 230 VAC, T_{amb} = +40 °C)
Life cycle (electrolytics)	The unit exclusively uses longlife electrolytics, specified for +105°C (cf. 'The SilverLine', p.2).

Construction / Mechanics*

Housing dimensions and Weight

• W x H x D	64 mm x 124 mm x 102 mm (+ DIN rail)
• Free space for ventilation	above/below 25 mm recommended left/right 15 mm recommended
• Weight	620 g

Design advantages:
- All connection blocks are easy to reach as mounted at the front panel.
- Input and output are strictly apart from each other and so cannot be mixed up (Input below, output above).

* For further information see data sheets „The SilverLine“, „SilverLine Family Branches“ and mechanics data sheet

Output

Output voltage	24 V DC +5% –1%
Output noise suppression	Radiated EMI values below EN 61000-6-3, even when using long, unscreened output cables.
Ambient temperature range T_{amb}	Operation: -10°C...+70°C (>60°C: Derating) Storage: -25°C...+85°C

Continuous loading (at T_{amb}= -10°C...+60°C, convection cooling), see also diagram overleaf. For start at T_{amb}< 0°C and low input voltage, please contact PULS.

Output is protected against short circuit, open circuit and overload

Switch	AC/DCin		Iout
230V	176-264 V	ACin	5 A / 6 A *
	95-176 V	ACin	3 A
	210-375 V	DCin	5 A / 6 A *
	150-210 V	DCin	3 A
	100-150 V	DCin	2 A
115V	85-132 V	ACin	5 A / 6 A *

* short-term 6 A (< 1 min), at 45°C or forced cooling even continuous

Derating	typ. 3 W/K (at T_{amb}=+60°C...+70°C)
Voltage regulation	better than 2% Vout overall
Ripple / Noise	< 50 mV_{PP}, (20 MHz bandw., 50 Ω measurem.)
Overvolt. protection	typ. 29 V
Parallel operation	yes; current sharing available on request
Power back immunity	26 V
Front panel indicator	Green LED, goes out at V_{out}<18V

Start / Overload Behaviour

Startup delay	typ. 0.1 s
Rise time	ca. 5-20 ms, depending on load

Overload Behaviour

• Special PULS Overload Design (see diagram overleaf)	– no disconnection, no hiccup if overloaded – high overload current (up to 1.9 I_{Nom}), Vout is gradually reduced with increasing current.
• 20% power boost	– 6A short-term, at 45°C or forced cooling even continuous

Advantages:
- High short-circuit current, giving large 'start-up window': unit starts reliably even with awkward loads (DC-DC converters, motors).
- No 'sticking' such as can occur with fold-back characteristics
- Secondary fuses operate reliably

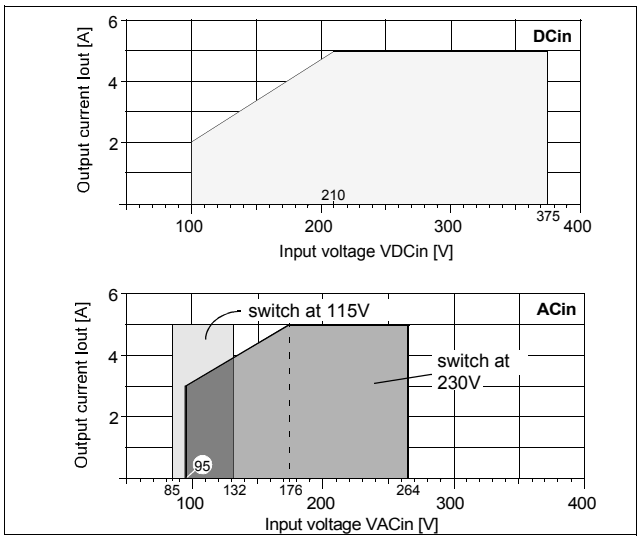
Order information

Order number	Description
SL5.100	(Basic version*)
SLR5.100	(N+1 redundancy*)
SLS5.100	(Safety Cover*)
SLZ01	Screw mounting set, two needed per unit

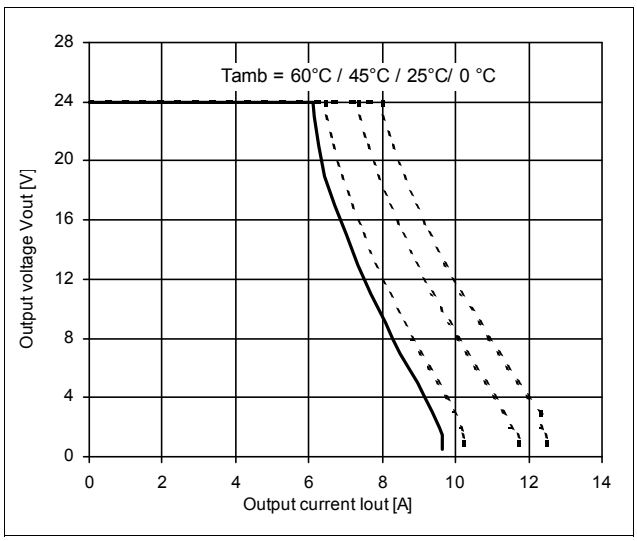
PULS

Data sheet

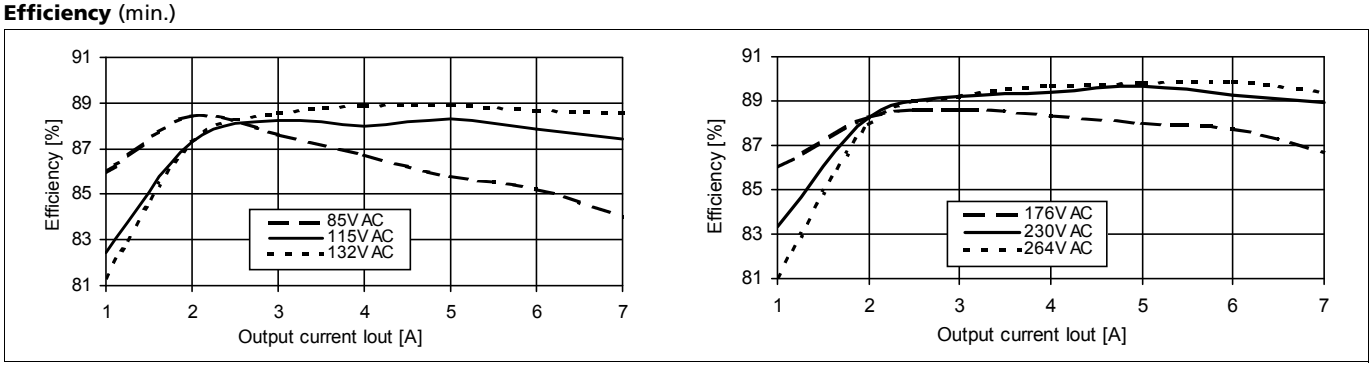
Output Current over Input Voltage (min.)



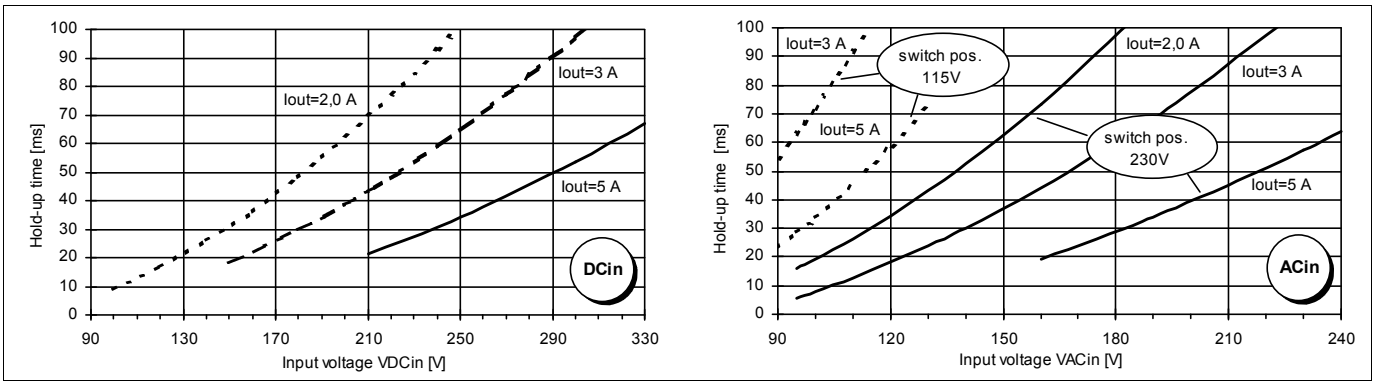
Output characteristic (min.)



Efficiency (min.)



Hold-up time (min.)



For further information, especially about

- EMC
- Connections
- Safety, Approvals
- Mechanics und Mounting,

see page 2 of the „The SilverLine“ data sheet.

For detailed dimensions

see SilverLine mechanics data sheet SL2.5/ SL5/ SL10

Unless otherwise stated, specifications are valid for AC 230V input voltage, +25°C ambient temperature, and 5 min. run-in time. They are subject to change without prior notice.

Your partner in power supply:

ISO 9000:2000 certified

EPSMA European Power Supply Manufacturers Association

AWARDED Bayerns Best 50 Czech 100 Best EuropeÕs 500

PULS GmbH
Arabellastraße 15
D-81925 München
Tel.: +49 89 9278-0
Fax: +49 89 9278-199
www.puls-power.com

3.5 SWITCHES, INDICATORS & PUSHBUTTONS

- KRAUS & NAIMER – **CA10-A0007/AU2123 E-FT2** Voltmeter Selector Switch
- KRAUS & NAIMER – **CA10-A058/AUN0180 E-FT2** Ammeter Selector Switch
- KRAUS & NAIMER – **CA10-A213-623-FT2**
- Engraved "REMOTE-OFF -LOCAL" Selector Switch

- SPRECHER & SCHUH – **D7P-F301-PX10** Green Start Pushbutton
- SPRECHER & SCHUH – **D7P-F402-PX01** Red Stop Pushbutton
- SPRECHER & SCHUH – **D7P-F607-PX10 + D7-X10** Blue Reset Pushbutton

- SPRECHER & SCHUH – **D7P-MT44-PX01**
  Emergency Stop Pushbutton

- SPRECHER & SCHUH – **D7P-P0-PN3A** Amber Pilot Lights
- SPRECHER & SCHUH – **D7P-P4-PN3R** Red Pilot Lights
- SPRECHER & SCHUH – **D7P-P7-PN3W** White Pilot Lights

- SPRECHER & SCHUH – **D7P-POT3** 1kΩ Potentiometer

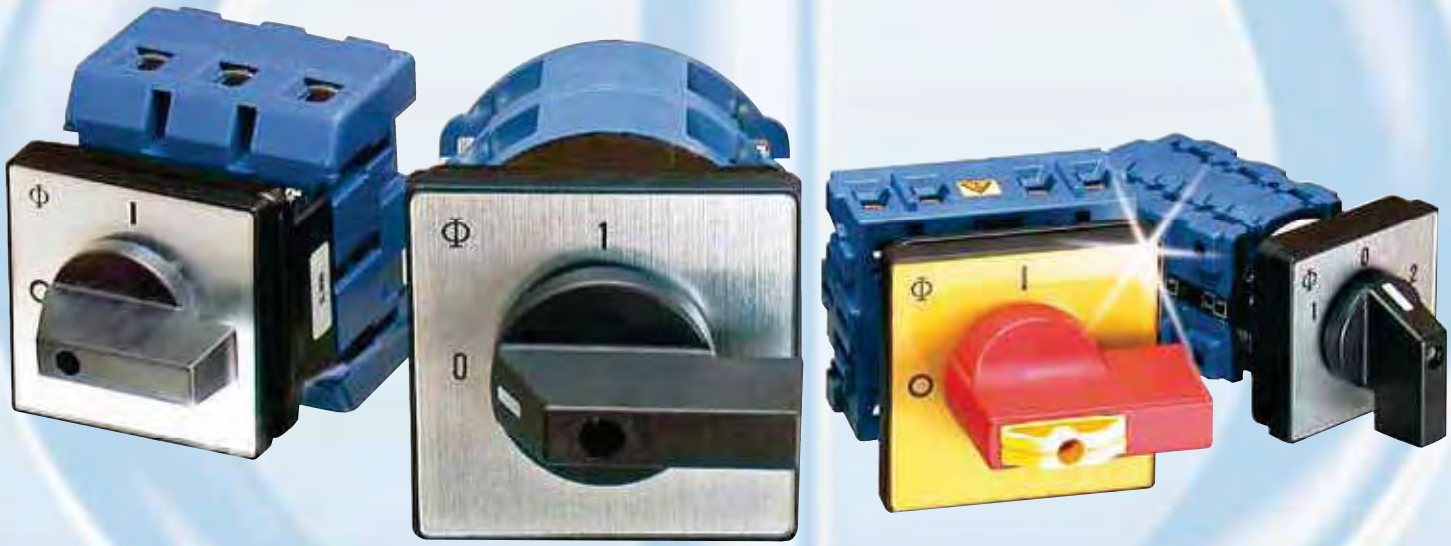
Kraus & Naimer Pty. Ltd.

BLUE LINE switchgear

2012

Short Form Catalogue

ALL PRICES EXCLUSIVE OF G.S.T



FOR COMPLETE PRODUCT RANGE VISIT

www.krausnaimer.com.au

Kraus & Naimer

BLUE LINE switchgear

The development of the Blue Line rotary switch, load break switches disconnectors - switch disconnectors, contactor and motor starter product ranges is based on One Hundred years experience by Kraus & Naimer. In the Design and manufacture of electrical switchgear, Kraus and Naimer have pioneered the introduction of the cam operated rotary switch, and continues to be recognised as the world leader in that product field.

BLUE LINE

Blue Line products are protected by numerous patents throughout the industrial world. They are built to national and international standards and designed to withstand adverse temperatures and climates.

Blue Line products are accepted and universally recognised for their quality and workmanship. They are supported by the world-wide sales and service organisation.

The Kraus & Naimer Registered Trademark

WORLDWIDE SYMBOL FOR QUALITY SWITCHGEAR

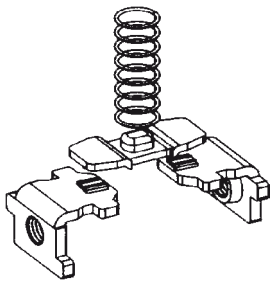
Contents

Technical Data

u Rated Operational Current

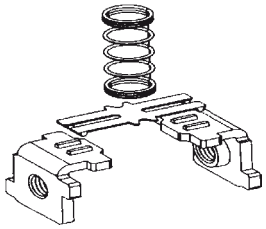
Multi cross point contacts		1V	6V	12V	24V	48V	110V	240V
CA4/CG4	AC21A	-	-	-	10	10	10	10
	DC21 B	-	-	-	10	6	0.7	0.2
H-Bridge cross wire contacts								
CGD4 - 1	AC21A	5	2	1.2	0.7	0.45	0.25	0.15
	DC21B	3	1.2	0.7	0.4	0.25	0.13	0.08
CAD11	AC21A	5	3	2	1	0.8	0.4	0.2
	DC21B	4	2.5	1.5	0.8	0.3	0.2	0.1
CAD12	AC21A	-	5	5	5	4	3	2
	DC21B	-	4	3	2.2	1.2	0.6	0.3

Special Contact Systems



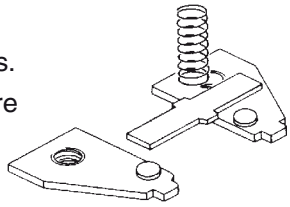
CA4/CG4 (@1µ gold plating)

A high contact reliability is achieved by the use of multiple crosspoint contacts, having a four point contact face to minimise contact resistance. Terminals on the CA series are accessible from both sides, and the terminals on the CG series are accessible from the rear. Both switches have finger proof terminals.These are the smallest cam switch 30mm sq.



CAD11/CAD12 / CGD4 - 1

H-bridge cross wire contact system. The moving contact is made of spring type material to absorb possible contact bounce. These corrosive resistant contacts are capable of operating on systems voltages as low as 1 volt. CAD11 = Gold contacts. CAD12 = Silver contacts. Both switches have screw driver guides, finger proof terminals and captive plus-minus terminal screws capable of accepting two variant cable sizes.



C/CA

Switches C/CA have finger proof terminals and captive plus-minus terminal screws. Each stage contains two rigid, double-break silver alloy contacts. The terminals are accessible from both sides. Ranging from 20 ~ 315 amperes these switches will accept a wide range of “optional extras”.

KG/KH Switches: This durable switch line possesses high short circuit withstand capabilities, with positive movement during both making and breaking functions. The **KG/KH** range of isolators and changeover switches exhibit excellent AC-3 and AC-23 making and breaking capabilities.

This ‘Short Form’ catalogue illustrates only a small selection of the KRAUS & NAIMER switches. Other switches available are:- A11, A14, A30, AD11, AD12, CH10 ~ CHR16B, D10 ~ D14R, DH, DHR, DK, DKR, L350 ~ L1251,X63 ~ X630. Additional information available on request.

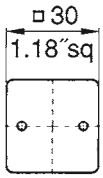
G20 (S) DC SWITCHING WITH KNIFE CONTACTS Refer Page 33

Rotary Cam Switches

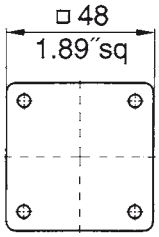
Rated Values

Escutcheon Plate Dimensions
Note: for drilling details refer to pages 31 & 32

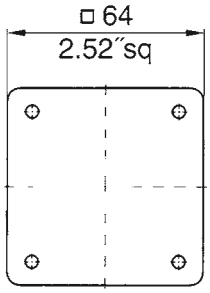
S00



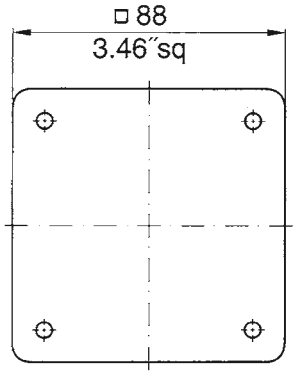
S0



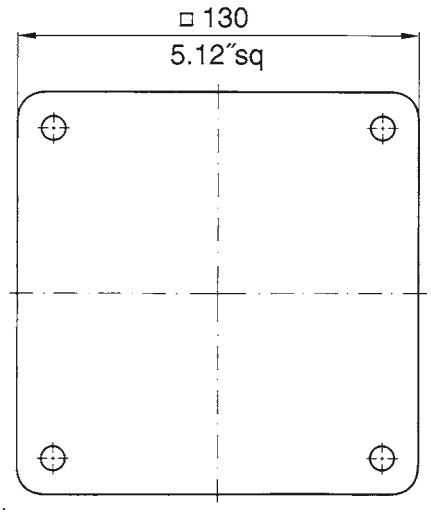
S1



S2



S3



TYPE	According to IEC 60947-3/VDE 0660, part 107				
	Cable mm²	Nominal Voltage U_i	Thermal Current I_u/I_{th}	Motor Rating 3 x 380 V - 440 V AC-23A	AC-3
		V	A	kW	kW
CA4	2 x 1.5	440	10	3	2.2
CG4	2 x 1.5	440	10	3	2.2
CG 8	2 x 2.5	690	20	7.5	5.5
CA10	2 x 2.5	690	20	7.5	5.5
CA20	2 X 4	690	25	11	7.5
CA25	2 x 6	690	32	15	11
CH10	2 x 4	690	20	7.5	5.5
CH16	2 x 4	690	25	11	7.5
CA10B	2 x 2.5	690	20	7.5	5.5
CA20B	2 x 4	690	25	11	7.5
CA25B	2 x 6	690	32	15	11
CA40	1 x 16	690	40	18.5	15
CA50	1 x 16	690	50	22	18.5
CA63	1 x 16	690	63	30	18.5
C26	2 x 6	690	32	15	11
C32	2 x 10	690	50	22	15
C42	2 x 16	690	63	30	18.5
CHR10B	Ring	690	20	7.5	5.5
CHR20B	Ring	690	25	11	7.5
C43	2 x 16	690	63	30	18.5
C80	35	690	115	45	30
C125	70	690	150	75	37
C200-4	M8	690	200	75	37
C315	M12	690	315	132	55
C316	M12	1000	315	132	55
L400	M12	690	500	132	55
L600	M16	690	800	132	55
L800	M16	690	1100	132	55
L1200	M16	690	1450	132	55
L1600	2 X M16	690	1900	132	55
L2000	2 X M16	690	2400	132	55

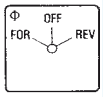
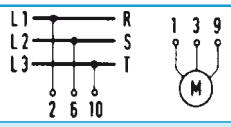
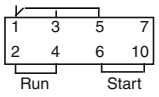
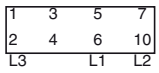
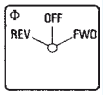
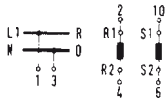
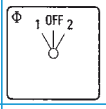
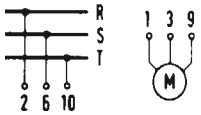
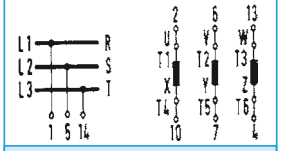
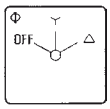
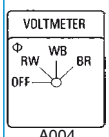
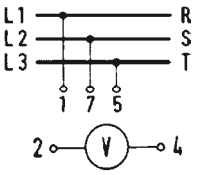
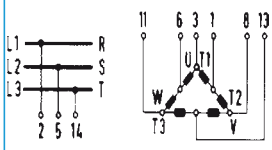
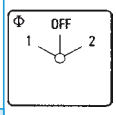
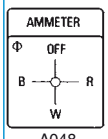
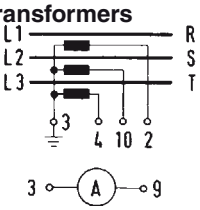
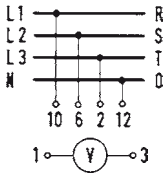
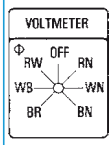
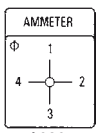
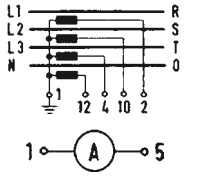
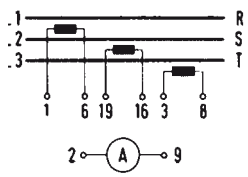
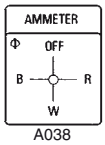
For further technical details, refer to Catalogue 100 and 120.
Gold contacts and quick connects see Catalogue 100 P4.

For Safety and Maintenance Switches Refer Page 16-19

Rotary Cam Switches - Panel Mounting

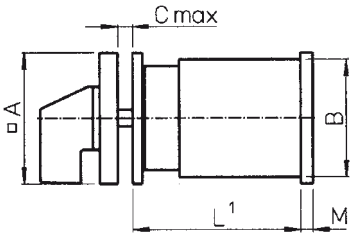
CA10 AU9Y96-600FT2

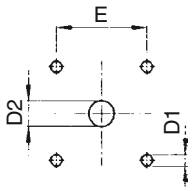
Selection Data	IEC 60947-3, EN 60947, VDE 0660			CG 4 CA 4	CG 8 CH 10 CA 10	CA20 CA20B	C26 CA25	CA 40	C32 CA 50
Rated Thermal Current		$I_U = I_{th}$	A	10	20	25	32	40	50
Rated Category	3 x 380 V/440 V	AC-23A	kW	3	7.5	11	15	18.5	22
				C 42 CA 63	C 80	C125	C200-4	C315	L400
Rated Thermal Current		$I_U = I_{th}$	A	63	115	150	200	315	500
Rated Category	3 x 380 V/440 V	AC-23A	kW	30	45	75	75	132	132

Function	Front Plate	Code No.	List Price $	No. of Stages	Code No.	List Price $	No. of Stages
Motor Reversing 3 Phase 60° Switching		 CA10 A401-620 E CA40/C26 A401-620 E		3 3	**Single or Three phase 90° Enclosed IP65** Single Phase Rev.  Run Start 3 Phase Rev. M3 M1 M2  L3 L1 L2		
Split Phase		 CA10 WAA622-600 E CA20B WAA622-600 E	Net	3 3	CA10C2Y096*PFAUS0001 CA10 AU9Y96600FT20002		3 3
Motor Reversing 3 Phase Spring Return		 CA10 A228-600 E CA40/C26 A228-600 E		3 3	**Off-Star-Delta**  CA10 A410-620 E CA40/C26 A410-620 E		4 4
Meter/Motor Switches	 A004	**3 Phase - 3 Wire**  CA10 A004-625 E CH10 A004-625 E		2 2	**Tap wound Motor**  CA10 A441-620 E CA20 A441-620 E	(2 Speed) 	4 4
Meter Switches	 A048	**1 Pole - 3 Current Transformers**  CA10 A058/AUN0180 E CH10 A058/AUN0180 E		3 3	**3 Ph - Ph / 3 Ph - N**  CA10 A007/AU2122 E CH10 A007/AU2122 E	 A007	3 3
	 A036	**1 Pole - 4 Current Transformers**  CA10 WAA036-620 E CH10 WAA036-620 E		4 4	**2 Pole - 3 Current Transformers** (Can be used for direct reading)  CA10 A038-622 E CA40/C26 A038-622 E	 A038	5 5

Dimensions mm

Rotary Cam Switches - Panel Mounting





E Panel Mounting
Size 0 - Size 3

	CG4	CAD's CA10	CA20	CA25	CA63 CA50 CA40 C26	C32	C42	C80	C200-4 C125	C315 L400
A	30	48	48	48	64	64	64	88	88	130
B	28	43	45	46	45/58	60	66	84	88	126
C	4	4	4	4	4	4	4	5,5	5,5	7
D1	3,2	5	5	5	5	5	5	6	6	7
D2	8	8	8	10	10	10	10	13	13	16
E	-	36	36	36	48	48	48	68	68	104
M	-	4,5	4,5	5,5	6,5	7.5	7.5	9,4	9,4	11,9

Length L

Stages	CG4	CAD's CA10	CA20	CA25	CA63 CA50 CA40 C26	C32	C42	C80	C200-4 C125	C315 L-switches Size S3
1	38,5	31,7	35,9	37,2	41	45,8	49,8	61,5	67,5	78,6
2	50	41,2	48,6	51,2	53.7	63,3	71,3	88	100	117,2
3	62,5	50,7	61,3	65,2	66.4	80,8	92,8	114,5	132,5	155,8
4	74,5	60,2	74	79,2	79.1	98,3	114,3	141	165	194,4
5	86,5	69,7	86,7	93,2	91.8	115,8	135,8	167,5	197,5	233
6	94,5	79,2	99,4	107,2	104.5	133,3	157,3	194	230	271,6
7	110,5	88,7	112,1	121,2	117.2	150,8	178,8	220,5	262,5	310,2
8	122,5	98,2	124,8	135,2	129.9	168,3	200,3	247	295	348,8
9	-	107,7	137,5	149,2	142.6	185,8	221,8	273,5	327,5	387,4
10	-	117,2	150,2	163,2	155.3	203,3	243,3	300	360	426
11	-	126,7	162,9	177,2	168	220,8	264,8	326,5	392,5	464,6
12	-	136,2	175,6	191,2		238,3	286,3	353	425	503,2

SWITCH ORDERING CHART

Mounting Requirements

- ☐ **E** Panel Mount. (5 hole mount)
- ☐ **VE** Base mount suitable for door clutch etc.
- ☐ **E - V** Panel Mount.(vertical access to terminals
- ☐ **E22** Panel mount. (3 hole, size 0)
- ☐ **ER** Combined panel square base plates.
- ☐ **T146 K** DIN rail mounting plate. (size 0 and size 1)
- ☐ **FT1** Single hole mtg. w/o esc. plate IP65. (S0 = 22.3mm)
- ☐ **FT2** Single hole mtg. wth square plate IP65. (S0 = 22.3mm)
- ☐ **EF** Panel seal IP65. (mounts between switch and panel).
- ☐ **KD/KN** Heavy duty mounting plate and metal shaft.
- ☐ **L100** Various shaft lengths (metal)
- ☐ **M004** Adjustable shaft (advise length).
- ☐ **PF** Enclosure ABS IP56
- ☐ **GK** Enclosure aluninium IP54.
- ☐ **M280E** Door clutch (specify depth required).
- ☐ **6 CL** Enclosure 56 series.
- ☐ **6 SS** Enclosure stainless steel.
- ☐ **KS/KL** Enclosures IP65.
- ☐ **6S115 x 70** Wall plate stainless or Plastic
- ☐ Other, nominate type of mounting required.

Handle Operation

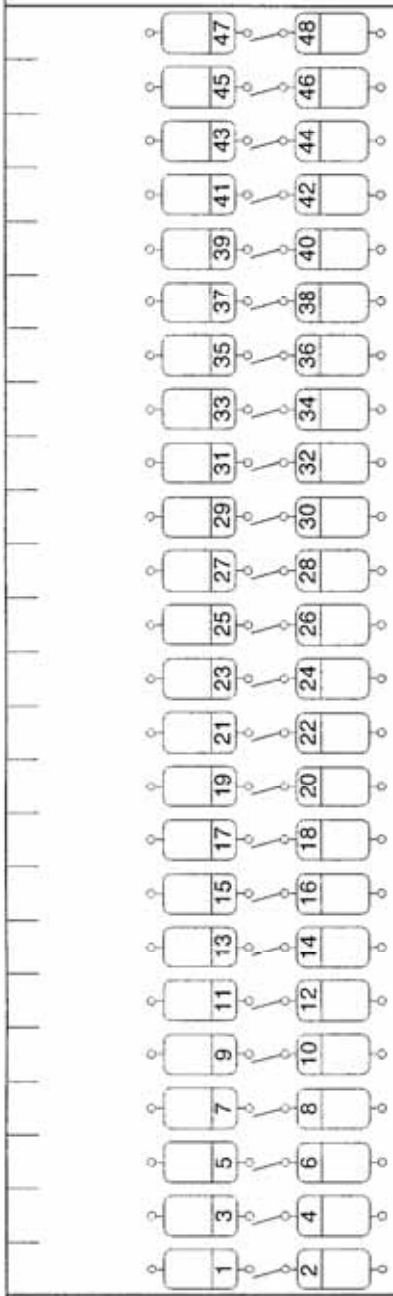
- ☐ Normal/standard handle (G251) or .....
- ☐ **V750D** Key operator size 00 ~ 0.
- ☐ **V755A** or **C** Key operator (530 series) .
- ☐ **V750/A9** Key operator size 0 switch.(Lockwood)
- ☐ **6SOLW V750** Key operator (201 Lockwood etc.)
- ☐ **V760** Seperate key and handle (programmable).
- ☐ **V840A/.**Padlockable handle (S0 & S1).
- ☐ **V845** Padlock Handle. (c/w esc.plate)
- ☐ **V840G** Padlock device.
- ☐ **V850** Padlockable with handle device
- ☐ **V400** Push-button interlock device.
- ☐ Other specify

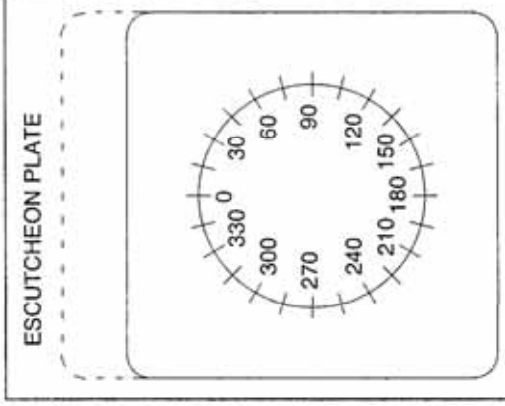
Essential Data

1. Switch/circuit requirement. . . Amp ..... Volts ..... **kW** .....
2. Cable size ..... or limiting dimensions .....
3. AC or DC (DC voltage required).....Duty:- AC21/AC22/AC23/AC11 or other.
4. **PLC**/Electronic circuit/dry circuit or standard switch.

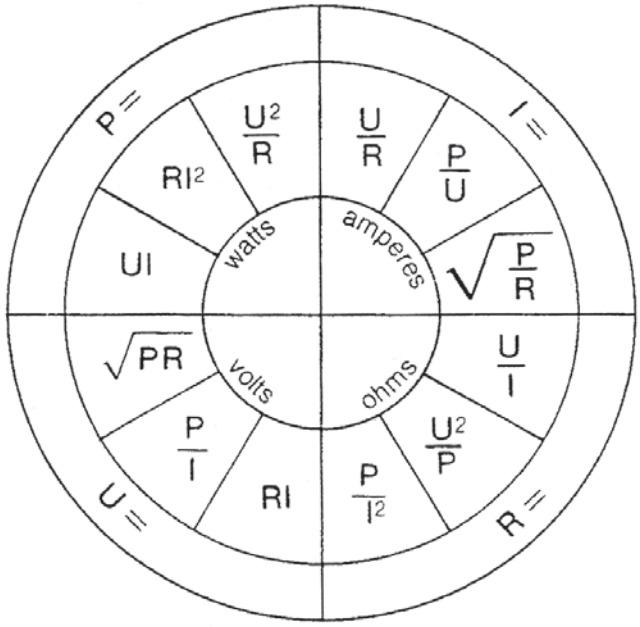
KRAUS & NAIMER "The Switchgear Innovators"

SWITCH TYPE	:	MOUNTING	:	FIRM	:
ESCUTCHEON PLATE	:	OPTIONAL EXTRAS	:		
HANDLE	:			DATE :	SIGNED :





Ohm's Law



SYMBOLS

U = Voltage in volts

I = Current in amperes

R = Resistance on ohms

P = Power in watts

Useful Formulae

$kW = kVA \times pF$	$\text{Line Amps} = \frac{hp \times 746}{\text{Line volts} \times 1.732 \times Eff \times pF}$
$kW = \frac{hp \times 746}{1000 \times Eff}$ $\quad \frac{hp \times 746 \times 100}{1000 \times \%Eff}$	$\text{Horsepower (hp)} = \frac{kVA \times 1000 \times Eff}{746}$
$kW = \frac{\text{Line amps} \times \text{Line volts} \times 1.732 \times pF}{1000}$	$hp = \frac{kVA \times 1000 \times Eff\ pF}{746}$
$kVA = \frac{kW}{pF}$	$hp = \frac{\text{Line amps} \times \text{Line volts} \times 1.732 \times Eff \times pF}{746}$
$kVA = \frac{hp \times 756}{1000 \times Eff \times pF}$	1 Watt = 1 joule/second
$kVA = \frac{\text{Line amps} \times \text{Line volts} \times 1.732}{1000}$	1 hp = 746 Watts
$\text{Line Amps} = \frac{kVA \times 1000}{\text{Line volts} \times 1.732}$	1 hp = 746 joules/second
$\text{Line Amps} = \frac{kW \times 1000}{\text{Line volts} \times 1.732 \times pF}$	

VOLT-DROP Single Phase

Service Voltage = 240V

Max Permissible Vd = $\frac{240 \times 2.5}{100}$ (2.5% Service Voltage)

= 6V

Max Unit Vd = $\frac{\text{Max Vd} \times 1000}{1 \times \text{distance}}$ (Length of cable run)

Index

AC-1
Resistive or low inductive loads.

AC-3
Direct on line starting, star delta starting.

AC-4
Direct on line starting, reversing, plugging and inching.

AC-21
Switching of resistive loads, including moderate overloads.

AC-23A
Frequent switching of motors or other highly inductive loads (selection criteria for main switches).

AC-22
Isolation of 6 Pole star delta motor circuits

POWER Motor Size		CURRENT three phase 50-60 Hz	
kW	h.p.	415V	440V
0.37	0.5	1.2	1
0.55	0.75	1.6	1.3
0.75	1	2	1.68
1.1	1.5	2.5	2.37
1.5	2	3.5	3.06
2.2	3	5	4.42
3	4	6.5	5.77
4	5.5	7.5	7
5.5	7.5	11	10.4
7.5	10	14	13.7
10	13.5	19	16.5
11	15	21	20.1
15	20	28	26.5
18.5	25	35	32.8
22	30	40	39
30	40	55	51.5
37	50	66	64
45	60	80	76.3
55	75	100	90
75	100	135	125
90	125	165	156
110	150	200	186
132	175	230	216
160	220	280	256
200	270	340	321
220	300	385	353
250	350	450	400
315	430	535	500

IP Ratings

IP65 - where 6 means complete protection against accidental contact with live or internal moving parts. Protection against the ingress of dust (dust tight). Where 5 means water projected by nozzle against the equipment from any direction shall have no harmful effect.

IP66 - where 6 means complete protection against accidental contact with live or internal moving parts. Protection against the ingress of dust (dust tight). Where 6 means water projected by powerful jets against the enclosure from any direction shall have no harmful effect.

IP69K - where 6 means complete protection against accidental contact with live or internal moving parts. Protection against the ingress of dust (dust tight). Where 9K means where water directed against the enclosure under extremely high pressure from any direction must not have any harmful effect. Water pressure of 100 bar. Water temperature of 80 deg C.

The Range of **Blue Line** Switchgear

Technical Catalogues for the following products are available from our website. www.krausnaimer.com.au

Main Switches and Main Switches with Emergency Function 16 A-315 A
Maintenance Switches 20 A-315 A
Switch Disconnectors 20 A-315 A
According to IEC 60947 - 3, EN 60947 - 3, VDE 0660 part 107, IEC 60204, EN 60204 and VDE 0113

500

CL SWitches 10 A-20 A
C, CA and CAD Switches 10 A-315 A and L Switches 350 A-2400 A
C, CA andCAD switches are designed for universal application. They are recommended for instument, isolator, double-throw and motor control.
L switches are designed for load and off-load applications. They are used to switch resistive or low inductive loads.

100

Optional Extras and Enclosures
The complete product line, a large number of oiptional extras is available, including door interlocks, push-pull devces, cylinder and padlock attachments, control and indicator devices, Ac motor drives, as well as enclosures, both inslated and metal.

101

A and AD Switches 6 A-25 A
A and AD Switches have 4 contacts in each switching stage. These switches provide an extensive range of switch functions and require a minimum mounting depth. Up to 36 switching postions are possible, with availability of 48 contacts per 12 stage column.

110

CG, CH and CHR Switches 10 A-25 A
Ultra compact CG, CH and CHR switches are ideally suited for control and instumentation applications.
Switch terminals are ‘finger-proof’ and conveniently accessible for wiring and are delivered open. All CG4 ewiches offer specially designed gold plated contacts or H-bridges with ‘cross-wire’ contact systems, which facilitates their use in electronic circuitry and chemically aggressive environments.

120

DH, DHR, DK and DKR Switches 6 A-16 A
DH, DHR, DK, and DKR switches incorporate unique corrosion resistant contacts that permit operation on system voltage as low as 1 V. They have fully enclosed and protected contacts which can be operated either by rotary and/or lateral handle movement. D switches are used in calibration and semiconductor circuits. They are also used for relay and contactor control.

130

X Switches 80 A-630 A
X swiches can be applied for load, tap and gang duties. They incorporate 6 contacts in each switching stage. Their compact design provides a minimum lengtgh dimension for mounting purpose.

140

KG Switches 20 A-315 A and KH and KHR Switches 16 A-80 A
KC, KG, KH anh KHR switches are excellent circuit interruptors. They have high through fault and fault making capacities and are especially designed for use as isolators and safety switches for machine tools, distribution panels and switchboards. KG ON/OFF switches offer unusually high dimensioned air and creepage distances between terminals which are designed for time saving ‘straight-line’ wiring. ON/OFF switches are available with up to 8 poles and double-throw switches are available with up to 4 poles.
KC switches offer spring cage terminals for greater termination security.

150

Push Buttons and Pilot Lights, 22.5 mm Ø
A complete range of state-of-the-art push buttons and pilot lights represent an ideal combination of functional security economical efficiency in a modular design.

302

Disconnectors for Photovoltaic

Maintence Switches for EMC - Compliant Connection
Frequency regulated motors.

We reserve the right to make technical and dimensional changes without prior notice. Any errors or omissions are not binding.

KRAUS & NAIMER
BLUE LINE SWITCHGEAR

www.krausnaimer.com

SINCE 1907

Catalog 100

CL Switches 10 A-20 A
C, CA, CAD Switches 10 A-315 A
L Switches 350 A-2400 A

KRAUS & NAIMER

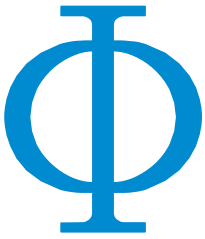
The development of the Blue Line rotary switch, contactor and motor starter product ranges is based on more than seventy-five years experience by Kraus & Naimer in the design and manufacture of electrical switchgear. Kraus & Naimer pioneered the introduction of the cam operated rotary switch and continues to be recognized as the world leader in that product field.

BLUE LINE

Blue Line products are protected by numerous patents throughout the industrial world. They are built to national and international standards and designed to withstand adverse temperatures and climates.

Blue Line products are accepted and universally recognized for their quality and workmanship. They are supported by a worldwide sales and service organization.

The Kraus & Naimer Registered Trademark



WORLDWIDE SYMBOL FOR QUALITY SWITCHGEAR

Construction Data

The load switches of the C, CA, CAD and CL-series offer a solution for most cam switch applications. Different contact designs, contact materials and terminals allow for their use as control switches, instrumentation switches and motor control switches, as well as in electronic circuitry and in aggressive environments according to IEC 60947-3 and VDE 0660 part 107.

The stage is the basis for all switches and can be supplied with a maximum of 2 contacts. The terminals are accessible from the side. CA and CAD switches are supplied with open terminals to facilitate wiring and are protected against accidental finger contact according to EN 50274, VDE 0660 part 514 and BGV A3. Captive plus-minus terminal screws and integrated screwdriver guides also reduce wiring.

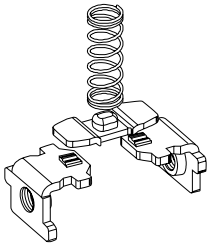
The switches of the new CL-series are supplied with rust-free and acid-resisting IDC terminals (**I**nsulation **D**isplacement **C**onnection) instead of screw type terminals. The stripping or preparation of the insulation is no longer required. Eliminate errors due to i.e., stripped end of the conductor too long or too short, incorrect sleeves used, sleeves crimped incorrectly or wrong crimping tool is used, terminal screws not tightened properly etc. The CL switches reduce installation time by 60 %-70 % compared to the screw type terminals. This translates to significant cost savings. For connecting 2 conductors to a terminal an additional screw terminal with plus-minus screw is available.

If a positive manual operation or a higher DC rating is required, many of these switches can be fitted with a snap action latching mechanism - suffix „S“ - to the switch type.

The cam-operated switches L350-L2000 are continuous current rated for off-load switching. They may be used to switch resistive or low inductive loads.

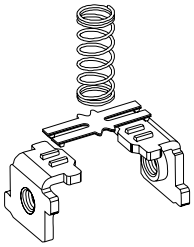
Special Contact Systems

CA4/CA4-1



High contact reliability by multiple cross-point contacts, electronic compatible, CA4 with 1 µ and CA4-1 with 35 µ gold plating.

CAD11/CAD12



H-bridge with „cross-wire“ contact system, high contact reliability also at lower voltages. CAD11 with gold-plated contacts, CAD12 with silver contact.

Type	Size	Possible Switching Angles	Max. No. of Stages
CA4, CA4-1	S00	30°, 45°, 60°, 90°	9
CL4	S00	30°, 45°, 60°, 90°	8
CA10-CA25	S0	30°, 45°, 60°, 90°	12
CA10S-CA25S	S0	60°	on request
CAD11, CAD12	S0	30°, 45°, 60°, 90°	12
CL10	S0	30°, 45°, 60°, 90°	10
CA10B-CA25B	S1	30°, 45°, 60°, 90°	12
C26, C32, C42	S1	20°, 30°, 45°, 60°, 90°	12
C26S, C32S, C42S	S1	60°	on request
C43, C80, C125	S2	20°, 30°, 45°, 60°, 90°	12
C315	S3	20°, 30°, 45°, 60°, 90°	12
L350/51, L630/31, L1000/01, L1250/51	S2	30°, 45°, 60°, 90°	12
L400, L600, L800, L1200, L1600, L2000	S3	30°, 45°, 60°, 90°	12

CL Switches

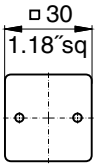
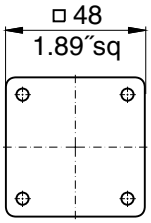
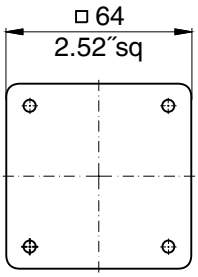
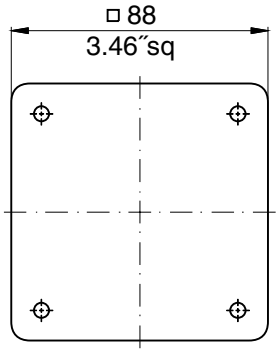
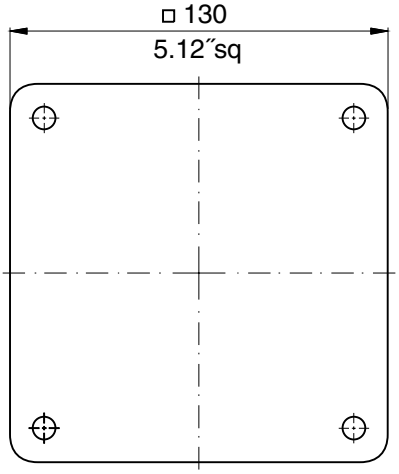
CA and CAD Switches

C Switches

L Switches

Above illustrates the standard terminal positions.

Nominal Ratings

Switch Size	Type	According to IEC 60947-3/VDE 0660 part 107			
		Insulation Voltage[1] U_i V	Thermal Current I_u/I_{th} A	Motor Rating 3 x 380 V-440 V AC-23 kW	AC-3 kW
S00 	CA4	440	10	3	2,2
	CA4-1	440	10	3	2,2
	CL4	440	10	3	2,2
S0 	CA10	690	20	7,5	5,5
	CA11	690	20	7,5	5,5
	CA20	690	25	11	7,5
	CA25	690	32	15	11
	CAD11	600	6	-	-
	CAD12	600	6	-	-
	CL10	690	20	7,5	5,5
S1 	CA10B	690	20	7,5	5,5
	CA11B	690	20	7,5	5,5
	CA20B	690	25	11	7,5
	CA25B	690	32	15	11
	C26	690	32	15	11
	C32	690	50	22	15
	C42	690	63	30	18,5
S2 	C43	690	63	30	18,5
	C80	690	115	45	30
	C125	690	150	75	37
	L350	690	350	90	37
	L351	690	350	90	37
	L630	690	630[2]	90	37
	L631	690	630[2]	90	37
	L1000	690	1000[2]	90	37
	L1001	690	1000[2]	90	37
	L1250	690	1250[2]	90	37
	L1251	690	1250[2]	90	37
S3 	C315	690	315	132	55
	C316[3]	1000	315	132	55
	L400	690	500	132	55
	L600	690	800[2]	132	55
	L800	690	1100[2]	132	55
	L1200	690	1450[2]	132	55
	L1600	690	1900[2]	132	55
	L2000	690	2400[2]	132	55

For further technical details, refer to pages 40-43.
To furnish with gold contacts and quick connects see page 4.

[1]Valid for lines with grounded common neutral termination, overvoltage category III, pollution degree 3. Values for other supply systems on request. [2]Ambient temperature 35 °C max. [3]Additional switch functions on request.

How to order

Disconnectors and Main Switches according to IEC 60947-3 see Catalog 500

Three types of data (shown below) are required for ordering Blue Line cam-operated switches. Code numbers for ordering are shown in this catalog.

1. Type of Switch

The type of switch required may be easily selected by referring to the table on page 3 which shows the thermal current, power rating and dimensions of each switch. For further technical details, refer to pages 40-43. Variations of contacts and terminals are shown below.

2. Switch Function

The code numbers for standard switches shown on pages 6-28 indicate the switch function, escutcheon plate, handle and any optional extras.

Additional coding to modify type and color of handle and escutcheon plate is explained below.

3. Type of Mounting

Types of mounting are shown on pages 29-35. Catalog **101** describes enclosures and optional extras.

Specify the mounting code to indicate required mounting.

CA10	A202-600	VE

Type of Switch

Extending the switch type coding the following combinations will define:

Amendment	Definition	For switch types
-1	with gold contacts[1]	CA10, CA11, CA10B, CA11B
-4	with quick connects	CA4
B	S0 switches with latching mechanism size S1	CA10, CA11, CA20, CA25, CAD12
C	S1 switches with latching mechanism size S2	C26, C32
L	with lockout-relay w/o manual release for std. sw.	CA10, C26, C32, C42
M	with lockout-relay with manual release for std. sw.	CA10, C26, C32, C42
X	with power failure release	CA10, CA11, CA20, CA25, CAD12, C26, C32, C42
Y	with power failure release and trip-free release	CA10, CA11, CA20
S	with snap action	CA10, CA11, CA20, CA25, C26, C32, C42 with 60° switching
R	with spring return latching mechanism	CA10

Example: Coding for switch type **CA10** with gold contacts is **CA10-1**.

Modification of Switches

The part number for switch function and options may be modified in cases where items are required other than standard. The modification may involve the escutcheon plate inscription, color combination of escutcheon plate and handle, type of escutcheon plate and handle or the optional extra.

Switch Size	Escutcheon Plate Frame	Handle	Escutcheon Plate Backing	Escutcheon Plate Lettering	Dash Number
S0, S1, S2, S3	electro-gray	electro-gray	brushed alu	black	-100
S0, S1, S2, S3	electro-gray	electro-gray	black	mat silver	-500
S00, S0, S1, S2, S3	black	black	brushed alu	black	-600
S00, S0, S1, S2, S3	black	black	black	mat silver	-700

[1]Technical data on request.

How to order

Modification of Switches

Color combinations of escutcheon plate and handle

The standard switch consists of a transparent escutcheon plate with brushed aluminum backing and black inscription. The escutcheon plate frame is black as well as the handle. Page 4 shows further color combinations of escutcheon plate and handle which are available. The appropriate dash number must be substituted in the switch function coding to specify other color combinations as required.

Example: The complete coding for switch type CA10 with a 3 pole ON/OFF switch function, electro-gray handle and electro-gray escutcheon plate frame with brushed aluminum backing and black inscription which reads 0-1 is as follows: **CA10 A202-100 E**.

The following is a list of special programs for escutcheon plate and handle combinations. They may be obtained by specifying any one of the following two (2) digit dash numbers as a part of the overall dash number. It is still necessary to prefix these two digit numbers with the first digit which represents the color combination desired.

Special programs for escutcheon plate and handle combinations

-000 = without escutcheon plate, without handle
- .01 = without escutcheon plate
- .02 = without handle
- .03 = with square escutcheon plate without lettering
- .04 = with rectangular escutcheon plate without lettering
- .05 = with square escutcheon plate without lettering and without handle
- .06 = with rectangular escutcheon plate without lettering and without handle
- .07 = standard escutcheon plate, without lettering on rectangular section
- .08 = with F-handle
- .09 = with P-handle
- .10 = escutcheon plate with frame and fixation ring only (if using switches with single hole mounting: **- .16**)
- .11 = without escutcheon plate, but with handle bearing plate
- .12 = with yellow escutcheon plate backing and red handle
- .14 = with B-handle
- .16 = escutcheon plate with frame and fixation ring only, if using switches with single hole mounting
- .17 = standard escutcheon plate and rectangular add-on escutcheon plate, if using switches with single hole mounting FT2

Example: The complete coding for switch type CA10 with a 3 pole ON/OFF switch function with electro-gray escutcheon plate frame, square escutcheon plate without lettering, brushed aluminum plate backing and electro-gray handle reads as follows: **CA10 A202-103 E**.

Handles, Escutcheon Plates and Optional Extras

The handles for standard switches shown on pages 6-28 are suitable for mounting units with four hole mounting. Alternative types of handles available are illustrated on pages 29-35.
When a handle, escutcheon plate or optional extra is required but not covered by the dash number, the code number for the selected component should be entered separately. A comprehensive range of available standard escutcheon plates is illustrated on pages 36 and 37. Non-standard or special escutcheon plate engravings are available at extra cost.
The large number of optional extras and enclosures is covered in Catalog **101**.

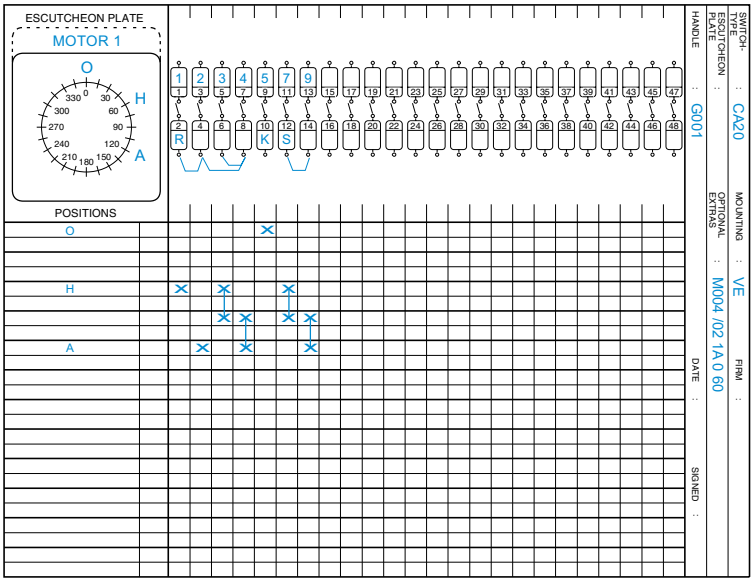
Switch Size

Blue Line switches are available in sizes S00, S0, S1, S2 and S3. These size codes indicate the dimensions of the mounting, the escutcheon plate and the handle, as well as the size of optional devices and enclosures.
Page 3 lists these sizes and the various switch types they include.

Ordering of Special Switches and Escutcheon Plates

When ordering special switches and escutcheon plates it is advisable to use our order form, as illustrated. The customer's requirements are shown in blue as an example.

For technical reasons, it may not be possible to follow the sequence of contacts requested by the customer. The final contact development which is sent with every switch will show the customer's original terminal markings.



Order forms are available on request.

Switch Function and Configuration — C, CA, CAD, CL Switches

Function	Escutch. Plate	Type/Handle: CA4 CA4-1 CL4	CAD.. CA10- CA25 CL10	CA10B- C43	C80- C315	Code	Stages	Connection Diagram
Double-throw Switches with Center „OFF“ 60° Switching								
1 pole						A210-600	1	1-4 pole: 3 1 7 5 11 9 15 13 / 2 6 10 14
2 pole						A211-600	2	
3 pole						A212-600	3	
4 pole						A213-600	4	
4 pole 1 pole preclose 6°[3]						A913-600	4	
5 pole						A361-600	5	
6 pole					[4]	A362-600	6	
7 pole						A363-600	7	
8 pole						A364-600	8	
8 pole 2 pole preclose 6°[3]						A664-600	8	
1 pole						A210-620	1	4 pole 1 pole preclose 6°: 3 1 7 5 11 9 15 13 / 2 6 10 14
2 pole						A211-620	2	
3 pole						A212-620	3	
4 pole						A213-620	4	
4 pole 1 pole preclose 6°[3]						A913-620	4	
5 pole						A361-620	5	5 pole: 5 1 7 3 13 9 15 11 19 17 / 2 4 10 12 18
6 pole					[4]	A362-620	6	
7 pole						A363-620	7	6 and 7 pole: 5 1 7 3 13 9 15 11 21 17 23 19 27 25 / 2 4 10 12 18 20 26
8 pole						A364-620	8	
8 pole 2 pole preclose 6°[3]						A664-620	8	
1 pole						A210-621	1	
2 pole						A211-621	2	
3 pole						A212-621	3	
1 pole						A210-622	1	8 pole: 5 1 7 3 13 9 15 11 21 17 23 19 29 25 31 27 / 2 4 10 12 18 20 26 28
2 pole						A211-622	2	
3 pole						A212-622	3	
1 pole						A210-623	1	8 pole 2 pole preclose 6°: 5 1 7 3 13 9 15 11 21 17 23 19 29 25 31 27 / 2 4 10 12 18 20 26 28
2 pole						A211-623	2	
3 pole						A212-623	3	
1 pole						A210-624	1	
2 pole						A211-624	2	
3 pole						A212-624	3	
4 pole						A213-624	4	
4 pole 1 pole preclose 6°[3]						A913-624	4	
Double-throw Switches with Center „OFF“ 90° Switching								
1 pole						A218-600	1	1-4 pole: 1 3 5 7 9 11 13 15 / 2 6 10 14
2 pole						A219-600	2	
3 pole					[1]	A299-600	3	
4 pole 1 pole preclose 60°					[1]	A294-600	4	
1 pole						A218-620	1	
2 pole						A219-620	2	
3 pole					[1]	A299-620	3	
4 pole 1 pole preclose 60°					[1]	A294-620	4	
Double-throw Switches with Center „OFF“ and electrically isolated contacts								
1 pole						A710-600	1	1-4 pole: 3 1 7 5 11 9 15 13 / 4 2 8 6 12 10 16 14
2 pole						A711-600	2	
3 pole						A712-600	3	
4 pole						A713-600	4	
4 pole 1 pole preclose 6°[3]						A963-600	4	4 pole 1 pole preclose 6°: 3 1 7 5 11 9 15 13 / 4 2 8 6 12 10 16 14
1 pole with spring return					[2]	A714-600	1	1 and 2 pole: 1 3 5 7 / 2 4 6 8
2 pole to center						A715-600	2	

[1] switch type C315 with handle [2] not available for switch type C315 [3] for use in a three phase four-wire system with switched neutral
[4] switch type C80 with handle

Mounting

C, CA, CAD, CL Switches

Single Hole Mounting	Terminals rotated 90°	Code	CA4 CA4-1 CL4	CAD.. CA10- CA25 CL10
With locking nut and shaft seal, protection IP 66			mm	mm
 Without escutcheon plate		FS1	16/22	
	●	FS1-V	16/22	
		FT1		22
	●	FT1-V		22
		FT3		22/30
	●	FT3-V		22/30
 With square escutcheon plate		FS2	16/22	
	●	FS2-V	16/22	
		FT2		22
	●	FT2-V		22
		FT4		22/30
	●	FT4-V		22/30
 With rectangular escutcheon plate		FS4	16/22	
	●	FS4-V	16/22	
 With size S1 escutcheon plate and heavy duty latching		FH3		22
	●	FH3-V		22
 Mounting key for locking nut		S00 T170 09		

International Standards and Approvals

Country	Authority	Mark or Standard	CL4 CL10	CAD11/12 CA4 CA4-1	CA10 CA11 CA20	CA10B CA11B CA20B	CA25 CA25B	C26 C32 C42	C43 C80 C125	L350/1 L630/1 L1000/1	L1250/1 C315 C316	L400 L600 L800	L1200 L1600 L2000
USA	Underwriters Laboratories Inc.	[1]								● ● ●	● ● ●	● ●	● + +
		[2] [3]	● ●	● ● ●	● ● ●	● ● ●	● ●	● ● ●	● ● ●			●	
Canada	UL investigated acc. to CSA	[6]		+ ● ●	● ● ●	● ● ●	● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●
		[1]								● ● ●	● ● ●	● ●	●
		[2] [3]	● ●	● ● ●	● ● ●	● ● ●	● ●	● ● ●	● ● ●			●	
Switzerland	Schweizerischer Elektrotechnischer Verein		+ +	+ + +	+ + +	+ + +	+ +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
Denmark	Danmarks Elektriske Materiellkontrol		+ +	+ + +	+ + +	+ + +	+ +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
Norway	Norges Elektriske Materiellkontroll		+ +	+ + +	+ + +	+ + +	+ +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
Sweden	Svenska Elektriska Materielkontroll-anstalten		+ +	+ + +	+ + +	+ + +	+ +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
Finland	Sähkötar-kastuskeskus		+ +	+ + +	+ + +	+ + +	+ +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
Austria	Österreichischer Verband für Elektrotechnik		+ +	+ + +	+ + +	+ + +	+ +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
Federal Republic of Germany	Verband Deutscher Elektrotechniker	VDE 0660[4]	+ +	+ + +	+ + +	+ + +	+ +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
Great Britain	British Standards Institution	BS EN 60947[4]	+ +	+ + +	+ + +	+ + +	+ +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
International Electrical Commission (IEC) Recommendation		IEC 60947[5]	+ +	+ + +	+ + +	+ + +	+ +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
China	China Quality Certification Centre	[7] GB14048.3		●	● ●	● ●							
Russian Federation	GOST	[7] CH01		● ● ●	● ● ●	● ● ●	● ●	● ● ●	● ● ●	+ + +	+ ● ●	+ + +	+ + +
Russian Federation	Russian Maritime Register of Shipping			● ●	● ● ●	● ● ●	● ●						
Germanischer Lloyd				+ + +	+ + +	+ + +	+ +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
Lloyds Register of Shipping				+ + +	+ + +	+ + +	+ +	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +

● Switch approved + Switch conforms to requirements + No approval required

[1] Approved under the "Component Program" (UL-Recognized Industrial Component). File No. E35541, Category Control No. NLRV2 (U.S.) resp. NLRV8 (Canada).
[2] Approved under the "Listing Program". File No. E35541, Category Control No. NLRV (U.S.) resp. NLRV7 (Canada).
[3] Switch types CAD11/CAD12 approved under the "Listing Program". File No. E60262, Category Control No. NRNT (U.S.) resp. NRNT7 (Canada).
[4] It is not required for Industrial Switchgear to bear a symbol but must conform to requirements. By stating the specific standard no. on the product the manufacturer declares that all requirements of the product standard are met.
[5] IEC does not operate an approval scheme.
[6] File No. 13002, Class No. 3211-05 resp. 4652-04.
[7] If this approval is required, please request when ordering.

Technical Data

C, CA, CL Switches

Selection Data

	CA4		CA10		CA11	CA20	CA25			C42			
	CA4-1	CL4	CA10B	CL10	CA11B	CA20B	CA25B	C26	C32	C43	C80	C125	C315/C316

Rated Insulation Voltage U_i	IEC 60947-3, EN 60947-3[1]														
	VDE 0660 part 107[1]	V	440	440	690	690	690	690	690	690	690	690	690	690	690/1000
	SEV[4]	V	380	380	660	690	660	660	690	660	660	660	660	660	660
	UL/Canada	V	300	300	300	600	600	600	300	600	600	600	600	600	600
	CEE/NEMKO	V	400/380	–	380	–	400	400	–	400	400	400	400	–	–
	min. voltage	V							on request						
Rated Impulse Withstand Voltage U_{imp}		kV	4	4	6	6	6	6	6	6	6	6	6	6	6/8
Rated Thermal Current I_u/I_{th}	IEC 60947-3, EN 60947-3														
	VDE 0660 part 107	A	10	10	20	20	20	25	32	32	50	63	115	150	315
	SEV[4] 380 V	A	10	10	16	16	16	25	32	32	40	63	100	160	315
	660 V	A	–	–	12	12	12	25	32	32	40	63	–	–	315
	UL/Canada	A	10	10	20	20	20	30	30	40	50	65	100	150	240
Rated Operational Current I_e															
AC-21A Switching of resistive loads, including moderate overloads	IEC 60947-3, EN 60947-3 VDE 0660 part 107	A	10	10	20	20	20	25	32	32	40	63	100	150	315
AC-1 Resistive or low inductive loads	SEV[4] 380 V	A	10	10	16	16	16	25	32	32	40	63	100	160	315
	660 V	A	–	–	12	12	12	20	32	32	40	63	–	–	315
AC-22A Switching of combined resistive or low inductive loads including moderate overloads	IEC 60947-3, EN 60947-3 VDE 0660 part 107 220 V-500 V	A	10	10	20	20	20	25	32	32	40	63	100	150	315
	660 V-690 V	A	–	–	20	20	20	25	32	32	40	63	100	125	125
AC-15 Switching of control devices, contactors, valves etc.	IEC 60947-3, EN 60947-3 VDE 0660 part 107 220 V-240 V	A	2,5	2,5	5	5	5	8	12	14	16	–	–	–	–
	380 V-440 V	A	1,5	1,5	4	4	4	5	6	6	7	–	–	–	–
Pilot Duty	UL/Canada[4] Heavy		A300	C300	A300	A600	A600	A600	A300	A600	A600	A600	–	–	A600
Ampere Rating Resistive or low inductive loads	UL/Canada[4]	A	10	10	20	20	20	30	30	40	50	65	100	150	240
Resistive load/motor load	CEE	A	4/2	–	10/6	–	10/6	16/10	–	25/10	32/10	40/10	63/10	–	–
	NEMKO	A	6/4[2]	–	10/6	–	–	20/10	–	–	–	–	–	–	–
Breaking capacity	220 V-240 V	A	50	50	150	150	150	200	280	280	380	550	860	1100	2000
	380 V-440 V	A	50	50	150	150	150	200	250	250	360	550	860	1100	2000
	660 V-690 V	A	–	–	80	80	80	125	150	150	270	365	400	490	340
Power loss per contact at I_u		W	0,4/0,9	0,4	0,9	1	0,9	0,9	0,7	1,3	1,3	1,7	5,8	3,8	17
Resistance to vibration					min. 4 g, 2-100 Hz, 1,6 mm							on request			
Resistance to shock					min. 6 g, 6 ms							on request			
Short Circuit Protection															
Max. fuse size	(gL-characteristic)	A	10	10	25	25	25	35	35	50	63	80	125	200	315
Rated short-time withstand current	(1s-current)	A	60	90	140	140	140	280	480	350	800	1000	1300	2000	4200

DC Switching Capacity[6]

Rated Operational Current I_e

No. of series contacts	1	2	3	4	5	6	8		CA4		CA10		CA11	CA20	CA25							C315[3]
	Voltage V								CA4-1	CL4	CA10B	CL10	CA11B	CA20B	CA25B	C26S	C32S	C42S	C80	C125	C316[3]	
Resistive loads	24	48	70	95	120	145	190	A	10	10	20	20	20	25	32	–	50	–	115	–	315	
T ≤ 1 ms	48	95	140	190	240	290	350		6	6	12	12	12	20	25	32	40	63	100	150	250	
	60	120	180	240	300	360	450		2,5	2,5	4,5	4,5	4,5	7,5	10	23	27	30	–	–	–	
	110	220	330	440	550	660	–		0,7	0,7	1	1	1	1,5	2	6,5	–	–	–	–	–	
	220	440	660	–	–	–	–		0,3	0,3	0,4	0,4	0,4	0,5	0,6	1,2	–	–	–	–	–	
	440	660	–	–	–	–	–		0,2	0,2	0,27	0,27	0,27	0,3	0,3	0,4	–	–	–	–	–	
Inductive loads	24	48	70	95	120	145	190	A	6	6	12	12	12	20	25	32	40	63	100	150	250	
T = 50 ms	30	60	90	120	150	180	240		3	3	5	5	5	9	12	25	30	55	33	50	70	
	48	95	140	190	240	290	350		1	1	2	2	2	3	3	16	20	–	–	–	–	
	60	120	180	240	300	360	450		0,7	0,7	1	1	1	1,5	1,5	11	15	–	–	–	–	
	110	220	330	440	550	660	–		0,3	0,3	0,4	0,4	0,4	0,5	0,5	3,2	3,5	–	–	–	–	

Ambient Temperature of Stages[5, 7]	open at 100 % I_u/I_{th}	55 °C during 24 hours with peaks up to 60 °C
	enclosed at 100 % I_{the}	35 °C during 24 hours with peaks up to 40 °C

[1] Valid for lines with grounded common neutral termination, overvoltage category III, pollution degree 3. Values for other supply systems on request. [2] Valid for CA4 only. [3] DC switching capacity applies to ON/OFF switches. Switching capacity for other configurations on request. [4] International Standards and Approvals, refer to page 39. [5] For electromagnetic optional extras see additional data in Catalog 101. [6] Values for switches with spring return on request. [7] Storage temperature: -40 °C to 85 °C (in case of temperature below -5 °C no shock load permissible).

Technical Data

C, CA, CL Switches

Selection Data

					CA4		CA10		CA11	CA20	CA25			C42			C315
					CA4-1	CL4	CA10B	CL10	CA11B	CA20B	CA25B	C26	C32	C43	C80	C125	C316
Rated Utilization Category		IEC 60947-3, EN 60947-3 VDE 0660 part 107															
AC-2	Slip ring motor starting, reversing and plugging, star-delta starting CA4-C32	3 phase 3 pole	220 V-240 V	kW	2,5	2,5	4	4	4	5,5	7,5	8	10	18,5	30	37	55
			380 V-440 V		4,5	4,5	7,5	7,5	7,5	11	15	15	18,5	30	45	55	90
			500 V		–	–	10	10	10	15	18,5	18,5	22	40	55	75	110
			660 V-690 V		–	–	10	10	10	13	15	15	22	37	55	55	55
AC-3	Direct-on-line starting, star-delta starting C42-C315	3 phase 3 pole	220 V-240 V	kW	1,5	1,5	3	3	3	4	5,5	5,5	7,5	11	15	22	37
			380 V-440 V		2,2	2,2	5,5	5,5	5,5	7,5	11	11	15	18,5	30	37	55
			500 V		–	–	5,5	5,5	5,5	7,5	11	11	15	18,5	30	37	55
			660 V-690 V		–	–	5,5	5,5	5,5	7,5	11	11	15	18,5	30	30	37
		1 phase 2 pole	110 V-120 V	kW	0,3	0,3	0,6	0,6	0,6	1,5	2,2	2,2	2,5	3	3,7	5,5	11
			220 V-240 V		0,55	0,55	2,2	2,2	2,2	3	4	4	5,5	6	7,5	11	22
			380 V-440 V		0,75	0,75	3	3	3	3,7	5,5	5,5	7,5	11	13	18,5	30
AC-4	Direct-on-line starting, reversing, plugging and inching	3 phase 3 pole	220 V-240 V	kW	0,37	0,37	0,55	0,55	0,55	1,5	2,5	2,7	3,7	5,5	6	10	15
			380 V-440 V		0,55	0,55	1,5	1,5	1,5	3	5,5	5,5	6	7,5	11	15	25
			500 V		–	–	1,5	1,5	1,5	3	5,5	5,5	6	7,5	11	15	25
			660 V-690 V		–	–	1,5	1,5	1,5	3	5,5	5,5	6	7,5	11	15	22
		1 phase 2 pole	110 V-120 V	kW	0,15	0,15	0,3	0,3	0,3	0,45	0,75	0,75	1,1	1,2	1,5	2,2	4
			220 V-240 V		0,25	0,25	0,75	0,75	0,75	1,1	1,5	1,5	2,2	2,4	3	4	7,5
			380 V-440 V		0,5	0,5	1,5	1,5	1,5	2,2	3	3	3,7	4	5,5	7,5	11
AC-23A	Frequent switching of motors or other high inductive loads	3 phase 3 pole	220 V-240 V	kW	1,8	1,8	3,7	3,7	3,7	5,5	7,5	7,5	11	15	30	37	75
			380 V-440 V		3	3	7,5	7,5	7,5	11	15	15	22	30	45	75	132
			500 V		–	–	7,5	7,5	7,5	11	15	15	30	45	55	90	132
			660 V-690 V		–	–	7,5	7,5	7,5	11	15	15	22	40	45	55	37
		1 phase 2 pole	110 V-120 V	kW	0,37	0,37	0,75	0,75	0,75	1,5	2,2	2,2	2,5	4	5,5	11	18,5
			220 V-240 V		0,75	0,75	2,5	2,5	2,5	3	4	4	5,5	10	15	22	37
			380 V-440 V		1,1	1,1	3,7	3,7	3,7	5,5	7,5	7,5	11	18,5	22	37	55
Ratings		UL/Canada															
	Standard motor load DOL-Rating (similar AC-3)	3 phase 3 pole	110 V-120 V	HP	0,75	0,75	1,5	1,5	1,5	3	5	5	7,5	7,5	10	15	30
			220 V-240 V		1	1	3	3	3	7,5	10	10	15	15	20	25	75
			440 V-480 V		–	–	–	5	5	10	–	20	25	25	30	40	75
			550 V-600 V		–	–	–	5	5	10	–	25	30	30	40	50	60
		1 phase 2 pole	110 V-120 V	HP	0,33	0,33	0,5	0,5	0,5	1,5	2	2	3	3	5	7,5	15
			220 V-240 V		0,75	0,75	1	1	1	3	5	5	7,5	7,5	10	15	40
			277 V		0,75	0,75	2	2	2	3	5	5	7,5	7,5	10	15	40
			440 V-480 V		–	–	–	2	2	5	–	10	15	15	20	25	50
			550 V-600 V		–	–	–	2	2	5	–	15	20	20	25	30	50
	Heavy motor load Reversing-Rating (similar AC-4)	3 phase 3 pole	110 V-120 V	HP	–	–	0,5	–	0,5	1	2	2	3	5	7,5	10	15
			220 V-240 V		–	–	1	–	1	2	3	3	5	7,5	15	20	30
			440 V-600 V		–	–	–	–	3	5	–	10	15	20	25	30	40
		1 phase 2 pole	110 V-120 V	HP	–	–	0,17	–	0,17	0,33	1,5	1,5	1,5	2	3	5	7,5
			220 V-240 V		–	–	0,5	–	0,5	0,75	3	3	3	5	7,5	10	15
			277 V		–	–	0,6	–	0,6	1	3	3	3	5	7,5	10	15
Max. Permissible Wire Gage - Use copper wire only					2x	1x[2]	2x	1x[2]	2x	2x	2x	2x	2x	2x			
	Single-core or stranded wire			mm²	1,5	0,5-1,5	2,5	0,5-2,5	2,5	4	6	6	10	16	35	70	185[1]
				AWG	14	20-16	12	20-14	12	10	8	8	8	6	2	2/0	MCM 350
					2x	1x[2]	2x	1x[2]	2x	2x	2x	2x	2x	2x			
	Flexible wire (sleeving in accordance with DIN 46228)			mm²	1,5	0,5-1,5	2,5	0,5-2,5	2,5	4	4	6	6	10	25	50	150[1]
					(–)	(–)	(2,5)	(–)	(2,5)	(2,5)	(4)	(4)	(6)	(10)	(25)	(50)	
	Flexible AWG wires (without sleeve)			AWG	16	20-16	14	20-14	14	12	10	10	8	6	3	1/0	MCM 300
Connecting wire - outside diameter				mm	–	1,5-2,8	–	1,5-3,6	–	–	–	–	–	–	–	–	–
Connecting wire - plug-in depth				mm	–	8,5	–	11,5	–	–	–	–	–	–	–	–	–
Permissible connecting ambiente temperature range				°C	–	5-40	–	5-40	–	–	–	–	–	–	–	–	–

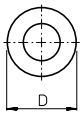
[1]Cable lug must accept M12 screw. [2]The insulation material of the conductor has to be PVC (typical wire codes are H05V-K0,5 ... H07V-K1,5 or H05V-U0,5 ... H07V-U1,5 etc.). Other materials on request. Connected conductors, which have to be disconnected and re-connected again must be cut in order to ensure a proper electrical connection and to prevent a complete cut-off of the wire insulation. The permissible ambient temperature range when connecting the wires is 5-40 °C.

Dimensions

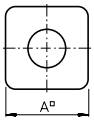
mm
inch

Single Hole Mounting or Base Mounting

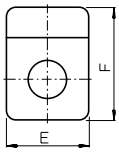
FS1...
FT1...
FT3...

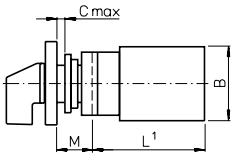


FH3...
FS2...
FT2...
FT4...

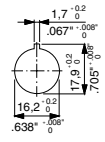


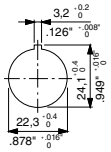
FS4...



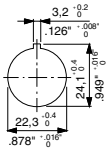


FS1...
FS2...
FS4...

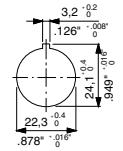


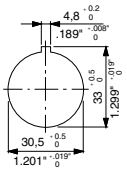


FH3...
FT1...
FT2...



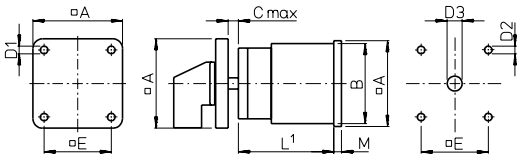
FT3...
FT4...



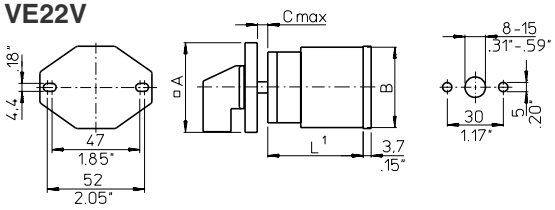


		CA4 CA4-1	CL4	CA10 CA11 CAD11 CAD12	CL10	CA20	CA25
A/E		30 1.18	30 1.18	48 1.89	48 1.89	48 1.89	48 1.89
	FH3...	- -	- -	64 2.52	64 2.52	64 2.52	64 2.52
B		28 1.10	38x46 1.50x1.81	43 1.69	50x56 1.97x2.20	45 1.77	46 1.81
C		5 .20	5 .20	6 .24	6 .24	6 .24	6 .24
D		29,5 1.16	29,5 1.16	39 1.54	39 1.54	39 1.54	39 1.54
F		39 1.54	39 1.54	- -	- -	- -	- -
M		12,5 .49	12,5 .49	18,2 .72	18,2 .72	18,2 .72	18,2 .72
	FH3...	- -	- -	25,2 .99	25,2 .99	25,2 .99	25,2 .99

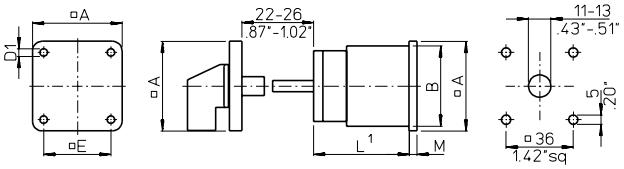
VE
VE-V



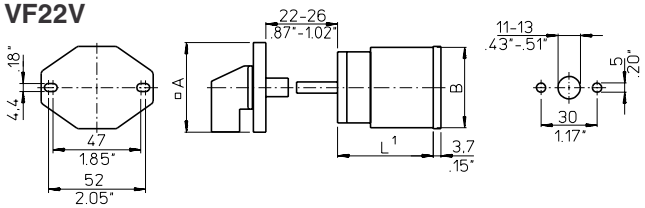
VE22
VE22V



VF
VF-V



VF22
VF22V



	CA10 CA11 CAD11 CAD12	CL10	CA20	CA25[2]	CA10B CA11B CA20B	CA25B	C26	C32	C42[2]	C43	C80	C125	C315 L switches Size S2	C315 L switches Size S3
A	48 1.89	48 1.89	48 1.89	48 (64) 1.89 (2.52)	64 2.52	64 2.52	64 2.52	64 2.52	64 (88) 2.52 (3.46)	88 3.46	88 3.46	88 3.46	88 3.46	128 5.04
B	43 1.69	50x56 1.97x2.20	45 1.77	46 1.81	56 2.20	56 2.20	58 2.28	60 2.36	66 2.60	84 3.30	84 3.30	88 3.46	88 3.46	126 4.96
C	10,5 .41	10,5 .41	10,5 .41	10,5 .41	13,5 .53	13,5 .53	13,5 .53	13,5 .53	13,5 .53	16 .63	16 .63	16 .63	16 .63	19,3 .76
D1	4,1 .16	- -	4,1 .16	4,1 .16	4,1 .16	4,1 .16	4,1 .16	4,1 .16	5,4 .21	5,4 .21	5,4 .21	5,4 .21	5,4 .21	7 .28
D2	5 .20	- -	5 .20	5 .20	5 .20	5 .20	5 .20	5 .20	5 .20	6 .24	6 .24	6 .24	6 .24	7 .28
D3	8-15 .31-.59	- -	8-15 .31-.59	8-15 .31-.59	10-15 .39-.59	10-15 .39-.59	10-15 .39-.59	10-15 .39-.59	10-15 .39-.59	13-17 .51-.67	13-17 .51-.67	13-17 .51-.67	13-17 .51-.67	15,5-20 .61-.79
E	36 1.42	- -	36 1.42	36 (48) 1.42 (1.89)	48 1.89	48 1.89	48 1.89	48 1.89	48 (68) 1.89 (2.68)	68 2.68	68 2.68	68 2.68	68 2.68	104 4.09
M	2,2 .09	- -	2,2 .09	3,2 .13	2,5 .10	2,5 .10	5 .20	5 .20	5 .20	7 .28	8,9 .35	8,9 .35	27 1.06	11,4 .45

[2]Dimensions in ( ) for revertive mounting plate

[1]see page 51

The Range of “Blue Line” Switchgear

Technical literature covering the following products is available on request.

	Catalog Number
Main Switches and Main Switches with Emergency Function 16 A-315 A **Maintenance Switches 20 A-315 A** **Switch Disconnectors 20 A-315 A** According to IEC 60947-3, EN 60947-3, VDE 0660 part 107, IEC 60204, EN 60204 and VDE 0113	**500**
CL Switches 10 A-20 A **C, CA and CAD Switches 10 A-315 A and L Switches 350 A-2400 A** C, CA and CAD switches are designed for universal application. They are recommended for instrument, isolator, double-throw and motor control. L switches are designed for load and off-load applications. They are used to switch resistive or low inductive loads.	**100**
Optional Extras and Enclosures The complete product line, a large number of optional extras is available, including door interlocks, push-pull devices, cylinder and padlock attachments, control and indicator devices, AC motor drives, as well as enclosures, both insulated and metal.	**101**
A and AD Switches 6 A-25 A A and AD switches have 4 contacts in each switching stage. These switches provide an extensive range of switch functions and require a minimum mounting depth. Up to 36 switching positions are possible, with availability of 48 contacts per 12 stage switch column.	**110**
CG, CH and CHR Switches 10 A-25 A Ultra compact CG, CH and CHR switches are ideally suited for control and instrumentation applications. Switch terminals are “finger-proof” and conveniently accessible for wiring and are delivered open. All CG4 switches offer specially designed gold plated contacts or H-bridges with “cross-wire” contact systems, which facilitates their use in electronic circuitry and chemically aggressive environments.	**120**
DH, DHR, DK and DKR Switches 6 A-16 A DH, DHR, DK and DKR switches incorporate unique corrosion resistant contacts that permit operation on system voltage as low as 1 V. They have fully enclosed and protected contacts which can be operated either by rotary and/or lateral handle movement. D switches are used in calibration and semiconductor circuits. They are also used for relay and contactor control.	**130**
X Switches 80 A-630 A X switches can be applied for load, tap and gang switching duties. They incorporate 6 contacts in each switching stage. Their compact design provides a minimum length dimension for mounting purposes.	**140**
KG Switches 20 A-315 A and KH and KHR Switches 16 A-80 A KG, KH and KHR switches are excellent circuit interruptors. They have high through fault and fault making capacities and are especially designed for use as isolators and safety switches for machine tools, distribution panels and switchboards. KG ON/OFF switches offer unusually high dimensioned air and creepage distances between terminals which are designed for time saving “straight-line” wiring. ON/OFF switches are available with up to 8 poles and double-throw switches are available with up to 4 poles.	**150**
Contactors 16 A-115 A and Motor Starters 1,1 kW-55 kW These include control relays, motor contactors, two and four pole output contactors, heating contactors, thermal overload relays.	**200**
Push Buttons and Pilot Lights, 22,5 mm Ø A complete range of state-of-the-art push buttons and pilot lights represent an ideal combination of functional security and economical efficiency in a modular design.	**302**

SALES AND SERVICE ORGANIZATION

Australia
australian solenoid Φ co. pty. ltd.
379 Liverpool Road, ASHFIELD, N.S.W. 2131
P. O. Box 1093, ASHFIELD, N.S.W. 1800
Tel: +61 2 9797-7333, Fax: 0092
e-mail: sales@austrasol.com.au

Austria
austro solenoid Φ ges.m.b.h.
Schumanngasse 35, Postfach 431
A-1181 WIEN
Tel: +43 1 404 06, Fax: 404 06-190
e-mail: aso@krausnaimer.com

Belgium, Luxembourg
solenoid benelux Φ b. v.
Stationstraat 34
B-3070 KORTENBERG
Tel: +32 2 757-0141, Fax: 1640
e-mail: sales@bensol.be

Brazil
solenoid do brasil Φ ltda.
Avenida Berna 230
04774-020 SAO PAULO
Tel: +55 11 5524-1288, Fax: 5521-4659/9633
e-mail: knbrasil@krausnaimer.com.br

Canada
canadian solenoid Φ inc.
219 Connie Crescent, Unit 13A
CONCORD, Ontario, L4K 1L4
Tel: +1 905 738-1666, Fax: 9327
e-mail: cdnsolenoid@cansol.on.ca

Chile
ASEA BROWN BOVERI S. A.
Vicuña Mackenna 1602, Casilla 3555
SANTIAGO DE CHILE
Tel: +56 2 544-7411, Fax: 7418

Cyprus
ELECTROMATIC CONSTRUCTIONS LTD.
72, Evagoras Pallikarides Str., CY-2235 LATSIA-Nicosia
P. O. Box 12630, CY-2251 LATSIA-Nicosia
Tel: +357 2 48 41 41, Fax: 48 57 47

Czech Republic
OBZOR, výrobní družstvo Zlín
Louky-Slanica 378
CZ-76413 ZLÍN
Tel: +420 57 7195-111/-153 (Techn. Supp.)
Fax: +420 57 7195-152/-138
e-mail: ots@obzor.cz

Denmark
C. THIIM A/S Ingeniørfirma
Transformervej 31
DK-2730 HERLEV
Tel: +45 44 85 80 00, Fax: 80 05
e-mail: thiim@thiim.com

Finland
suomen solenoid Φ oy
Karitie 7
FIN-01530 VANTAA
Tel: +358 9 825-4240, Fax: 42410
e-mail: etunimi.sukunimi@finsol.fi

France
solenoid france Φ s. a.
33, rue Bobillot
F-75013 PARIS
Tél: +33 1 58 40 80 80, Fax: 45 80 91 19
e-mail: sales@solfrance.fr

Germany
deutsche solenoid Φ vertriebs-gmbh
Wikingerstraße 20-28, D-76189 KARLSRUHE
Postfach 10 01 24, D-76231 KARLSRUHE
Tel: +49 721 59 88-0, Fax: 59 28 28
e-mail: desol@krausnaimer.com

Great Britain
u. k. solenoid Φ ltd.
115 London Road
NEWBURY/BERKSHIRE RG14 2AH
Tel: +44 1635 45991, Fax: 37807
e-mail: sales@uksol.co.uk

Greece
KALAMARAKIS-SAPOUNAS S. A.
Ionias & Neromilou Str., P. O. Box 46566
GR-13671 ACHARNES/ATHENS
Tel: +30 2 10 240-6000-6, Fax: 240-6007
e-mail: ksa@ksa.gr

Hungary
GANZ, Schalter- u. Gerätefabrik
X. Kőbányal út 41/c, Postfach 87
H-1475 BUDAPEST
Tel: +36 1 261-5479, Fax: 4685
e-mail: ganzkk@ganzkk.hu

Iceland
BRAEDURNIR ORMSSON EHF
Lágmúli 6-9, P. O. Box 8670
REYKJAVIK
Tel: +354 530-28 00, Fax: 28 10
e-mail: skuli@ormsson.is

Iran
RBS components GmbH
Kohlriege 14
D-33758 SCHLOSS HOLTE-STUKENBROCK
Tel: +49 5207 9111 21, Fax: 9111 19
e-mail: contact@rbs-gmbh.de

Republic of Ireland
irish solenoid Φ ltd.
Bay 145, Shannon Free Zone
SHANNON, Co. Clare
Tel: +353 61 704700, Fax: 471084
e-mail: salesirs@krausnaimer.ie

Italy
solenoid italia Φ s.r.l.
Via Terracini, 9
I-24047 TREVIGLIO (BG)
Tel: +39 0363-30 11 12, Fax: 30 21 13
e-mail: michelle.ford@italsol.it

Japan
solenoid japan Φ co. ltd.
Yoshiwada Building 2F
1-11-6 Hamamatsucho
Minato-Ku, TOKYO 105-0013
Tel: +81 3 3436-6151, Fax: 6325
e-mail: kazumi.nakazato@japsol.co.jp

Kuwait
AMMAR & PARTNERS ELECTRICAL CO.
P. O. Box 1871
13019 SAFAT
Tel: +965 483-0122/483-0133
Fax: +965 484-1818

Malaysia
INDUSTRIAL AUTOMATION (M) Sdn Bhd
30-3 & 30-4 Loke New Road
55200 KUALA LUMPUR
Tel: +60 3-9-2210511, Fax: 2222299
e-mail: inquiry@iasb.com.my

Mexico
ING. JAVIER CABALLERO B.
A. Gaviño 30, Satélite,
53100, Edo. de Mexico, MEXICO
Tel: +52 5555 62-7577, Fax: 0434
e-mail: j_caballero_b@infosel.net.mx

Netherlands
solenoid benelux Φ b. v.
Wegtersweg 38, Postbus 199
NL-7556 BR HENGELO (Ov.)
Tel: +31 74 291-9441, Fax: 8380
e-mail: sales@bensol.nl

New Zealand
new zealand solenoid Φ co. ltd.
42 Miramar Avenue, P. O. Box 15-009
WELLINGTON
Tel: +64 4 380-9888, Fax: 9877
e-mail: sales@nzsolenoid.co.nz

Norway
norsk solenoid Φ a/s
Hjalmar Brantings vei 8, P. O. Box 21, Økern
N-0508 OSLO
Tel: +47 22 64 44 20, Fax: 65 39 49
e-mail: nos@norsksol.no

Poland
ASTAT sp. z o.o
ul. Dąbrowskiego 461
PL-60451 POZNAŃ
Tel: +48 61 848-8871/72, Fax: 8276
e-mail: info@astat.com.pl

Portugal
ELECTRICOL-DAMAS, FERREIRA & DAMASCENO, S. A.
Apartado 1083
P-2671-852 SANTO ANTÓNIO DOS CAVALEIROS
Tel: +351 21 989-8939, Fax: 988-6464

Singapore
solenoid singapore Φ pte. ltd.
115A, Commonwealth Drive
03-17/23
SINGAPORE 149 596
Tel: +65 6473-8166, Fax: 8643
e-mail: krausnaimer@singsol.com.sg

Slovenia
SCHRACK Energietechnik d.o.o.
Glavni trg 47
SI-2380 SLOVENJ GRADEC
Tel: +386 2 88 392 00, Fax: 434 71
e-mail: schrack.sg@schrack-energietechnik.si

Republic of South Africa
south african solenoid Φ co. pty. ltd.
7 Village Crescent, Linbro Village
Linbro Business Park, SANDTON 2065
P. O. Box 511, KELVIN 2054
Tel: +27 11 608-6060, Fax: 608-2874
e-mail: sales@sasolenoid.co.za

Spain
HAZEMEYER ESPAÑOLA S. A.
Crta. de Tiana s/n, Esq. N-2
BADALONA-BARCELONA
Tel: +34 93 389-4262, Fax: 384-3586
e-mail: heshaze@catworld.net

Sweden
skandinaviska solenoid Φ ab
Dr. Widerströms Gata 11, FRUÄNGEN
Box 42097, S-126 14 STOCKHOLM
Tel: +46 8 97 00 80, Fax: 97 87 33
e-mail: order@skansol.se

Switzerland
AWAG Elektrotechnik AG
Sandbüelstraße 2, Postfach
CH-8604 VOLKETSWIL
Tel: +41 1 908-1919, Fax: 1999
e-mail: info@awag.ch

Taiwan
NUWTEC ENTERPRISE Co Ltd
No. 301, Sec. 1, Nan Kang Road
TAIPEI 115, Taiwan, R. o. C.
Tel: +886 2 265-13279, Fax: 13264
e-mail: nathan.nuwtec@msa.hinet.net

Turkey
ÜNAL KARDEŞ ELEKTRIK GEREÇLERI A. Ş.
Beşyol, Eski Londra Asfaltı-6
TR-34630 SEFAKÖY-Istanbul
Tel: +90 212 624-9204, Fax: 592-4810
e-mail: info@unalkardes.com.tr

USA
american solenoid Φ co. inc.
760 New Brunswick Road, P. O. Box 430
SOMERSET, NJ 08873
Tel: +1 732 560-1240, Fax: 8823
e-mail: amsol@krausnaimer-us.com

Control & Switching

[CATALOGUE D7-CAT]

D7 Pushbuttons

D7

sprecher+schuh

INDUSTRIAL SWITCHGEAR & AUTOMATION SPECIALISTS

NHP

PUT YOUR CONTROL AND SWITCHING SOLUTIONS IN OUR HANDS

Experience a Touch of Quality

D7

sprecher+schuh

D7 22.5 mm CONTROL & SIGNALLING PRODUCTS

NHP

New D7...
Experience a Touch of Quality

D7 d seven

Introducing the all new D7 range from Sprecher + Schuh. The D7 range is the latest in a long line of quality 22.5 mm control and signalling equipment from a company with a long built reputation for combining high quality manufacturing skills and attention to detail to produce only the finest quality products.

Available in both thermoplastic and metal variations, the D7 range incorporates all the features that you have come to expect from Sprecher + Schuh and raises the bar one step further with a functional low profile design and all new stylish appearance.

Once you get past the new appearance you will find the D7 range has some unique features incorporated, such as improved operational feel on the pushbuttons for a positive “tactile” response and a new positive detent on selector switches. In addition optional time saving cage style termination on contact blocks, improved LED illumination on pilot lights and hard wearing laser engraving have also been included.

Utilising state of the art modelling technologies and finite element analysis, you can be sure every component used in the D7 range has been optimised for durability and reliability with the aim of providing the ultimate in control and indication.

Designed and manufactured to meet the most exacting performance, the new D7 range is ***the*** pushbutton to use in today’s demanding environments.

sprecher+schuh

D7 at a glance...

"Auto Break" Safety contacts

Separation of the contact block assembly from the front operator or mounting latch can prevent an Emergency Stop from shutting down the controlled process in an emergency.

Correct contact block installation is critical to ensure that the normally closed contacts will open when the emergency stop operator is active. The exclusive Sprecher + Schuh *"Auto Break"* contact block monitors itself to ensure it is always correctly installed.

A normally open *"Auto Break"* contact is physically moulded and wired in series with a standard set of normally closed contacts. When correctly installed the operator creates a maintained pressure on the normally open *"Auto Break"* contact and automatically closes the contact. In this state the normally closed contact operates as normal.

If the contact block assembly should separate from the front operator, the pressure releases and the *"Auto Break"* contact will automatically open. Because the *"Auto Break"* contact is wired in series with the normally closed, the opening of either set of contacts will open the circuit controlled by the emergency stop operator.

Coupling plates and contact blocks

Choice of metal or plastic coupling plates

Rotating collar with "snap secure" system ensures fast one-hand removal

Contact blocks snap-fit and are hinged at one end for easy installation

Colour coded contact block plungers for easy identification

H-bridge contact design and the option of gold contacts provides cleaner current flow for maximum reliability at lower voltages

Bifurcated contacts provide excellent wiping and optimal switching reliability

Option of Cage style wire termination or Screw clamp

Live components are shrouded and touch safe to IP 20

Inscription caps and diffusers

Durable abrasion-proof press plates

6 colour choices

Ergonomically contoured design

Diffusers constructed in two colour moulded assembly

Durable wear resistant laser printing available

Enclosures

Metal and plastic enclosures

In choices to accommodate up to 6 x 22.5 mm operators

Yellow thermoplastic pendant style enclosure available for up to 2 operators

20 mm metric cable entry

Suitable for base or panel mount contact blocks

Accepts two piece snap-in legend

Illumination

Modern and compact integrated LED lamp modules

Superior illumination qualities

5 colour choices

11 year lamp life (100,000 hrs)

Maintenance free

Vibration and shock resistant

24 V AC/DC, 110 V AC and 240 V AC

sprecher+schuh

D7 22.5 mm CONTROL & SIGNALLING PRODUCTS

NHP

Contents Page No.

sprecher+schuh

D7 22.5 mm CONTROL & SIGNALLING PRODUCTS

NHP

Design

Functional low profile appearance
Ergonomic easy to operate handles
Reduced depth contact blocks
Improved positive “tactile” operation on pushbuttons
Improved “positive detent” on rotary selector switches
Durable two colour plastic caps and laser engraving

Improved safety

Unique “Auto break” self-monitoring emergency contact system
IP 20 touch protection
Tamperproof rear fixing nut

Time saving

New design snap-lock, twist-to-reset rotating collar on coupling plates for easier mounting and assembly
Snap-on components
Redesigned anti-rotation tab

Flexibility

Thermoplastic or metal operators
Latching or impulse operators
Five different colour choices
Maximum of six contact blocks
Full voltage and transformer lamp blocks

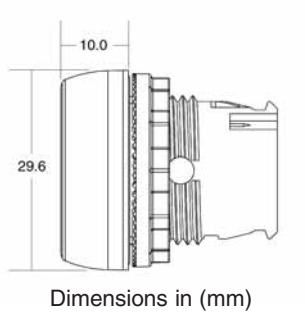
Improved reliability

IP 65/66 sealing across the range for reliability in dusty and wet conditions
Improved vibration resistance
Continuous wiping contact for improved reliability
Tested to IEC 947
Positive detent on rotary switches which ensures operation will not “hang up” between positions

Contact blocks

Improved mounting from “Snapsecure” snap fit mounting system
Colour coded plungers for easy identification
Optional Quadfurcated Gold contacts for improved low voltage switching
Optional spring clamp termination on contact blocks for reduced wiring time

Non-Illuminated Momentary Pushbuttons



Dimensions in (mm)

Metal or plastic options

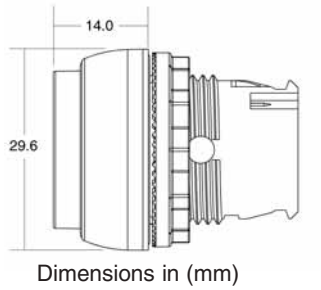
Improved momentary action for fast response

Low mounting depth from panel

D7P-F3-PX10

D7M-F4-MX01

Description	Contact	Plastic Body Cat. No.	Metal Body Cat. No.
Flush Pushbutton			
with Green insert		**D7P-F3-PX10** [1])	**D7M-F3-MX10** [1])
with Red insert		**D7P-F4-PX01** [1])	**D7M-F4-MX01** [1])
with Blue insert		**D7P-F6-PX10** [1])	**D7M-F6-MX10** [1])



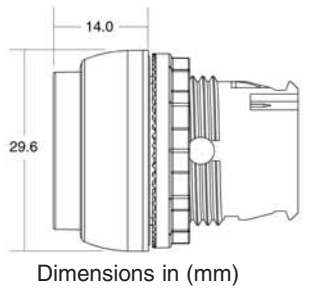
Dimensions in (mm)

D7P-E4-PX01

D7M-E4-MX01

Description	Contact	Plastic Body Cat. No.	Metal Body Cat. No.
Extended Pushbutton			
with Red insert		**D7P-E4-PX01** [1])	**D7M-E4-MX01** [1])

Non-Illuminated Momentary Pushbuttons with labelled Press Plates



Dimensions in (mm)

Laser etched markings for improved abrasion resistance

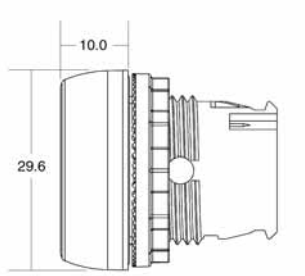
D7P-E402-PX01

D7M-F301-MX10

Description	Contact	Plastic Body Cat. No.	Metal Body Cat. No.
Flush Pushbutton			
with Green insert labelled “Start”		**D7P-F301-PX10** [1])	**D7M-F301-MX10** [1])
with Red insert labelled “Stop”		**D7P-F402-PX01** [1])	**D7M-F402-MX01** [1])
with Blue insert labelled “Reset”		**D7P-F607-PX10** [1])	**D7M-F607-MX10** [1])
with extended Red press plate labelled “Stop”		**D7P-E402-PX01** [1])	**D7M-E402-MX01** [1])

Note: [1]) Add suffix “**bx**” for special box/hang-sell packaging eg: D7P-F3-PX10**bx**.

Illuminated Momentary Flush Pushbuttons with integrated LED Lamp Block



Dimensions in (mm)

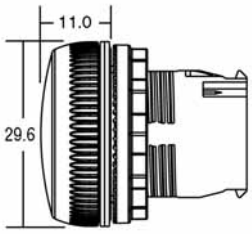
- Long life integrated LED illumination
- 24 V and 240 V versions
- Supplied complete with contact blocks

D7P-LF5-PN3Y-X10

D7M-LF6-MN3B-X10

Description	Contact	Plastic Body Cat. No.	Metal Body Cat. No.
24 V AC/DC			
Green pushbutton with Green LED		**D7P-LF3-PN3G-X10** [1])	**D7M-LF3-MN3G-X10** [1])
Red pushbutton with Red LED		**D7P-LF4-PN3R-X01** [1])	**D7M-LF4-MN3R-X01** [1])
Blue pushbutton with Blue LED		**D7P-LF6-PN3B-X10** [1])	**D7M-LF6-MN3B-X10** [1])
Yellow pushbutton with Yellow LED		**D7P-LF5-PN3Y-X10** [1])	**D7M-LF5-MN3Y-X10** [1])
240 V AC			
Green pushbutton with Green LED		**D7P-LF3-PN7G-X10** [1])	**D7M-LF3-MN7G-X10** [1])
Red pushbutton with Red LED		**D7P-LF4-PN7R-X01** [1])	**D7M-LF4-MN7R-X01** [1])
Blue pushbutton with Blue LED		**D7P-LF6-PN7B-X10** [1])	**D7M-LF6-MN7B-X10** [1])
Yellow pushbutton with Yellow LED		**D7P-LF5-PN7Y-X10** [1])	**D7M-LF5-MN7Y-X10** [1])

Pilot Light with integrated LED Lamp Block



Dimensions in (mm)

- Superior LED illumination qualities
- Scratch resistant lenses
- Modern low profile bodies

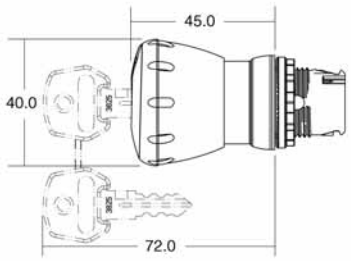
D7P-P5-PN3Y

D7M-P3-MN3G

Description	Contact	Plastic Body Cat. No.	Metal Body Cat. No.
24 V AC/DC			
Green pilot light with Green LED		**D7P-P3-PN3G** [1])	**D7M-P3-MN3G** [1])
Red pilot light with Red LED		**D7P-P4-PN3R** [1])	**D7M-P4-MN3R** [1])
Blue pilot light with Blue LED		**D7P-P6-PN3B** [1])	**D7M-P6-MN3B** [1])
Yellow pilot light with Yellow LED		**D7P-P5-PN3Y** [1])	**D7M-P5-MN3Y** [1])
Translucent pilot light with White LED		**D7P-P7-PN3W** [1])	**D7M-P7-MN3W** [1])
240 V AC			
Green pilot light with Green LED		**D7P-P3-PN7G** [1])	**D7M-P3-MN7G** [1])
Red pilot light with Red LED		**D7P-P4-PN7R** [1])	**D7M-P4-MN7R** [1])
Blue pilot light with Blue LED		**D7P-P6-PN7B** [1])	**D7M-P6-MN7B** [1])
Yellow pilot light with Yellow LED		**D7P-P5-PN7Y** [1])	**D7M-P5-MN7Y** [1])
Translucent pilot light with White LED		**D7P-P7-PN7W** [1])	**D7M-P7-MN7W** [1])

Note: [1]) Add suffix "**bx**" for special box/hang-sell packaging eg: D7P-LF3-PN3GX10**bx**.

Emergency Stop Operators



Dimensions in (mm)

Choice of "Auto Break" or Standard normally closed contacts

30, 40 or 60 mm Mushroom head

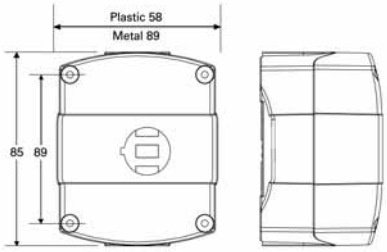
Extra security key release

D7P-MT64-PX01S

D7M-MK44-MX01S

Description	Contact	Plastic Body Cat. No.	Metal Body Cat. No.
Twist To Reset with Standard Contact Blocks			
30 mm Operator		**D7P-MT34-PX01** [1])	**D7M-MT34-MX01** [1])
40 mm Operator		**D7P-MT44-PX01** [1])	**D7M-MT44-MX01** [1])
60 mm Operator		**D7P-MT64-PX01** [1])	**D7M-MT64-MX01** [1])
Key To Reset with Standard Contact Blocks			
40 mm Operator		**D7P-MK44-PX01** [1])	**D7M-MK44-MX01** [1])
Twist To Reset with "Auto Break" Safety Contact Blocks			
30 mm Operator		**D7P-MT34-PX01S** [1])	**D7M-MT34-MX01S** [1])
40 mm Operator		**D7P-MT44-PX01S** [1])	**D7M-MT44-MX01S** [1])
60 mm Operator		**D7P-MT64-PX01S** [1])	**D7M-MT64-MX01S** [1])
Key To Reset with "Auto Break" Safety Contact Blocks			
40 mm Operator		**D7P-MK44-PX01S** [1])	**D7M-MK44-MX01S** [1])

Enclosed Emergency Stop Operators



Dimensions in (mm)

Modern low profile enclosures

Supplied complete

20 mm metric cable entry

Plastic or Metal enclosures

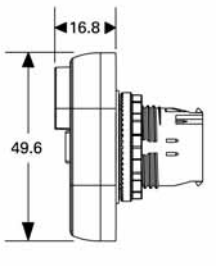
D71YM1

D71MM1

Description	Contact	Cat. No.
Plastic Enclosures with Emergency Stop "Twist To Reset" Operator		
Yellow enclosure 40 mm plastic operator		**D71YM1**
Plastic Enclosures with Emergency Stop "Twist Key To Reset" Operator		
Yellow enclosure 40 mm plastic operator		**D71Y4**
Metal Enclosures with Emergency Stop "Twist To Reset" Operator		
Grey enclosure 40 mm metal operator		**D71MM1**
Metal Enclosures with Emergency Stop "Twist Key To Reset" Operator		
Grey enclosure 40 mm metal operator		**D71MM4**

Note: [1]) Add suffix "**bx**" for special box/hang-sell packaging eg: D7P-MT34-PX01**bx**.

Multi Function Operators



Dimensions in (mm)

Time saving
- Central nut fixing
- Snap fitting of components

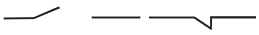
Space efficient
- 2 or 3 functions in a minimum of space
- Single 22.5 mm hole mounting

Economical
- Negates the need for 3 separate devices
- Less mounting time

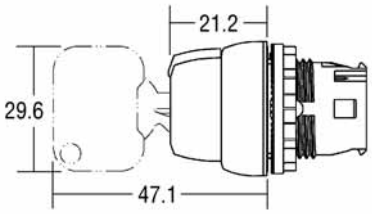
Flexible
- Uses standard D7 rear elements
- 2 contact levels possible
- Choice of plastic or metal body
- IP 66 protection

D7P-U2E4F3-PX11

D7M-U2E4F3-MX11

Description	Contact	Plastic Body Cat. No.	Metal Body Cat. No.
Maintained Operation			
Blank press plates (Red / Green)		**D7P-U2E4F3-PX11** [1])	**D7M-U2E4F3-MX11** [1])
O-I (Red “Stop” / Green “Start”)		**D7P-U2EFFE-PX11** [1])	**D7M-U2EFFEMX11** [1])

Short lever Rotary Switches and Key Operated Rotary Switches



Dimensions in (mm)

Improved sealing

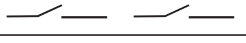
Raised detent for improved switching capabilities

Ergonomic handles

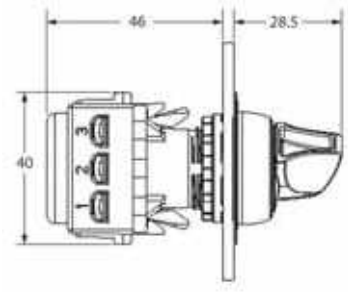
Key release at off position

D7P-SM22-PX10

D7M-KM31-MX20

Description	Contact	Plastic Body Cat. No.	Metal Body Cat. No.
Maintained Operation			
2 pos Rotary SW 90°		**D7P-SM22-PX10** [1])	**D7M-SM22-MX10** [1])
3 pos Rotary SW 2 x 60°		**D7P-SM32-PX20** [1])	**D7M-SM32-MX20** [1])
2 pos Key SW 90°		**D7P-KM21-PX10** [1])	**D7M-KM21-MX10** [1])
3 pos Key SW 2 x 60°	 	**D7P-KM31-PX20** [1])	**D7M-KM31-MX20** [1])

Potentiometer



Dimensions in (mm)

Supplied complete with resistive elements

Thermoplastic body

D7P-POT

Description	Contact	Plastic Body Cat. No.
Operator without resistive element		**D7P-POT**
Operator with 1000 Ω resistive		**D7P-POT3**
Operator with 5000 Ω resistive		**D7P-POT5**
Operator with 10000 Ω resistive		**D7P-POT6**

Note: [1]) Add suffix “**bx**” for special box/hang-sell packaging eg: D7P-U2E4F3-PX11**bx**.

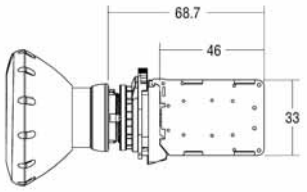
Back of panel components for base or panel mounting

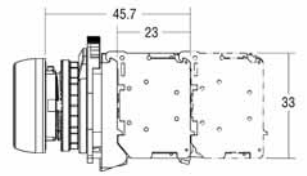
Each component supplied separately

D7-ALP / D7-ALM Contact block coupling plates

- Time saving snap-on twist to release operation
- Suitable for 3 contacts in one level
- Available in metal or plastic

Description	Cat. No.
Plastic coupling plate	**D7-ALP**
Metal coupling plate	**D7-ALM**





Dimensions in (mm)

D7-X / D7-Q Panel mount contact blocks

D7-BX / D7-BQ Base mount contact blocks

- Option of screw or spring clamp termination
- Self-cleaning operation for long life
- Colour coded operators for easy identification
- Small dimensions
- Panel mount can be mounted to metal or plastic coupling plate

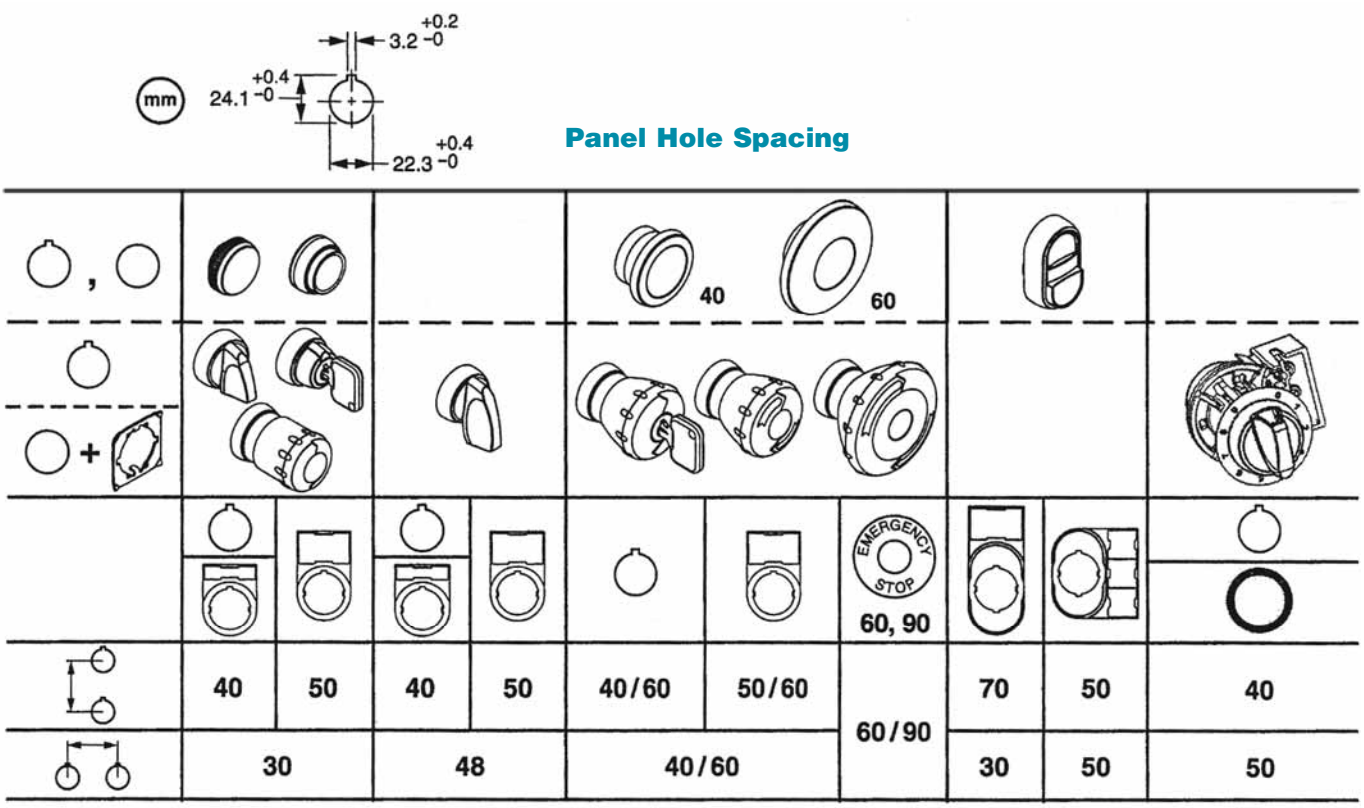
D7-X01S

D7-X10V

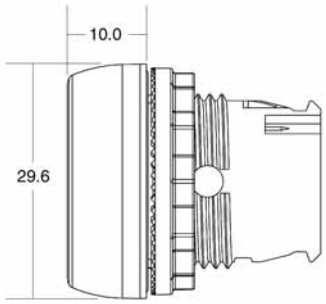
D7-BX01V

Description	Operator Colour	Panel Mount Cat. No.	Base Mount Cat. No.
Normally open contact block	**Green**	**D7-X10**	**D7-B10**
Normally closed contact block	**Red**	**D7-X01**	**D7-B01**
Normally open contact block with spring clamp terminals	**Green**	**D7-Q10**	**D7-BQ10**
Normally closed contact block with spring clamp terminals	**Red**	**D7-Q01**	**D7-BQ01**
Normally open early make	**Green**	**D7-X10E**	**D7-BX10E**
Normally closed late brake	**Red**	**D7-X01L**	**D7-BX01L**
Normally open low voltage (*Quadfurcated* gold contacts	**Blue**	**D7-X10V**	**D7-BX10V**
Normally closed low voltage (*Quadfurcated* gold contacts	**Blue**	**D7-X01V**	**D7-BX01V**
Dual circuit 2 normally open	**Green**	**D7-X20D**	**N/A**
Dual circuit 2 normally closed	**Red**	**D7-X02D**	**N/A**
Autobreak safety contact block for emergency stop operators	**Yellow**	**D7-X01S**	**N/A**

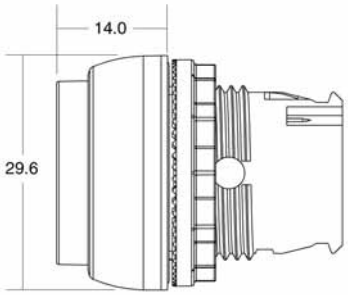
Dimensions (mm) and panel hole spacing



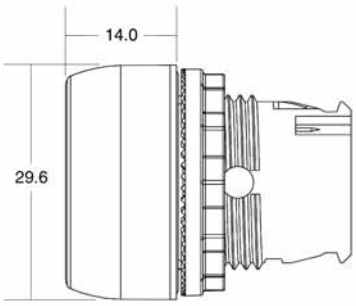
Non-Illuminated and Illuminated Momentary Flush pushbutton Operators



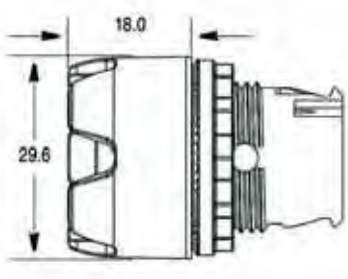
Illuminated and Non-Illuminated Momentary Extended pushbutton Operators



Non-Illuminated Guarded, Illuminated and Non-Illuminated Alternate Action pushbutton Operators

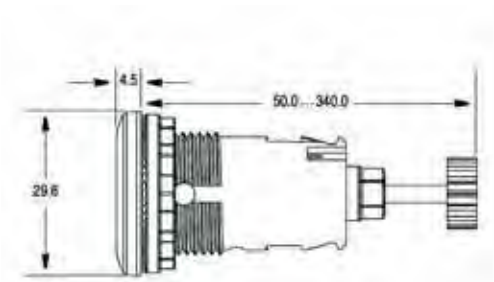


Illuminated Momentary Guarded pushbutton Operators

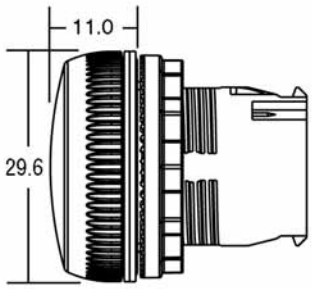


Dimensions (mm)

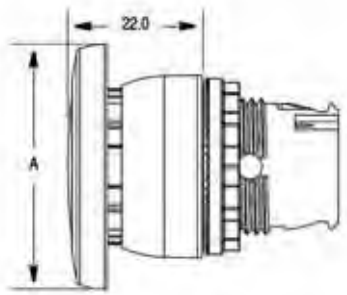
Reset Operators with Reset Rod



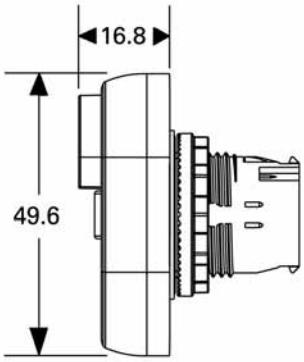
Pilot Light Operators



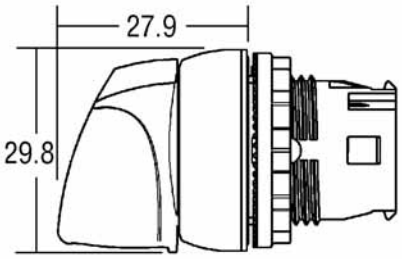
Illuminated and Non-Illuminated
Momentary Mushroom Operators
40 mm and 60 mm



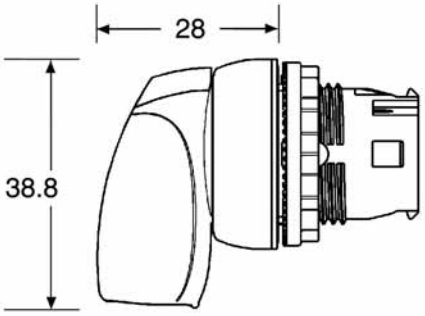
Illuminated and Non-Illuminated
2-Position Multi-Function Operators



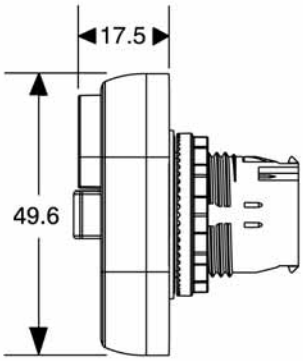
Illuminated and Non-Illuminated
Knob Selector Switch and
Potentiometer Operators



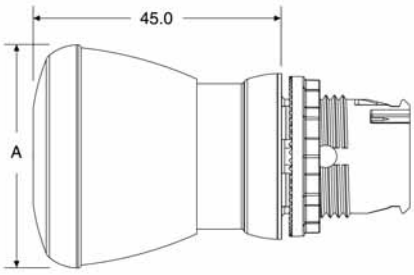
Non-Illuminated Knob Lever
Selector Switch Operators



Non-Illuminated
3-Position Multi-Function Operators

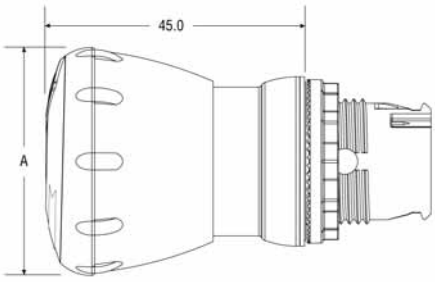


Illuminated and Non-Illuminated
Push-Pull Mushroom Operators
30 mm, 40 mm and 60 mm



Operator	A
30 mm	30.0
40 mm	40.0
60 mm	60.0

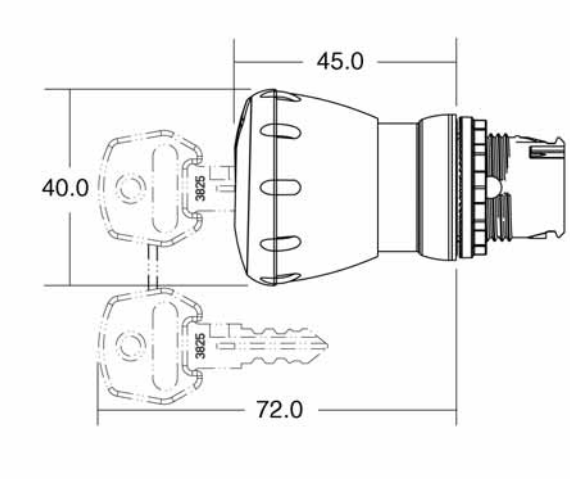
Illuminated and Non-Illuminated
Twist-to-Release Operators
30 mm, 40 mm and 60 mm



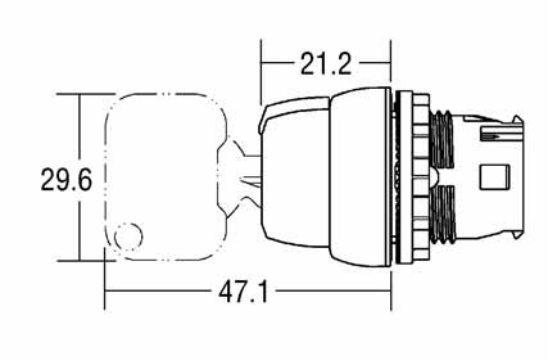
Operator	A
30 mm	30.0
40 mm	40.0
60 mm	60.0

Dimensions (mm)

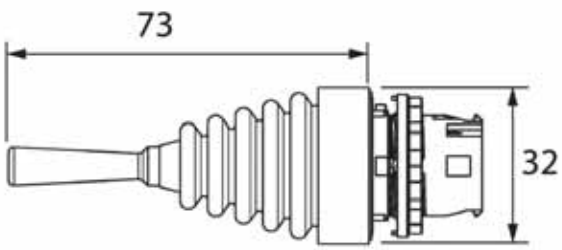
Mushroom Key Release Operator
40 mm



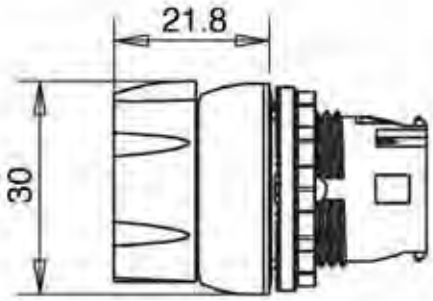
Key Selector Switch and Key Ejected
SensEject Operators



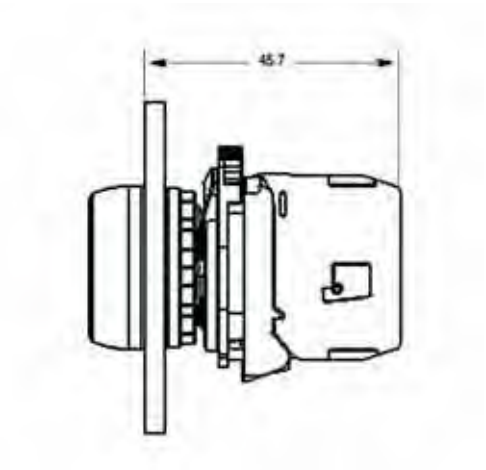
Joystick Operators



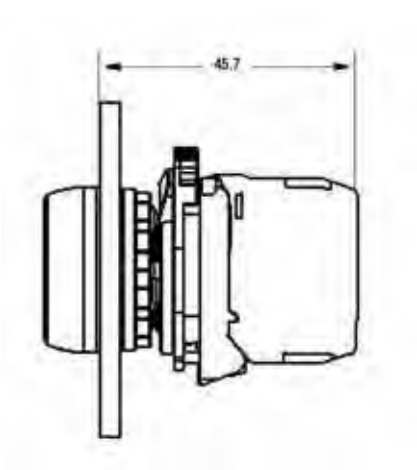
Selector Jog Operators



Back-of-Panel Components -
Incandescent Module with coupling plate

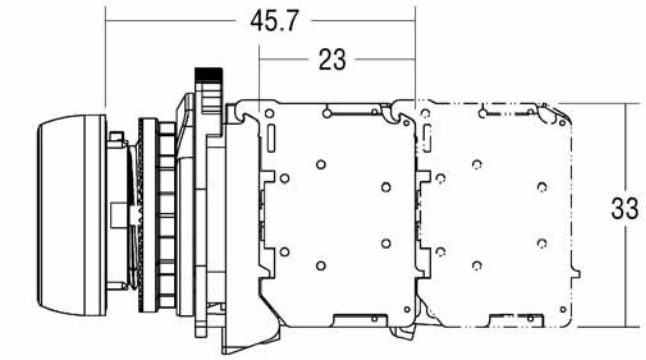


Back-of-Panel Components -
LED Module with coupling plate

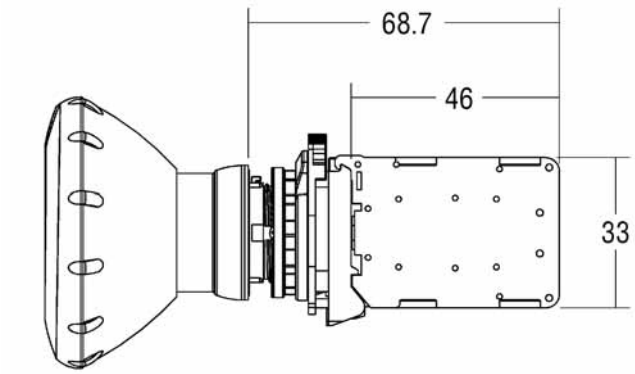


Dimensions (mm)

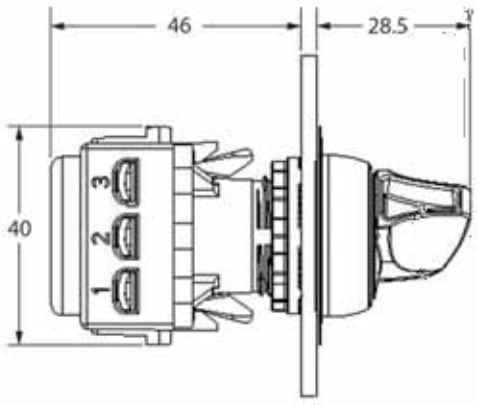
Back-of-Panel Components -
Contact Cartridges with coupling plate



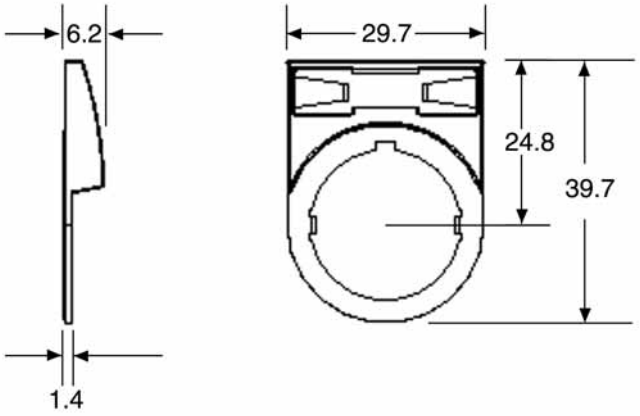
Back-of-Panel Components -
Dual Circuit Contact Block or SMBC Contact Block
(Max. of 1 Deep)



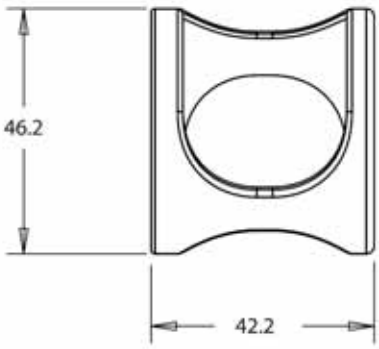
Potentiometer with Resistive Element



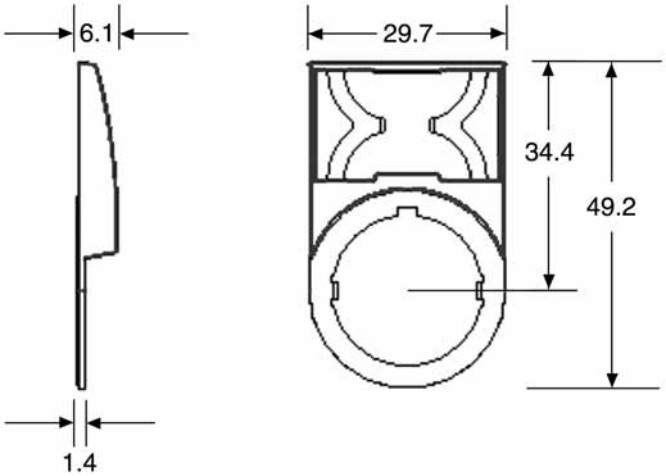
30 x 40 mm Snap-In Legend Plate



Protective Ring

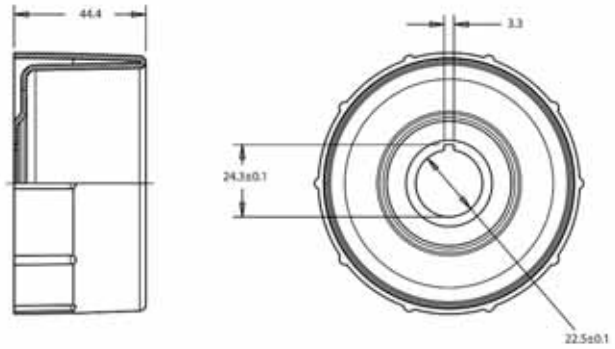


30 x 50 mm Snap-In Legend Plate

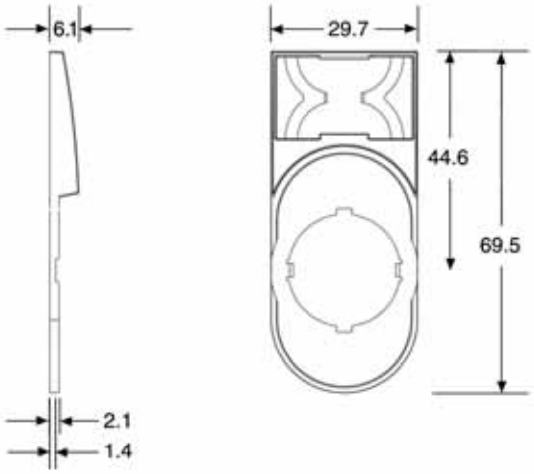


Dimensions (mm)

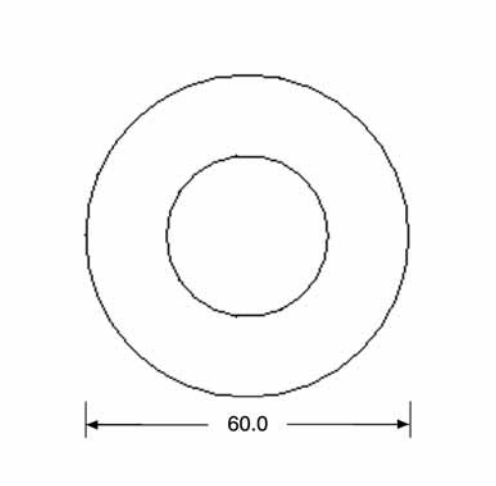
Plastic Guard



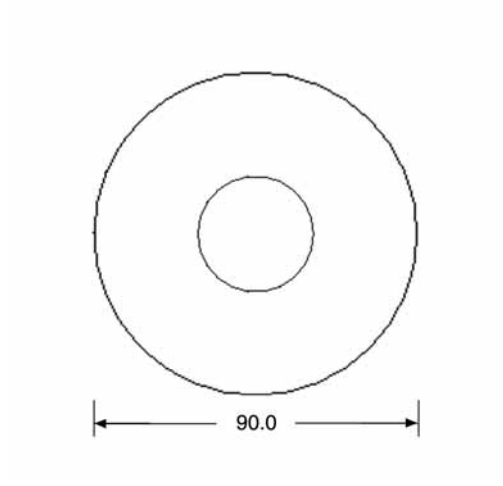
30 x 60 mm
Snap-In Legend Plate



60 mm Round Legend

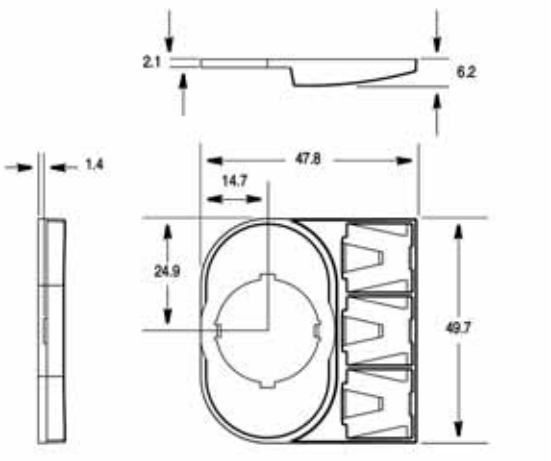


90 mm Round legend



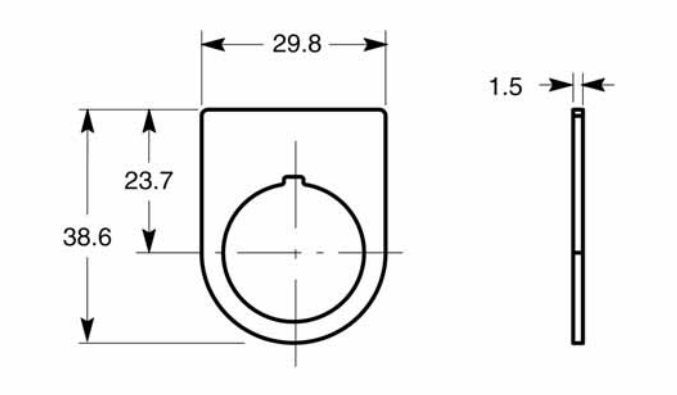
Potentiometer Legend Plate

Special Multi-Function
Snap-In Legend Plate

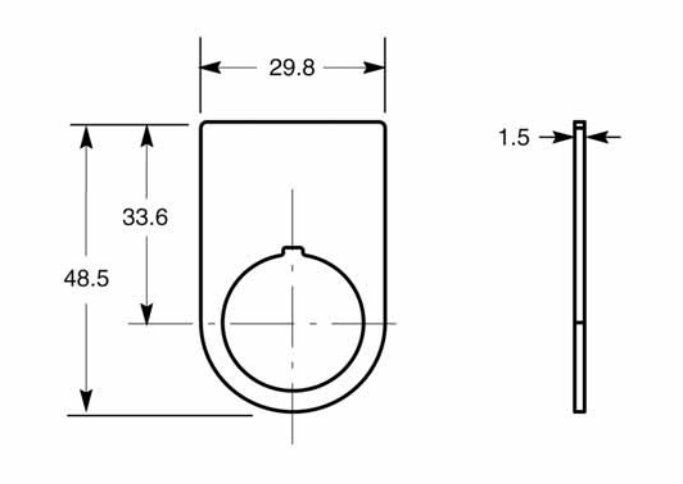


Dimensions (mm)

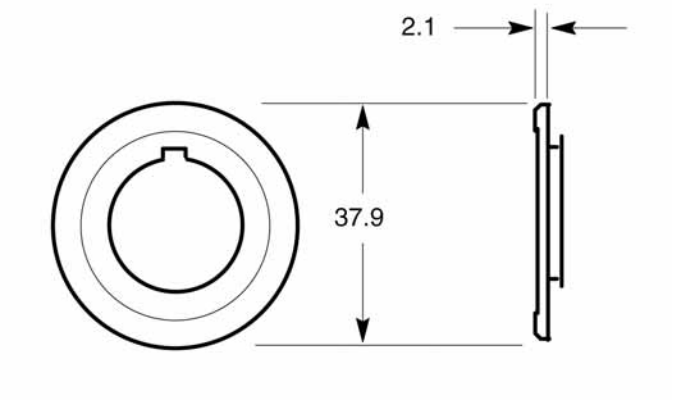
30 x 40 mm One-Piece Legend Plate



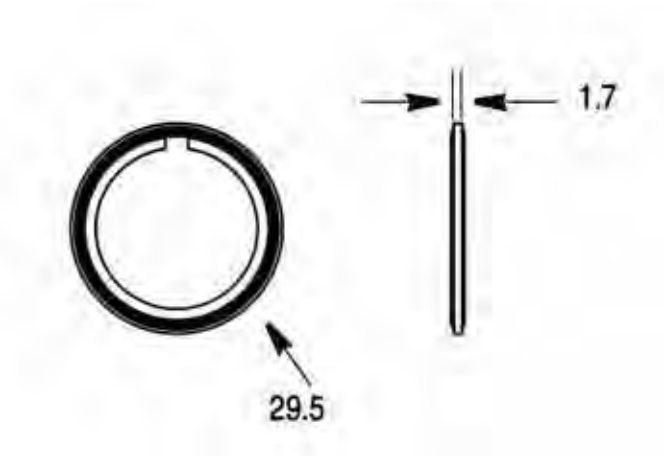
30 x 50 mm One-Piece Legend Plate



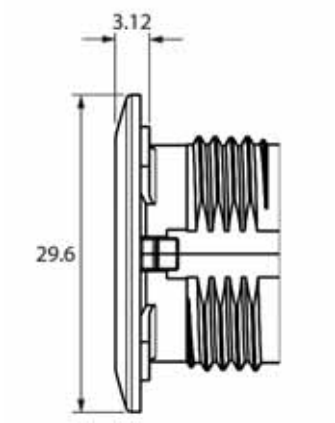
30 to 22.5 mm Hole Adaptor



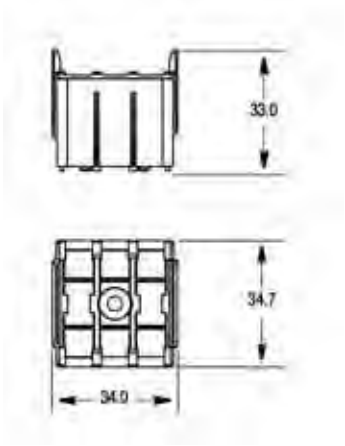
Trim Washer



Hole Plug

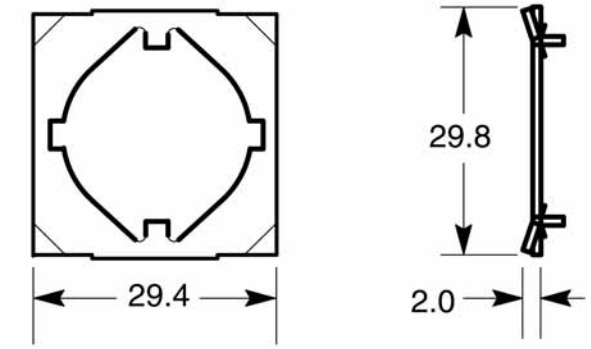


Base Mount Adaptor

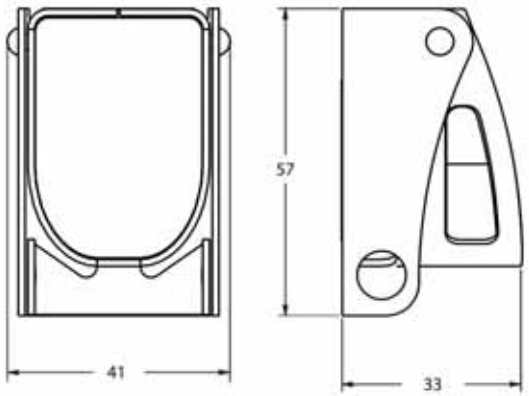


Dimensions (mm)

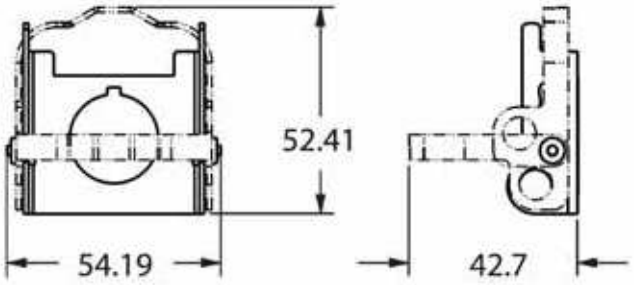
Anti-Rotation Washer



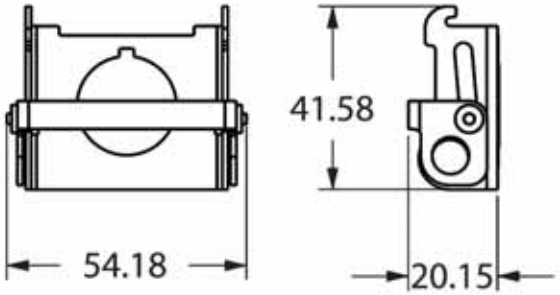
Locking Cover



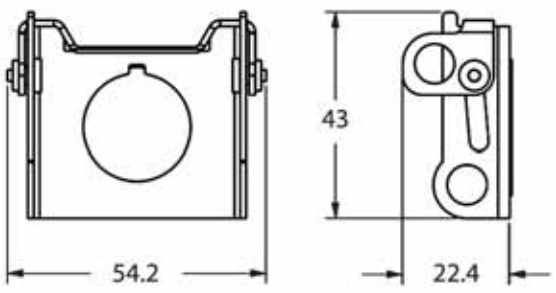
Maintained Mushroom Locking Attachment



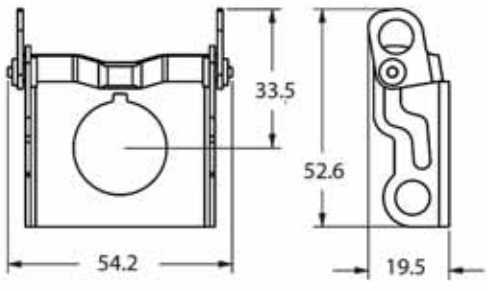
Momentary Mushroom Locking Attachment



Extended Non-Illuminated locking Attachment

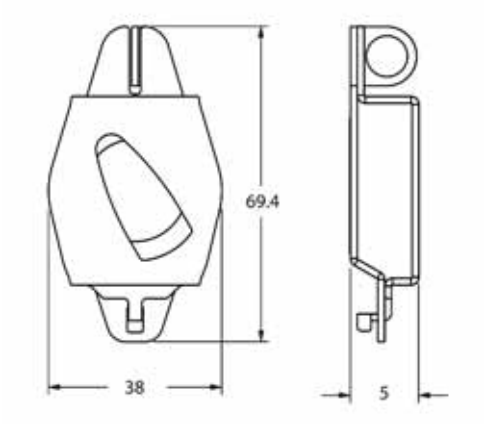


Flush Non-Illuminated Locking Attachment

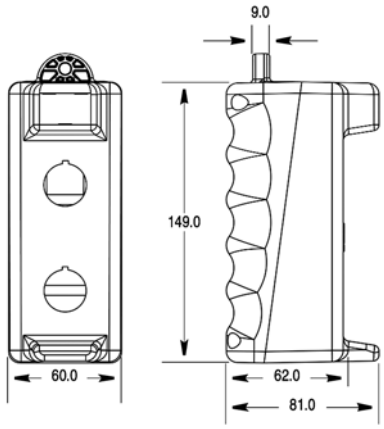


Dimensions (mm)

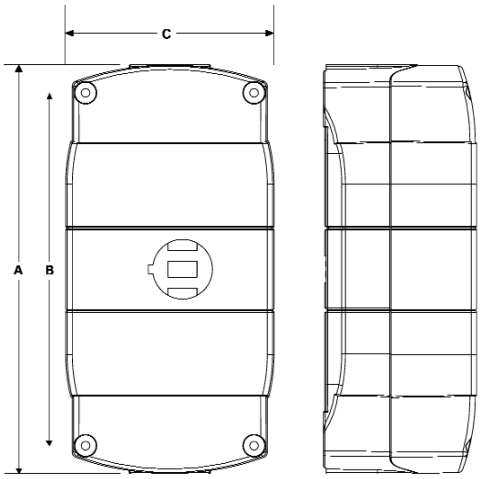
Selector Switch Locking Cover
(Same for all Lock Positions)



Pendant Stations

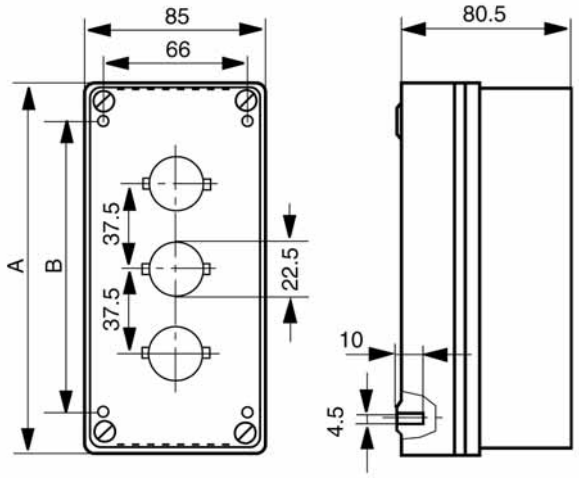


Plastic Enclosures



Cat. No.	No. of Units (Holes)	A	B	C
D7F-1PM	1	85	89	58
D7F-2PM	2	124	79	58
D7F-3PM	3	155	79	58
D7F-4PM	4	186	79	58
D7F-6PM	6	248	87	64

Metal Enclosures



Cat. No.	No. of Units (Holes)	A	B
D7F-1MM	1	85	89
D7F-2MM	2	124	79
D7F-3MM	3	155	79
D7F-5MM	5	186	79

Product selection made easy

Until now, NHP has been easily recognisable by its logo NHP. However, we realise that, as a customer you need to locate the products and information most relevant to you quickly and easily. That's why we're phasing in our new product icons, to help you differentiate the product information you need amongst the clutter that is business today.

You may have already come across these icons, prominent on the front of our literature as new catalogues and flyers become available. These brightly coloured icons in an obvious location mean no longer will you have to worry about searching for product information amongst the mounds of promotional literature. No more flicking through pages of catalogues, wondering where the things you need might be. We've done the searching for you. Just look for the icon that suits your product needs…....your guide to save yourself time……..so that you can get back to your business.

When it comes to motor control, our product package is by far the most technically advanced and comprehensive.
This includes the leading Sprecher+Schuh motor starting and protection products, well known for their reliability in service.

NHP offers an extensive range of power quality products to maintain and protect your power distribution network. All our products, from Terasaki circuit protection devices through to our load-break and switch-fuses, offer high levels of security and reliability.

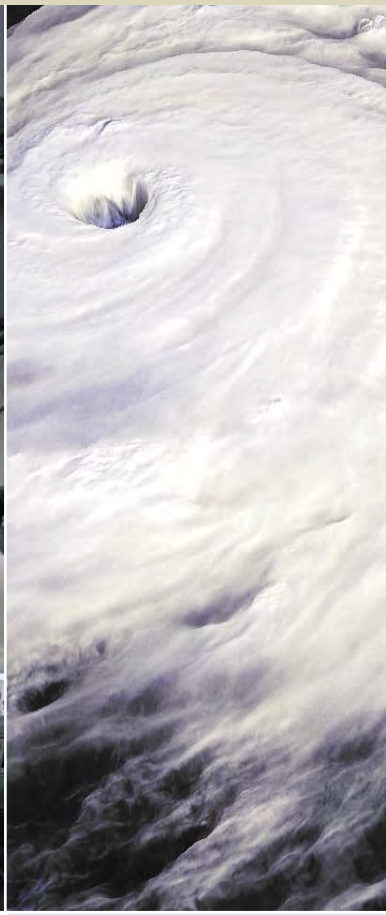
Automation and communication systems are central to your productivity and efficiency. Our range consists of the world's best and proven products, from Hitachi drives to the technically advanced Adroit SCADA system.

Our control and switching range keeps the risk of human error to a minimum with pushbuttons, cam switches, pendant controllers, foot switches, relays and timers.

3.6 FANS & SIRENS

- COSMOTEC – **GKF25** Grill & Filter
- COSMOTEC – **GKF30** Grill & Filter
- COSMOTEC – **GKV30A1220** Cubicle Fan
- COSMOTEC – **KTS01141** Thermostat

- KLAXON – **KL980554** Siren



FILTER FANS

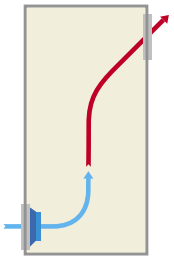
STULZ the natural choice

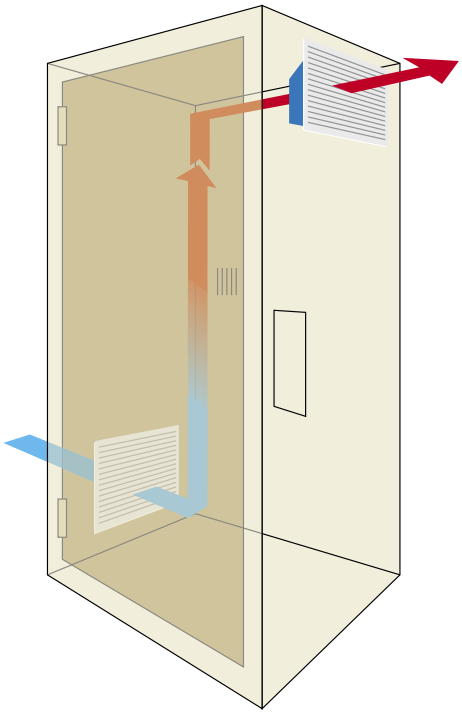
cosmotec®
industrial cooling

STULZ

KRYOS

Filter fans
Griglie di ventilazione con filtro
Lüftungsgitter mit Filter
Rejillas de ventilaciön con filtro





COMMON FEATURES
The units allow a simple and cost effective solution for enclosure cooling. Designed for easy clip-on mounting and made out of high resistance, self-extinguishing ABS UL94VO grade, they cover an air flow rate range from 35 m3/hr to 1100 m3/hr. They provide an IP54 protection degree. All the fans are mounted on ball bearings with MTBF of 40000 hrs.

CARATTERISTICHE GENERALI
I sistemi di ventilazione garantiscono una soluzione semplice ed economica per la gestione della temperatura dell'armadio elettrico. Progettati per il montaggio facilitato a scatto, sono costruiti in ABS UL94VO autoestinguente ad elevata resistenza meccanica. Le portate d'aria vanno da 35 a 1100 m3/h grazie ad efficienti ventilatori su cuscinetto con una vita attesa di 40000 ore. Il grado di protezione standard è IP54.

ALLGEMEINE MERKMALE
Die Filterlüfter erlauben eine einfache und günstige Lösung für Schaltschrankkühlung. Durch die Snap-In Montage sind sie schnell zu montieren.
Das Material ist aus höchst resistentem, selbstverlöschenden ABS nach UL 94V-O.
Luftförderleistungen sind von35 bis 1100m_/h verfügbar.
Kugelgelagerte Lüfter garantieren eine Lebensdauer von 40.000 Betriebsstunden.
Die Schutzart ist IP54.

CARACTERÍSTICAS COMUNES
Este sistema de ventilación es una solución simple y económica de la gestión de la temperatura de los armarios eléctricos. Estan diseñados para un fácil montaje de clip a presión y construidos en ABS UL94VO auto-extinguibles de elevada resistencia mecánica. Cubren una amplia gama de caudales desde 35 m3/h a 1100 m3/h . Proveen un grado de protección IP54. Todos los ventiladores son de rodamientos con una duración de 40000 horas.

KRYOS

IP54
The unit have IP54 protection degree

IP54
I prodotti sono IP54

IP54
Die Artikel sind IP54

IP54
Proteccion IP54

UL
Self-extinguishing ABS UL94VO grade

UL
ABS ad alta resistenza meccanica ed autoestinguente (UL94 VO)

UL
Selbstlöschendem ABS (UL94 VO) decken

UL
ABS de alta resistencia mecánica e incombustible (UL94 VO)

Ball bearings:
Ball bearing fans

Ball bearings:
Ventilatori su cuscinetti a sfera

Ball bearings:
Luefter auf Lagern

Ball bearings:
Ventiladores sobre cojinetes

Air flow:
35/1100m³/h

Portata d'aria:
35/1100m³/h

Luftmenge:
35/1100m³/h

Caudal aire:
35/1100m³/h

ACCESSORIES - ACCESSORI - ZUBEHOR - ACCESORIOS

TMF
Mechanical thermostat 0-60°C

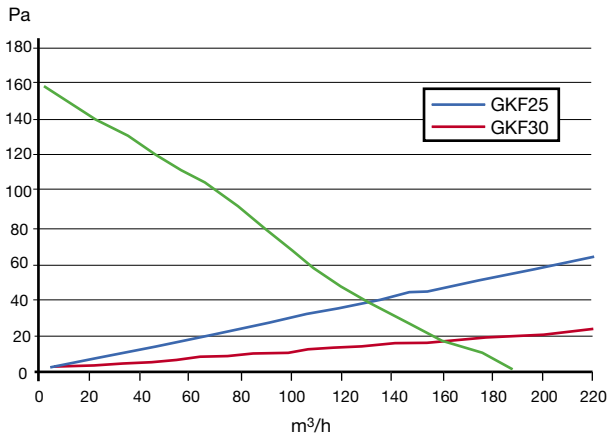
TMF
Termostato meccanico 0-60°C

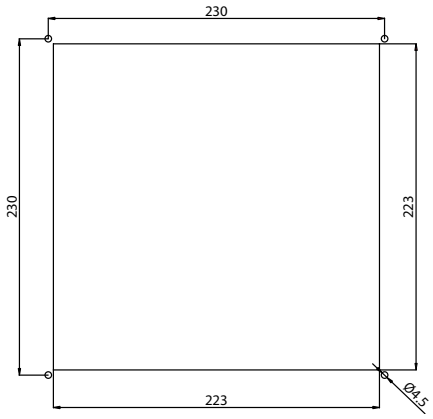
TMF
Mechanischer Thermostat 0-60°C

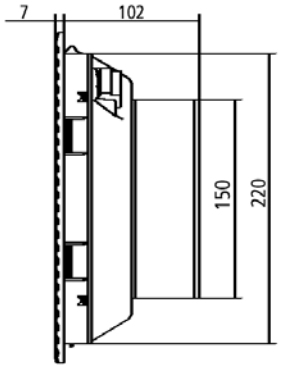
TMF
Termostato mecanico 0-60°C

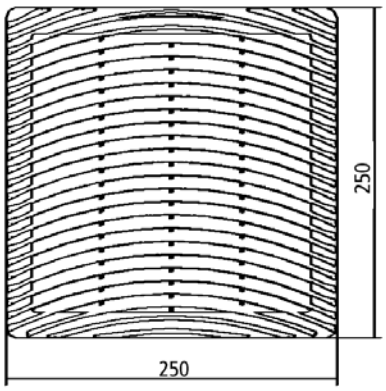
KRYOS
GKV2500

Performance - Resa - Leistung - Rendimento







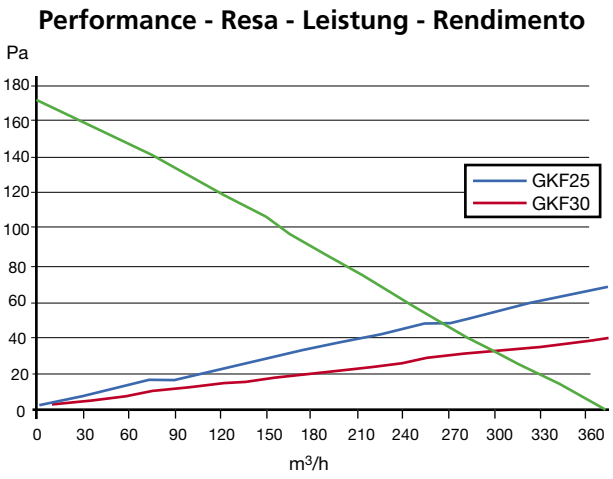


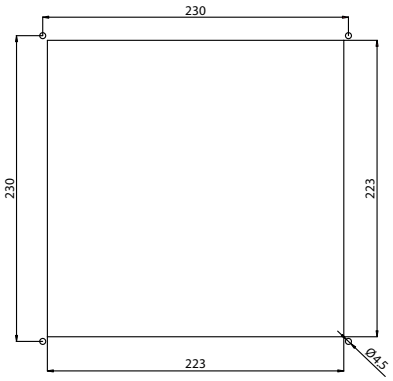
CODE - CODICE - CODE - CÓDIGO		GKF25	GKV2500220 GKV25P0220	GKV2500222 GKV25P0222	GKV2500210 GKV25P0210	GKV2500211 GKV25P0211	GKV2500212 GKV25P0212
Voltage / Phase / Frequency - Tensione / Fase / Frequenza Spannung / Phase / Frequenz - Voltaje / Fase / Frecuencia	V-ph-Hz	-	230-1-50/60	115/1/50-60	12 DC	24 DC	48 DC
Height / Width / Depth - Altezza / Larghezza / Profondità Höhe / Breite / Tiefe - Altura / Ancho / Profundidad	mm	250x250x25	250x250x109	250x250x109	250x250x109	250x250x109	250x250x109
Power absorbed - Potenza assorbit Leistungsaufnahme - Potencia absorbida	W/A	-	30/0,23	38/0,5	14/1,2	14/0,6	14/0,0,3
Temperature limits - Limiti temperatura Temperaturbereich - Límites temperatura	°C	-	-10/+70	-10/+70	-10/+70	-10/+70	-10/+70
Protection degree - Grado di protezione Schutzgrad - Protección	IP	54	54	54	54	54	54
Noise level - Rumorosità Geräuschpegel dB(A) - Nivel de ruido	dB(A)	-	50	50	50	50	50
Fan flow GKV- Portata aria GKV Luftmenge GKV- Caudal aire ventil GKV	m³/h	-	190	190	190	190	190
Fan flow GKV+GKF25/GKF30 - Portata aria GKV+GKF25/GKF30 Luftmenge GKV+GKF25/GKF30 - Caudal aire ventil GKV+GKF25/GKF30	m³/h	-	130/160	130/160	130/160	130/160	130/160
Air flow direction – Senso del flusso d'aria Richtung Luftmenge – Dirección del flujo de aire			A/P	A/P	A/P	A/P	A/P

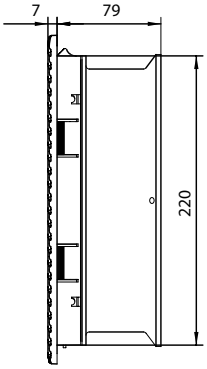
c UL us c UL us

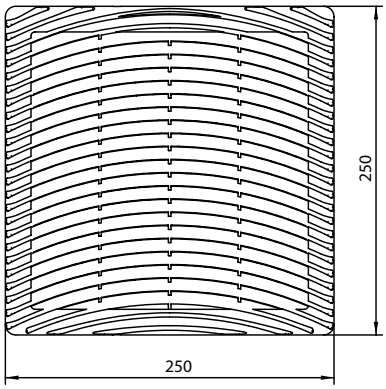
E194444

KRYOS
GKV2501



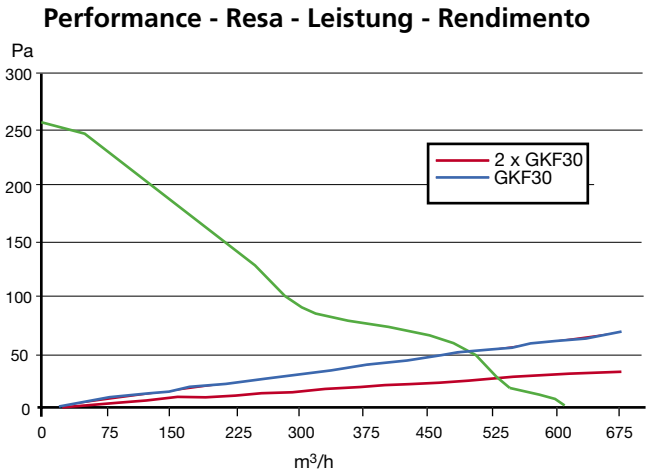


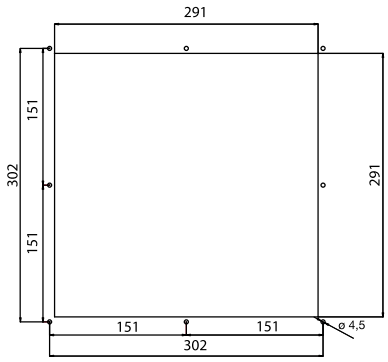


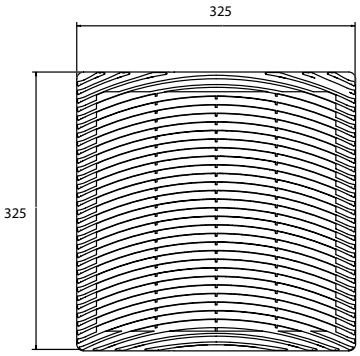


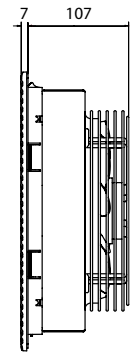
CODE - CODICE - CODE - CÓDIGO		GKF25	GKV2501220	GKV2501222	GKV25P1220	GKV25P1222
Voltage / Phase / Frequency - Tensione / Fase / Frequenza Spannung / Phase / Frequenz - Voltaje / Fase / Frecuencia	V-ph-Hz	-	230-1-50/60	115/1/50-60	230-1-50/60	115/1/50-60
Height / Width / Depth - Altezza / Larghezza / Profondità Höhe / Breite / Tiefe - Altura / Ancho / Profundidad	mm	230X250X25	250X250X86	250X250X86	250X250X86	250X250X86
Power absorbed - Potenza assorbit Leistungsaufnahme - Potencia absorbida	W/A	-	50/0,25	50/0.42	50/0,25	50/0.42
Temperature limits - Limiti temperatura Temperaturbereich - Límites temperatura	°C	-	-10/+70	-10/+70	-10/+70	-10/+70
Protection degree - Grado di protezione Schutzgrad - Protección	IP	54	54	54	54	54
Noise level - Rumorosità Geräuschpegel dB(A) - Nivel de ruido	dB(A)	-	59	59	59	59
Fan flow GKV- Portata aria GKV Luftmenge GKV- Caudal aire ventil GKV	m³/h	-	370	370	370	370
Fan flow GKV+GKF25/GKF30 - Portata aria GKV+GKF25/GKF30 Luftmenge GKV+GKF25/GKF30 - Caudal aire ventil GKV+GKF25/GKF30	m³/h	-	270/305	270/305	270/305	270/305
Air flow direction – Senso del flusso d'aria Richtung Luftmenge – Dirección del flujo de aire			A	A	P	P
			E194444		E194444	

KRYOS
GKV3001









CODE - CODICE - CODE - CÓDIGO		GKF30	GKV30A1220 GKV30P1220	GKV30A1222 GKV30P1222	GKV30A1220U GKV30P1220U	GKV30A1222U GKV30P1222U
Voltage / Phase / Frequency - Tensione / Fase / Frequenza Spannung / Phase / Frequenz - Voltaje / Fase / Frecuencia	V-ph-Hz	-	230-1-50/60	115/1/50-60	230-1-50/60	115/1/50-60
Height / Width / Depth - Altezza / Larghezza / Profondità Höhe / Breite / Tiefe - Altura / Ancho / Profundidad	mm	325X325X25	325X325X140	325X325X140	325X325X140	325X325X140
Power absorbed - Potenza assorbit Leistungsaufnahme - Potencia absorbida	W/A	-	63/0,30 77/0,34	63/0,6 77/0,68	63/0,30 77/0,34	68/0,6 70/0,68
Temperature limits - Limiti temperatura Temperaturbereich - Límites temperatura	°C	-	-10/+70	-10/+70	-10/+70	-10/+70
Protection degree - Grado di protezione Schutzgrad - Protección	IP	54	54	54	54	54
Noise level - Rumorosità Geräuschpegel dB(A) - Nivel de ruido	dB(A)	-	69	69	69	69
Fan flow GKV- Portata aria GKV Luftmenge GKV- Caudal aire ventil GKV	m³/h	-	615	615	615	615
Fan flow GKV+GKF30/2xGKF30 - Portata aria GKV+GKF30/2xGKF30 Luftmenge GKV+GKF30/2xGKF30 - Caudal aire ventil GKV+GKF30/2xGKF30	m³/h	-	500/550	500/550	500/550	500/550
Air flow direction – Senso del flusso d'aria Richtung Luftmenge – Dirección del flujo de aire			A/P	A/P	A/P	A/P

E194444

Small, compact Thermostat KTO 011 / KTS 011

Large setting range
Small size
Simple to mount
High switching performance

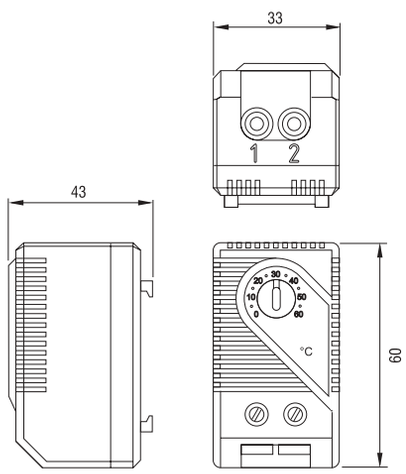
KTO 011: Thermostat (normally closed); contact breaker for regulating heaters.

KTS 011: Thermostat (normally open); contact maker for regulating of filter fans and heat exchangers or for switching signal devised when temperature limit has been exceeded.

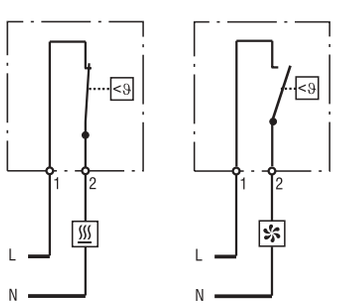
CE

Technical Data

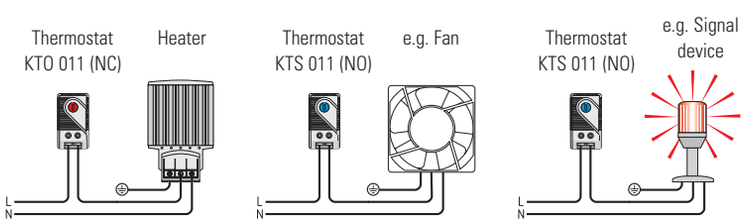
Switch temperature difference	7K (± 4K tolerance)
Sensor element	thermostatic bimetal
Contact type	snap-action contact
Contact resistance	< 10mOhm
Service life	> 100,000 cycles
Max. Switching capacity	250VAC, 10 (2) A
	120VAC, 15 (2) A
	DC 30W
EMC	acc. to EN 55014-1-2, EN 61000-3-2, EN 61000-3-3
Connection	2-pole terminal for 2.5mm², clamping torque 0.8Nm
Mounting	clip for 35mm DIN rail, EN50022
	(or for exit filter EF 118 Series)
Casing	plastic according to UL94 V-0, light grey
Dimensions	60 x 33 x 43mm
Weight	approx. 40g
Fitting position	variable
Operating/Storage temperature	-20 to +80 °C (-4 to +176 °F) / -45 to +80 °C (-49 to +176 °F)
Protection type	IP20



Thermostat KTO 011 (NC) | Thermostat KTS 011 (NO)



Example of connection



Example of connection

Setting range	Art. No. Contact Breaker (NC)	Art. No. Contact Maker (NO)	Approvals
0 to +60°C	01140.0-00	01141.0-00	VDE
-10 to +50°C	01142.0-00	01143.0-00	VDE
+20 to +80°C	01159.0-00	01158.0-00	VDE
+32 to +140°F	01140.9-00	01141.9-00	UL File No. E164102
+14 to +122°F	01142.9-00	01143.9-00	UL File No. E164102
0 to +60°C	01146.9-00	01147.9-00	UL File No. E164102

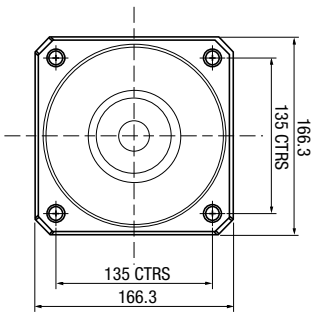
klaxon

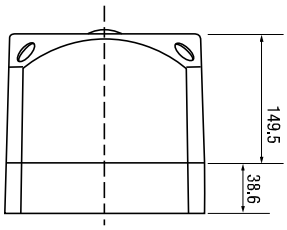
SIGHT & SOUND

ELECTRONIC SOUNDERS

NEXUS 110

The Nexus 110 sounder is a high output low current consumption sounder. Ideal for outdoor marine applications due to its high IP 66 rating. Both AC and DC models have the ability to use 3 stage alarms for multiple sound applications.





TECHNICAL SPECIFICATION

SUPPLY VOLTAGE:	10-60 V DC, 24 - 48 V AC & 110/240 V AC
PEAK SOUND LEVEL:	110 dB @ 1 metre
IP RATING:	IP 66
NUMBER OF TONES:	64
FREQUENCY RANGE:	refer to tones table on page 56-57
OPERATING TEMP:	- 25 ºC to + 70 ºC (DC) - 25 ºC to + 55 ºC (AC)
CURRENT:	10-40 mA (DC)/11-23 mA (240 V AC)
RATING:	Continuous
CASING:	Hi impact ABS / polycarbonate
CABLE ENTRIES:	Drilling guides in sides and base
WEIGHT:	(DC) 1.1 Kg (AC) 1.2 Kg

VOLTAGE	ORDER CODES
10-60 V DC	**KL980554**
24-48 V AC	**KL980605**
110/240 V AC	**KL980557**

PRODUCT TIP:

NEXUS sounders can be synchronised for “daisy chain” applications. If used outdoors do not mount vertically with cone facing upwards, as water or foreign matter may collect and impede sound output.

NOTES:

Voltage selection is achieved by wiring to premarked terminals in base. No selector switch used.

3.7 INSTRUMENTATION & CURRENT TRANSFORMER

- IME – **RQ480 10-80VDC** Hour Run Meter
- IME – **RQ96 E ACT 5A 5X 400A** 0-400A Ammeter
- IME – **RQ96 E VAC 500V** 0-500V Voltmeter

- IME – **TAI 400 400 5A** 400/5A Current Transformer

IME

Analogue meters

Moving iron ammeters and voltmeters

General features

- Accuracy class 1.5
- 600 V operational voltage rating
- Insulation tested at 2 kV/min @ 50 Hz
- Operating temperature -25 to +50 °C
- Overload parameters:
  Ammeters 1.2 x In cont., 10 x In for 5 sec.
  Voltmeters 1.2 x Un cont., 2 x Un for 5 sec.
- Suitable for mounting on ferromagnetic materials
- Self-extinguishing housing
- IP 52 rated front frame
- Operates with ambient humidity rating 85 % without condensation at max. 35 °C for 60 days
- Vibration resistant with amplitude of 1-0.03 mm peak frequency on 3 axes @ 5-80 Hz (IEC 68-2-6)

Catalogue Number construction

RQ 96 E ACT 5A 5X 100A

- RQ = 90 degree pointer deflection
- 96 = Frame size 48 mm², 72 mm², 96 mm²
- E = Moving iron instrument
- ACT = Ammeter, current transformer connected
- 5A = CT secondary current, 5 A or 1 A
- 5X = 5x overcurrent measurement
- 100A = Primary current value of CT

Ordering guide

Analogue meters can be ordered by constructing the Catalogue Number from tables 1 (meter type and size) plus table 2 (scale / input). If the input is different from the scale, select it from table 3 and clearly state when placing your order.

Example 1. To order a 90° AC ammeter – direct connect with a 96 mm x 96 mm window including a 10 A scale and input:

Customer Order
1 x RQ96EAAC10A

Example 2. To order a 90° AC ammeter – CT connect with a 72 mm x 72 mm window with a 100 A scale and a 5 A input:

Customer Order
1 x RQ72EACT5A5X100A
Input: **5 A**
Scale: **100 A**

90° AC ammeter - Direct connect

With 5x over-scale

Ordering

Construct the Catalogue Number by selecting the meter from table 1 and adding the scale / input from table 2 .

RQ72E AAC 100A

1 Window size	Cat. No.
48 mm x 48 mm	RQ48EAAC...
72 mm x 72 mm	RQ72EAAC...
96 mm x 96 mm	RQ96EAAC...

2 Scale / input selection	1 A, 2.5 A, 5 A, 10 A,15 A, 20 A, 25 A, 30 A, 40 A, 50 A, 60 A, 80 A, 100 A

Analogue meters

Moving iron ammeters and voltmeters

90° AC ammeter - CT connect [1])

5A Current transformer operation with 5x over-scale

Ordering

Construct the Catalogue Number by selecting the meter from table 1 and adding the scale from table 2. The input is 5 A. 1 A input is available on request, contact NHP for further details.

RQ72E ACT 5A 5X 750

1 Window size	Cat. No.
48 mm x 48 mm	RQ48EACT5A5X...
72 mm x 72 mm	RQ72EACT5A5X...
96 mm x 96 mm	RQ96EACT5A5X...

2 Scale selection	5 A, 10 A, 12 A, 15 A, 20 A, 25 A, 30 A, 40 A, 50 A, 60 A, 75 A, 80 A, 100 A, 120 A, 150 A, 200 A, 300 A, 400 A, 500 A, 600 A, 750 A, 800 A, 1 kA, 1.2 kA, 1.5 kA, 1.6 kA, 2 kA, 3 kA, 4 kA

90° AC Voltmeter - Direct connect

Ordering

Construct the Catalogue Number by selecting the meter from table 1 and adding the scale / input from table 2.
E.g. RQ72EVAC500V.

RQ72E VAC 500V

1 Window size	Cat. No.
48 mm x 48 mm	RQ48EVAC...
72 mm x 72 mm	RQ72EVAC...
96 mm x 96 mm	RQ96EVAC...

2 Scale / input selection	50 V, 150 V, 300 V, 500 V

90° AC Voltmeter - VT Connect

High voltage measurement, voltage transformer operated

Ordering

Construct the Catalogue Number by selecting the meter from table 1 and adding the input from table 2, and then state the required scale from table 3 on your order.
E.g. RQ72EVVT110V.

RQ72E VVT
110V/1.1kV

1 Window size	Cat. No.
48 mm x 48 mm	RQ48EVVT...
72 mm x 72 mm	RQ72EVVT...
96 mm x 96 mm	RQ96EVVT...

2 Input selection	24 V, 110 V, 240 V, 415 V

3 Scale selection	1.0 kV, 1.5 kV, 2 kV, 3 kV, 4 kV, 5 kV, 10 kV

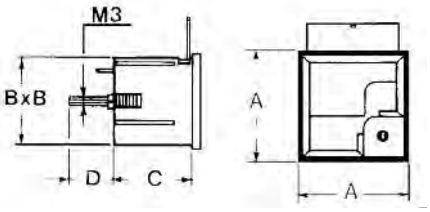
Dimensions and shunts

Analogue meters

Overall dimensions (mm) and weight – RQ/90° and AQ/240° Instruments

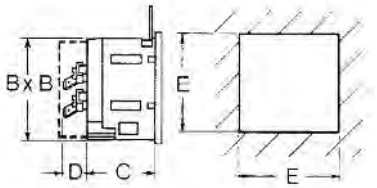
Cat. No.	A	B	C	D	E	Weight (g)
RQ48	48 x 48	44.5 x 44.5	40	22	45	100
AQ48	48 x 48	44.5 x 44.5	57.5	22	45	200
RQ72	72 x 72	66.5 x 66.5	44	12	68	150
AQ72	72 x 72	66.5 x 66.5	59	12	68	300
RQ96	96 x 96	91 x 91	44	12	92	210
AQ96	96 x 96	91 x 91	59	12	92	400

RQ/90°



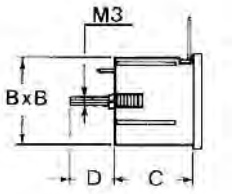
RQ48

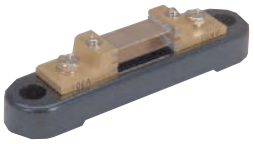
RQ/90°



RQ72-96

AQ/240°



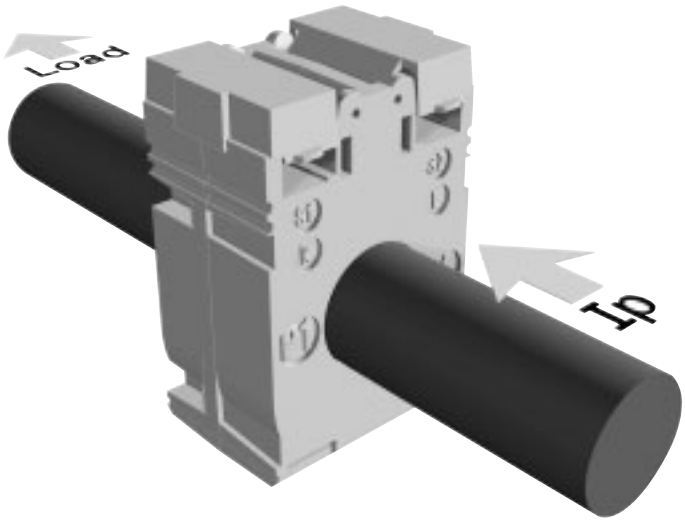


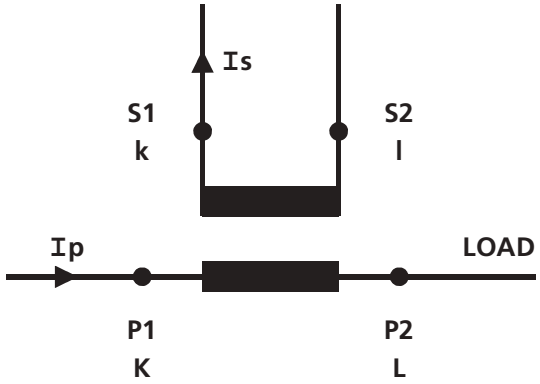
NHP100-50 mV Shunt

Shunts (50 mV)

Current rating Amps DC	Cat. No. [1]) Output
10 A	**NHP 10-50MV**
20 A	**NHP 20-50MV**
30 A	**NHP 30-50MV**
40 A	**NHP 40-50MV**
50 A	**NHP 50-50MV**
60 A	**NHP 60-50MV**
75 A	**NHP 75-50MV**
80 A	**NHP 80-50MV**
100 A	**NHP 100-50MV**
150 A	**NHP 150-50MV**
200 A	**NHP 200-50MV**

Current rating Amps DC	Cat. No. [1]) Output
250 A	**NHP 250-50MV**
300 A	**NHP 300-50MV**
400 A	**NHP 400-50MV**
500 A	**NHP 500-50MV**
600 A	**NHP 600-50MV**
800 A	**NHP 800-50MV**
1000 A	**NHP 1000-50MV**
1200 A	**NHP 1200-50MV**
1500 A	**NHP 1500-50MV**
2000 A	**NHP 2000-50MV**
	-





Current transformers

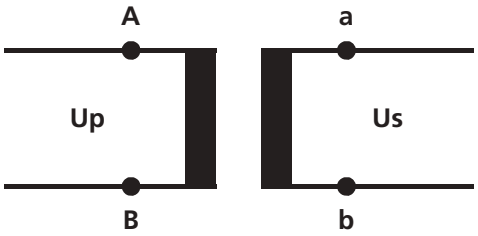
- Reference Standards EN60044-1
- Standard secondary currents 5A or 1A
- Frequency 47÷63Hz
- Insulation reference voltage 0,72kV
  test voltage 3kV per 1' a 50Hz
- insulation class B (CEI EN 60044-1)
- Rated continuous thermal current according to CEI EN 60044-1
- Rated short-time thermal current (Ith):
  models passing bar 60In (max 60kA/1s)
  models with wound primary 60In (TAQ1, TAQ2 and TAQ6 30In)
- Rated dynamic current (Idyn) 2,5 Ith
- Safety factor (f.s.) ≤ 5 for class 0,5-1-3
  (for models TAU8-9-10-11 f.s. ≤ 10)
- Working time with secondary winding open 1 min.
- Connectors marking:
  primary P1 - P2 (K - L)
  secondary s1 - s2 (k - l)
- Terminal protection degree:
  series TAI - TRA - TAC - BTA IP20
  series TAS - TAU - TAQ - BSA IP00
  (IP20 with sealable terminal cover)
- Self-extinguishing polycarbonate housing, VO classification according to UL-94 (except for models TRA11 - TRA15 thermoplastic material and partially filled with resin, BTA2 metallic housing)
- Tropicalized execution / standard marine use

Absorbed power (VA) of connecting cables between CT and instrument

section mm² Cu	VA for each double pole cable meter at 20°C*		rated burden of each current circuit	
	secondary 5A	secondary 1A		
1	1	0,04	Moving iron ammeters RQ//D4/NP	1,1VA
1,5	0,685	0,0274	Moving iron ammeters AQ	1,7VA
			Moving coil ammeters with rectifier AQ	0,7VA
2,5	0,41	0,0164	Thermal ammeters RQ	1,5VA
			Moving iron thermal ammeters RQ	2,5VA
4	0,254	0,0102	Insulated multifunction Nemo	0,5VA
			Non-insulated multifunction Nemo	0,75VA
6	0,169	0,0068	KWhmeter Conto	0,5VA
			Current relay RM	0,5VA
10	0,0975	0,0039	Tema fP trasducers	0,5VA
			Tema self-supplied current transducers	2,5VA
16	0,062	0,0025	Tema current transducers with separate auxiliary	0,5VA
			Tesi transducers	0,5VA
			DG digitals	≤ 1VA

*** For each 10°C of temperature variation, the VA assorbed by connecting cable will increase of 4%**

Low voltage transformers



Voltage transformers

- Reference Standards EN60044-2
- Standard secondary voltages
  100V - 110V - 100:√3V - 110:√3V
- Frequency 47÷63Hz
- Insulation reference voltage 0,72kV } for prymary voltages
  test voltage 3kV for 1' to 50Hz } ≤660V or 660:√3V
- Insulation reference voltage 1,2kV } for prymary voltages
  test voltage 6kV for 1' to 50Hz } ≥690V or 690:√3V
- Maximun heating voltage (voltage factor):
  models for phase-phase connection 1,2 Un continuous
  models for phase-neutral connection 1,2 Un continuous and 1,9 Un for 8 hours
- Connectors marking:
  Primary A - B / secondary a - b (types between phase-phase)
  Primary A - N / secondary a - n (types between phase-neutral)
- Metal housing
- Tropicalized execution / standard marine use

CURRENT TRANSFORMERS / DC SHUNTS

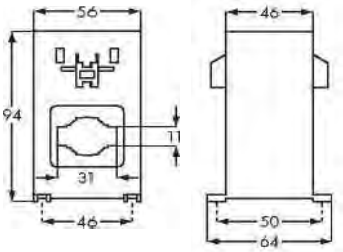
Integra Range - Moulded Case

TAI300 /310 /312 /400 /402 /500

VYDAS

TAI300

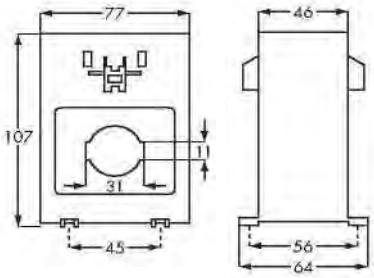
Cable Aperture 22mm dia
Busbar Window 31x11mm, 21x14mm
SecondaryTerminals M4 screws/ 6.3x0.8mm fast-on
Weight 290g



Primary current A	Burden cl. 0·5 VA	cl. 1 VA	cl. 3 VA
100	–	2	3
120	–	2·5	3·5
125	–	2·5	3·5
150	–	3·5	4·5
200	3	4	6
250	5	6	8
300	6	8	9
400	7·5	10	12
500	10	12	15
600	12	15	15
1A or 5A secondary			

TAI310/TA312

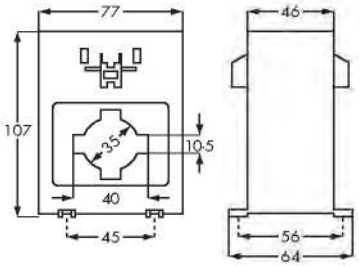
Cable Aperture 28mm dia
Busbar Window 31x11mm
Secondary Terminals M4 screws/ 6.3x0.8mm fast-on
Weight 370g



Primary current A	Burden TAI310 cl.0·5 VA	TAI310 cl.1 VA	TAI310 cl.3 VA	TAI312 cl.0·2 VA
50	–	–	2	–
60	–	–	3	–
75	–	–	3·5	–
80	–	1·5	3·5	–
100	–	2	6	–
120	1	2	8	–
125	1	2	8	–
150	1·5	3·5	10	–
200	4	8	12	1·5
250	6	12	15	2·5
300	10	15	20	5
400	15	20	25	8
500	20	25	30	10
600	25	25	30	15
1A or 5A secondary				

TAI400/TAI402

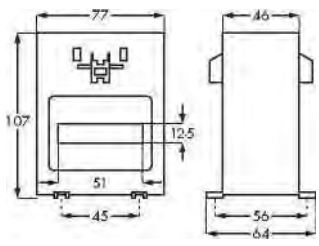
Cable Aperture 35mm dia
Busbar Window 40x10.5mm
Secondary Terminals M4 screws/ 6.3x0.8mm fast-on
Weight 400g



Primary current A	Burden TAI400 cl.0·5 VA	TAI400 cl.1 VA	TAI400 cl.3 VA	TAI402 cl.0·2 VA
50	–	–	1·5	–
60	–	–	2	–
70	-	-	3	-
75	–	–	3	–
80	–	–	3	–
100	–	1	4	–
120	–	2	5	–
125	–	2	6	–
150	1	3	6	–
200	1·5	3	6	1·5
250	2·5	5	8	2·5
300	4	8	12	2·5
400	8	12	15	4
500	10	12	15	6
600	10	12	15	8
700	10	12	15	-
750	10	12	15	8
800	10	12	15	8
1000	10	12	15	10
1A or 5A secondary				

TAI500

Busbar Window 51x12.5mm
Secondary Terminals M4 screws/ 6.3x0.8mm fast-on
Weight 400g



Primary current A	Burden cl. 0·5 VA	cl. 1 VA	cl. 3 VA
250	–	–	3
300	–	2	4
400	–	4	6
500	2	4	6
600	6	8	10
800	8	10	12
1000	10	12	15
1200	12	15	20
1A or 5A secondary			

VYDAS INTERNATIONAL MARKETING Swan House Passfield Business Centre Lynchborough Road Passfield Hants GU30 7SB UK
Telephone: 44 (0)1428 751822 Fax: 44 (0)1428 751833 Email: info@vydas.co.uk Website: www.vydas.co.uk

3.8 TERMINALS & LINKS

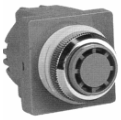
• DORE ELECTRICS – **250E36**	36-Hole Earth Bar
• DORE ELECTRICS – **250E36** c/w E/NFEET	36-Hole Neutral Bar
• WEIDMULLER – **AA0028**	Terminal Test Links
• JPR MANUFACTURED BUSBAR	Earth Bar
• JPR MANUFACTURED BUSBAR	Neutral Bar

Buzzers - IP44

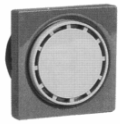
SCHEDULE 1

Part No.	Type	Dia.	dB
BZ22R12AC/DC	Flashing-Red	22mm	80
BZ22R24AC/DC	Flashing-Red	22mm	80
BZ22R240	Flashing-Red	22mm	80
BZ30DC24	Flush	30mm	75
BZ30AC24	Flush	30mm	75
BZ30AC110	Flush	30mm	75
BZ30AC240	Flush	30mm	75
BZ80DC24	Flush	80mm	85
BZ80AC24	Flush	80mm	85
BZ80AC240	Flush	80mm	85
BZ82AC12	Surface	82mm	85
BZ82DC12	Surface	82mm	85
BZ82DC24	Surface	82mm	85
BZ82AC24	Surface	82mm	85
BZ82AC240	Surface	82mm	85

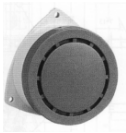
BZ22



BZ30



BZ80



BZ82

Sirens & Hooters - IP44

SCHEDULE 1

SCZDC24	Siren	100mm	105
TCZAC230	Siren	75mm	105
TSDAC220	Siren	123mm	120
TCZDC24	Hooter	135mm	105
TCZAC240	Hooter	135mm	105

Siren

Hooter

Earth & Neutral Bars – 165 Amp & 250 Amp

SCHEDULE 1

- **Earth Links = 2 Main Screws for – 2 Screws per Tunnel for 16mm Cable.**

165 Amp Bars

No. of Holes	Part No.
6	165E6
12	165E12
18	165E18
24	165E24
30	165E30
36	165E36
42	165E42
48	165E48
54	165E54
60	165E60
72	165E72
80	165E80
84	165E84
96	165E96
108	165E108

250 Amp Bars

Part No.
250E24
250E36
250E48
250E60
250E72
250E84
250E96

165E24

250E24

Mounting Feet

E/NFEET

4 SWITCHBOARD WORKS TEST RESULTS

Form No. F1017/3

J. & P. RICHARDSON INDUSTRIES PTY LTD
114 Campbell Avenue, WACOL QLD 4076
Ph: (07) 3271 2911 - Fax: (07) 3271 3623
E-mail: jpr@jpr.com.au

SWITCHBOARD & SHEETMETAL INSPECTION REPORT

Customer Name: QUU			Job No: C54500		
Item: 1 x EFFLUENT PUMP STATION SWITCHBOARD.			Drawing No: E11-C54500/130 - 137.		
TASK	PRODUCT DETAIL	INSPECTED BY	DATE	PASS / FAIL	CORRECTIVE ACTION REQUEST OR COMMENTS
Design	Documents	D.Mc	25-1-12	P	
Drafting	Documents	D.Mc	25-1-12	P	
Sheetmetal (Refer F1018 for details)	Switchboard	D.C	28-2-12	P	
	Doors	D.C	28-2-12	P	
	Cell/Panels				
Painting					
Process	Powder / Wet				
Min DFT (40 STD)					
Cure Test					
Colour Exterior					
Colour Internal		[signature]	29/02/12	P	
Colour Panels					
Cubicle Erection					
Electrical Fitout (In accordance with drawings)					
Inspection & Test		A. VARY	18-4-12	PASS	
(Refer to F1019)		S. Tredgo	2-5-12	PASS	
Packing					

Comments:

All Reqs Are Done [signature] 29/02/12 Lew.

NOTE: - Manufacture is not to proceed to the next process unit the item has passed inspection

Affix Status Here: -

Yellow	Awaiting Inspection
Green	Inspection & Test Passed
Red	Inspection & Test Failed, Awaiting Rectification

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E-mail: jpr@jpr.com.au

SWITCHBOARD / SHEETMETAL INSPECTION CHECKLIST

CLIENT: QUU				JOB NO: C 54500
PRODUCT DESCRIPTION: 1X EFFLUENT PUMP STATION SWITCH BOARD			DRAWING & SCHEDULE NUMBERS E11 - C54500/B0 - B7	
CONSTRUCTION	QUALITY		COMPLIANCE WITH DRAWINGS		REMARKS OR ACTION
	GOOD	POOR	YES	NO	
1. Folds			✓		
2. Welds			✓		
3. Edges / File			✓		
4. Gauge			✓		
5. Material			✓		
6. Ventilation Openings / Filter Bracket			✓		
7. Water Ingress Test			✓		
8. Equipment Mounting Arrangement			✓		
9. Doors Stiffened			✓		
10. Escutcheons and Lexan Covers			✓		
11. Cable Saddles			✓		
12. Grinding			✓		
13. Door Stays Fitted			✓		
14. Earth Studs			✓		
15. Rubber Retainer				✓	
16. Drawing Holder			✓		
17. Hat Sections			✓		
18. Locking Bars Fitted			✓		
19. External Crevice Welded and Ground			✓		
20. Legend Cards			✓		
21. General Conditions Satisfactory			✓		
22. Cabinet Clean			✓		
23. Job Name and Number Marked on Board and Panels			✓		
24. Lap Top Tray			✓		
25. Gland Plates Fitted			✓		
26. Sunshields Fitted				✓	

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SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT

Customer Name:	QUU						
Project:	LUGGAGE POINT WASTE WATER PLANT						
JPR Job No:	M54500		**Item:**	EFFLUENT PUMP STATION			
Constructed by:	B. RICHARDSON		**Tested by:**	A. VARY		**Date:**	18-4-12
Item Check list:		***To comply with Drawings, Documents & Specification***					
Main Functional Unit/s	Qty	✓	Size	✓	Settings	✓	
Fuse Fittings	Qty	✓	Size	✓	Fuse Size	✓	
Circuit Breakers	Qty	✓	Size	✓	Settings	✓	
Motor Protection C.B.	Rating		Setting		Function		
Neutral	Reqd	✓	Size	✓	ID	✓	
Equipment Earthing	Checked	✓	Size	✓			
C.T.s	Qty	✓	Rating	✓	Pri Inject.	✓	
Meters	Qty	✓	Rating	✓	Function	✓	
Contactors	Qty	✓	Rating	✓	Voltage	✓	
Overloads	Qty		Rating		Function		
Relays	Qty	✓	Rating	✓	Voltage	✓	
Timers	Qty	✓	Rating	✓	Voltage	✓	
Control Switches	Qty	✓	Rating	✓	Function	✓	
Push Buttons	Qty	✓	Rating	✓	Function	✓	
Pilot Lights	Qty	✓	Rating	✓	Voltage	✓	
Transformers	Qty	✓	Rating	✓	Voltage	✓	
ATT/VFD/Soft Starter	Qty	✓	Rating	✓	Function	✓	
DC Supply	Qty	✓	Rating	✓	Voltage	✓	
Terminals	Qty	✓	Size	✓	ID	✓	
Engraving	Qty	✓	Size	✓	ID	✓	
Cabling	Type	✓	Size	✓	ID	✓	
Busbars	Type		Size		ID		
Escutcheons / Shrouds	Type	✓	Label	✓	IP rating	✓	
S.A. Metering CTs	Qty		Rating				
S.A Metering Links	Type						
S.A. Meters	Type		Size				
JPR Label	Fitted	✓	Stamped	✓	Safety Stkr	✓	
Legend Card	Qty	✓	Correct	✓			
PLC/Telemetry	Qty		Size				
Power Monitor Relay	Qty		Rating		Function		
General Check List:							
IP Sealing	Rating	✓					
Door Latches/Hinges	Qty	✓	Type	✓	Operation	✓	
Ventilation	Required	✓	Type	✓	Operation	✓	
Circuit Schedule	Markup	✓	Checked		Supplied		
Terminal Tightness	Power	✓	Control	✓	Result	✓	
Busbar System	Clearances		Joints		ID		
Earth Continuity	Body to E	✓	Doors to E	✓	Panels to E	✓	
Cubicle Cleaned	✓						
Paint Finish Intact	✓						
Polarity Check	R - R	✓	W - W	✓	B - B	✓	
Function	Power	✓	Control	✓	PLC/Telem		
Continuity Check	R - R	✓	W - W	✓	B - B	✓	N - N ✓
Comments:							

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SWITCHBOARD CONTINUITY & INSULATION TEST REPORT

Customer Name: QUU		
Project: LUGGAGE POINT WASTE WATER PLANT		
JPR Job No: M 54500	**Switchboard:** EFFLUENT PUMP STATION	
Constructed by: B. RICHARDSON	**Tested by:** A. VARY	**Date:** 18-4-12

CONTINUITY TEST

From	To	Red	White	Blue	Neutral

Sketch:

INSULATION TESTS TO SECTION 8 OF AS3439.1

Designation	1000 V Test (MΩ)	2.5 kV Test (1min)	1000 V Test (MΩ)
Red to Earth	500		
White to Earth	500		
Blue to Earth	500		
Neutral to Earth			
Red to White	500		
Red to Blue	500		
White to Blue	500		

Comments:

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SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT
PRIMARY & SECONDARY INJECTION TESTS

Customer Name: QUU			
JPR Job No: M54503	**Item:** EFFLUENT PUMP STATION	**Drive:**	
Constructed by: B. RICHARDSON	**Tested by:** A. VARY	**Date:** 18-4-12	

Item	CT Ratio	Primary Turns	Primary Amps	Secondary Amps	Percentage (%)	Comment
T1	400/5	8	50	398		
T2	400/5	8	50	400		
T3	400/5	8	50	397		

Comments:

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E-mail: jpr@jpr.com.au

SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT
EARTH LEAKAGE TEST

Customer Name: QUU					
JPR Job No: M54500		**Item:** EFFLUENT PUMP STATION			
Constructed by: B. RICHARDSON		**Tested by:** A. VARY		**Date:** 18-4-12	
Test Unit	**Megger RCDT330**	✓	**Other**		

Circuit Breaker	Phase	Rated Current (mA)		Trip Current (mA)		Trip Time (mS)	Comments
	R			21		52.2	
1Q2	W	30		21		50.8	
	B			21		50.3	
	R			25		20.6	
2Q2	W	30		25		20.2	
	B			25		21.8	
	R			21		28.7	
3Q2	W	30		21		31.9	
	B			21		30.2	
	R			23		34.1	
4Q2	W	30		23		31.6	
	B			23		31.2	
	R			19		31.4	
5Q2	W	30		19		33.3	
	B			19		30.3	
	R			21		21.1	
6Q2	W	30		19		18.8	
	B			21		20.2	
7Q2	W	30		23		28.4	
8Q2	B	30		25		28.7	

Comments:-

JOB SAFETY ANALYSIS

LIVE LOW VOLTAGE WORK

TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

APPROVED BY: Eric McCulloch (WHSO)

LOCATION: WACOL WORKSHOP DATE: 19/4/13

AUTHORISATIONS		PERSONAL PROTECTIVE EQUIPMENT	
• Authorisation from person in charge (Signature)	☑ YES	• Long cotton clothing • Insulating work gloves in test • Insulating mats / covers in test • Switchboard rescue kit in test	☑ YES ☑ YES ☑ YES ☑ YES

TASK		
LIVE LOW VOLTAGE WORK	• Isolation points identified and accessible	☑ YES
	• Work area clear of obstructions	☑ YES
	• Unauthorised access prevented to work area	☑ YES
	• P.P.E. is fit for purpose	☑ YES
	• Test equipment is fit for purpose	☑ YES
	• Written authority to proceed has been obtained from a person in charge	☑ YES
TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES	• JPR authorisation to conduct live work is current	☑ YES
	• Approved dedicated power supply only used for testing.	☑ YES
	• Approved dedicated power supply in current test	☑ YES
OPTION	(A) RCD protected outputs used at power supply	☑ YES
	> RCD protection checked daily prior to use	☑ YES
	> Safety Observer is / is not required	☑ YES
OPTION	(B) Non RCD protected outputs used at power supply	☐ YES
	> Supervisor consulted prior to use	☐ YES
	> Safety Observer is in attendance	☐ YES

I understand and am fully aware of the requirements of this job safety analysis.

Signatures:	1.	2.	3.	4.	5.

JOB SAFETY ANALYSIS

LIVE LOW VOLTAGE WORK

TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

APPROVED BY: Eric McCulloch (WHSO)

LOCATION: WACOL WORKSHOP DATE: 23/4/12

AUTHORISATIONS		PERSONAL PROTECTIVE EQUIPMENT	
• Authorisation from person in charge (Signature)	☑ YES	• Long cotton clothing	☑ YES
		• Insulating work gloves in test	☑ YES
		• Insulating mats / covers in test	☑ YES
		• Switchboard rescue kit in test	☑ YES

TASK		
LIVE LOW VOLTAGE WORK	• Isolation points identified and accessible	☑ YES
	• Work area clear of obstructions	☑ YES
	• Unauthorised access prevented to work area	☑ YES
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	> Safety Observer is / is not required	☑ YES
OPTION	(B) Non RCD protected outputs used at power supply	☒ YES
	> Supervisor consulted prior to use	☐ YES
	> Safety Observer is in attendance	☐ YES

I understand and am fully aware of the requirements of this job safety analysis.

Signatures:	1.	2.	3.	4.	5.

JOB SAFETY ANALYSIS

LIVE LOW VOLTAGE WORK

TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

APPROVED BY: Eric McCulloch (WHSO)

LOCATION: WACOL WORKSHOP DATE: 24/4/13

AUTHORISATIONS		PERSONAL PROTECTIVE EQUIPMENT	
• Authorisation from person in charge (Signature)	☑ YES	• Long cotton clothing	☑ YES
		• Insulating work gloves in test	☑ YES
		• Insulating mats / covers in test	☑ YES
		• Switchboard rescue kit in test	☑ YES

TASK		
LIVE LOW VOLTAGE WORK	• Isolation points identified and accessible	☑ YES
	• Work area clear of obstructions	☑ YES
	• Unauthorised access prevented to work area	☑ YES
	• P.P.E. is fit for purpose	☑ YES
	• Test equipment is fit for purpose	☑ YES
	• Written authority to proceed has been obtained from a person in charge	☑ YES
TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES	• JPR authorisation to conduct live work is current	☑ YES
	• Approved dedicated power supply only used for testing.	☐ YES
	• Approved dedicated power supply in current test	☐ YES
OPTION	(A) RCD protected outputs used at power supply	☑ YES
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	> Safety Observer is / is not required	☑ YES
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	> Supervisor consulted prior to use	☐ YES
	> Safety Observer is in attendance	☐ YES

I understand and am fully aware of the requirements of this job safety analysis.

Signatures:	1.	2.	3.	4.	5.

JOB SAFETY ANALYSIS

LIVE LOW VOLTAGE WORK

TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISE

APPROVED BY: Eric McCulloch (WHSO)

LOCATION: WACOL WORKSHOP DATE: 29/8/12

AUTHORISATIONS		PERSONAL PROTECTIVE EQUIPMENT	
• Authorisation from person in charge (Signature)	☑ YES	• Long cotton clothing • Insulating work gloves in test • Insulating mats / covers in test • Switchboard rescue kit in test	☑ YES ☐ YES ☐ YES ☑ YES

TASK		
LIVE LOW VOLTAGE WORK	• Isolation points identified and accessible	☑ YES
	• Work area clear of obstructions	☑ YES
	• Unauthorised access prevented to work area	☑ YES
	• P.P.E. is fit for purpose	☐ YES
	• Test equipment is fit for purpose	☑ YES
	• Written authority to proceed has been obtained from a person in charge	☐ YES
TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES	• JPR authorisation to conduct live work is current	☑ YES
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	• Approved dedicated power supply in current test	☐ YES
OPTION	(A) RCD protected outputs used at power supply	☐ YES
	> RCD protection checked daily prior to use	☐ YES
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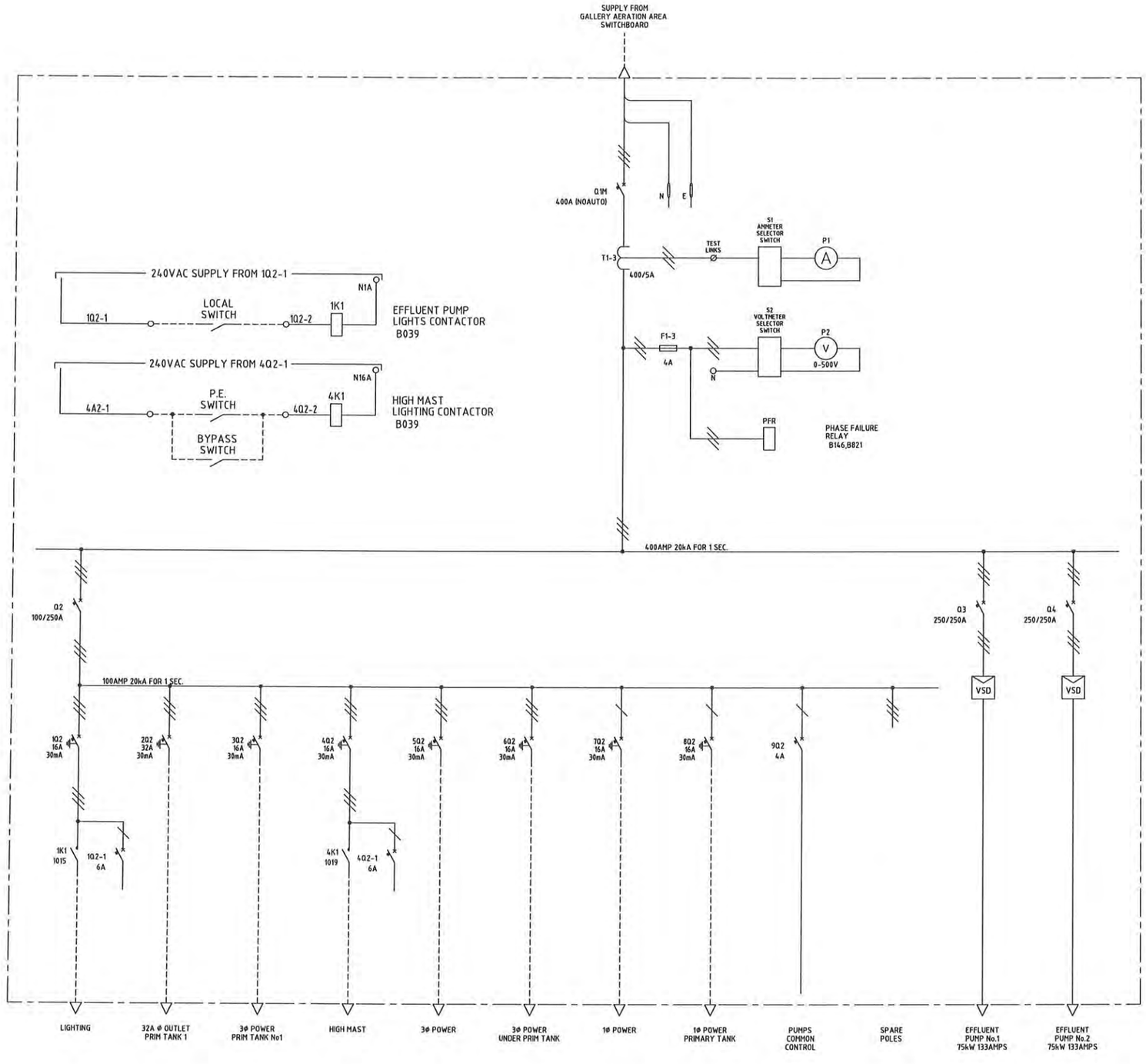
	> Supervisor consulted prior to use	☐ YES
	> Safety Observer is in attendance	☐ YES

I understand and am fully aware of the requirements of this job safety analysis.

Signatures:	1.	2.	3.	4.	5.

5 “AS INSTALLED” DRAWINGS



AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 26-02-13

NAME of SIGNATORY: DARREN McKLAREN

RPEQ No. or LICENCE: 756

COMPANY NAME: J&P RICHARDSON INDUSTRIES

START DATE: 25-01-12 FINISH DATE: 24-04-12

J. & P. RICHARDSON
INDUSTRIES PTY LTD
ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 23 001 952 325
114 CAMPBELL AVE WACOL QLD 4076
PH. (07) 3271 2911
FAX. (07) 3271 3623
EMAIL. jpr@jpr.com.au

JPR Project No.: E12–C54500

NAME SIGNATURE DATE

QUEENSLAND URBAN UTILITIES DELEGATE
(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)

QUEENSLAND Urban Utilities

No.	DATE	AMENDMENT	DRAFTED	DESIGNED	RPEQ NO.	APPROVED
B	02.13	AMENDED TITLE BLOCK	B.A.	D.Mc		
A	01.13	AS CONSTRUCTED	B.A.	D.Mc		

FUNDING		DRAFTED	DARREN McKLAREN
DESIGN W.O. No.	PB006558	DRAFTING CHECK	DARREN McKLAREN
CONSTRUCTION W.O. No.	PB006558	CAD FILE	55-0164-000_B.dwg
FUNDED BY Q.U.U. (✓)	EXTERNAL ( )	Q.U.U. FILE No.	

ORINGINAL SIGNED BY DARREN McKLAREN 15-12-11

DESIGN R.P.E.Q. No. DATE

DESIGN CHECK R.P.E.Q. No. DATE

APPROVED BY SIGNATURE DATE

CONSTRUCTION MANAGER SIGNATURE DATE

ASSET/PROJECT: LUGGAGE POINT WASTE WATER TREATMENT PLANT

DRAWING TITLE: EFFLUENT PUMP STATION SWITCHBOARD SINGLE LINE DIAGRAM

SHEET No. 0 OF 10

QUEENSLAND URBAN UTILITIES DRAWING No.: 486/5/5-0164-000

AMEND.: B

DRIVE PARAMETERS

0-02	H2
0-10	MULTI SETUP
0-11	ACTIVE SETUP
0-12	SETUP 2
0-51	COPY TO ALL
1-90	THERMISTOR TRIP
1-91	DI33
3-02	0Hz
3-03	50Hz
3-15	ANALOGUE INPUT 54
3-16	ANALOGUE INPUT 53
3-41	6sec.
3-42	4sec.
4-12	0Hz
4-14	50Hz
4-18	110%
5-10	START (TERM 18)
5-12	COAST TO STOP (TERM 27)
5-14	SETUP SELECT BIT 0
5-40.0	RUNNING (RELAY 1)
5-40.1	ALARM (RELAY 2)
6-50	4-20mA
20-00	ANALOGUE INPUT 54 (NO FUNCTION)
20-12	bar
20-21	5bar
20-73	0.5bar
20-74	10bar
20-81	NORMAL
20-83	0Hz
20-93	1
20-94	4sec.

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 26-02-13

NAME of SIGNATORY: DARREN McKLAREN

RPEQ No. or LICENCE: 756

COMPANY NAME: J&P RICHARDSON INDUSTRIES

START DATE: 25-01-12 FINISH DATE: 24-04-12

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EMAIL. jpr@jpr.com.au

JPR Project No.: E12-C54500

NAME SIGNATURE DATE

QUEENSLAND URBAN UTILITIES DELEGATE
(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)

QUEENSLAND Urban Utilities

No.	DATE	AMENDMENT	DRAFTED	DESIGNED	RPEQ NO.	APPROVED
B	02.13	AMENDED TITLE BLOCK	B.A.	D.Mc		
A	01.13	AS CONSTRUCTED	B.A.	D.Mc		

FUNDING		DRAFTED	DARREN McKLAREN	ORIGINAL SIGNED BY DARREN McKLAREN 15-12-11		
DESIGN W.O. No.	PB006558	DRAFTING CHECK	DARREN McKLAREN	DESIGN R.P.E.Q. No. DATE	APPROVED BY	SIGNATURE DATE
CONSTRUCTION W.O. No.	PB006558	CAD FILE	55-0164-001_B.dwg			
FUNDED BY Q.U.U. (✓)	EXTERNAL ( )	Q.U.U. FILE No.		DESIGN CHECK R.P.E.Q. No. DATE	CONSTRUCTION MANAGER	SIGNATURE DATE

ASSET/PROJECT
LUGGAGE POINT WASTE WATER TREATMENT PLANT

DRAWING TITLE
EFFLUENT PUMP STATION PUMP No.1 SCHEMATIC WIRING DIAGRAM

SHEET No. 1 OF 10

QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0164-001

AMEND. B

2U1
VARIABLE SPEED DRIVE
DANFOSS

E N R W B

Q4
250A
Q4-1
4A
QD4
10A

PUMP 2
POWER
SUPPLY
PS-P2
5A 24VDC

COOLING
FAN
2TH1
2E1

2ISOL.
PUMP No2
75kW 133A
MOTOR THERMISTORS

4-20mA SIGNAL
VSD SPEED TO PLC
ANALOGUE INPUT

4-20mA
SPEED / PRESSURE SIGNAL
FROM SS20

POT2
1kΩ
1W
1 TURN
MANUAL SPEED ADJUST

RUN COMMAND
FAULT RESET
COAST TO STOP
SETUP 2
SAFETY STOP
REMOTE OFF LOCAL
2S1
2S5
2K8
2K30

HOURS RUN
METER
2HR1

RUNNING
RELAY
B237,B243,B916
2K3

STARTER FAULT
RELAY
B231,B235,B913
2K4

FAULT
INDICATOR
2H2

CONTROL HEALTHY
INDICATOR
2H3

CONTROL CIRCUIT SUPPLY HEALTHY
RELAY
B234,B913
2K5

COMMON FAULT
RELAY
B235
2K6

RUN FORWARD
RELAY
B210,B237
2K8

PUMP RUNNING
FORWARD
2H1

REFLUX VALVE
PROXIMITY SWITCH

NO FLOW
RELAY
B243
B241
2K9

NO FLOW
TIMER
B245
B920
2KT9

NO FLOW
RELAY
B233,B240,B247,B919
2K10

NO FLOW
FAULT
2H4

GE
IC200MDL640
RACK 03
SLOT 06
24V VDC POS LOGIC IN
PLC 03

LOCAL START
LOCAL STOP
FIELD ISOLATOR
CONTROL POWER AVAILABLE
DRIVE FAULT
FAULT RESET
PUMP RUNNING
REMOTE SELECTED
LOCAL SELECTED
NO FLOW FAULT
NO FLOW

GE
IC200MDL940
RACK 02
SLOT 01
RELAY ISO OUTPUTS
PLC 03

PUMP No.2
START RELAY
B235,B922
2K20

PUMP No.2
FAULT RESET RELAY
B212,B923
B247
2K30

START UP
WARNING SIREN
SIR

R2/33
R2/34
R2/35

DRIVE PARAMETERS

0-02	H2
0-10	MULTI SETUP
0-11	ACTIVE SETUP
0-12	SETUP 2
0-51	COPY TO ALL
1-90	THERMISTOR TRIP
1-91	DI33
3-02	0Hz
3-03	50Hz
3-15	ANALOGUE INPUT 54
3-16	ANALOGUE INPUT 53
3-41	6sec.
3-42	4sec.
4-12	0Hz
4-14	50Hz
4-18	110%
5-10	START (TERM 18)
5-12	COAST TO STOP (TERM 27)
5-14	SETUP SELECT BIT 0
5-40.0	RUNNING (RELAY 1)
5-40.1	ALARM (RELAY 2)
6-50	4-20mA
20-00	ANALOGUE INPUT 54 (NO FUNCTION)
20-12	bar
20-21	5bar
20-73	0.5bar
20-74	10bar
20-81	NORMAL
20-83	0Hz
20-93	1
20-94	4sec.

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 26-02-13

NAME OF SIGNATORY: DARREN McKLAREN

RPEQ No. or LICENCE: 756

COMPANY NAME: J&P RICHARDSON INDUSTRIES

START DATE: 25-01-12 FINISH DATE: 24-04-12

J. & P. RICHARDSON
INDUSTRIES PTY LTD
ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 23 001 952 325
114 CAMPBELL AVE WACOL QLD 4076
PH. (07) 3271 2911
FAX. (07) 3271 3623
EMAIL. jp@jpr.com.au

JPR Project No.: E12-C54500

NAME SIGNATURE DATE

QUEENSLAND URBAN UTILITIES DELEGATE
(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)

QUEENSLAND Urban Utilities

No.	DATE	AMENDMENT	DRAFTED	DESIGNED	RPEQ NO.	APPROVED
B	02.13	AMENDED TITLE BLOCK	B.A.	D.Mc		
A	01.13	AS CONSTRUCTED	B.A.	D.Mc		

FUNDING		DRAFTED	DARREN McKLAREN
DESIGN W.O. No.	PB006558	DRAFTING CHECK	DARREN McKLAREN
CONSTRUCTION W.O. No.	PB006558	CAD FILE	55-0164-002_B.dwg
FUNDED BY Q.U.U. (✓)	EXTERNAL ( )	Q.U.U. FILE No.	

ORIGINAL SIGNED BY DARREN McKLAREN			15-12-11	
DESIGN	R.P.E.Q. No.	DATE	APPROVED BY	SIGNATURE DATE
DESIGN CHECK	R.P.E.Q. No.	DATE	CONSTRUCTION MANAGER	SIGNATURE DATE

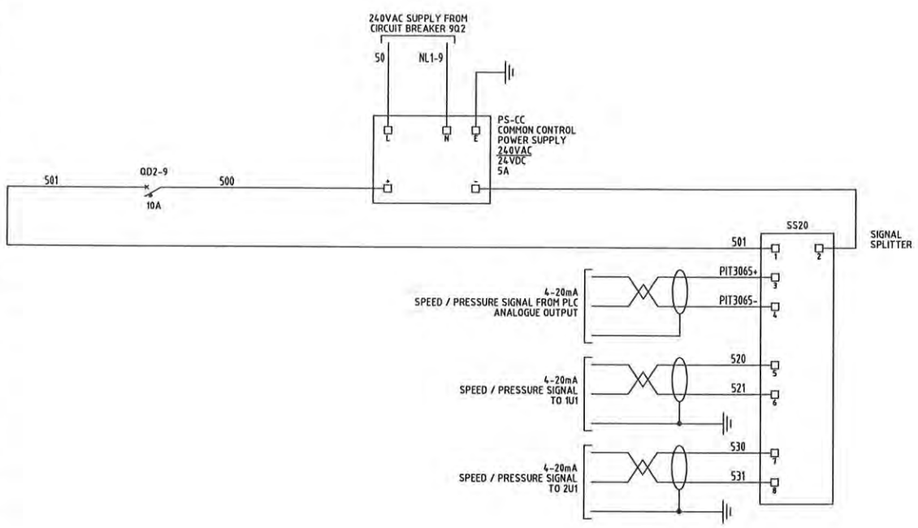
ASSET/PROJECT
LUGGAGE POINT WASTE WATER TREATMENT PLANT

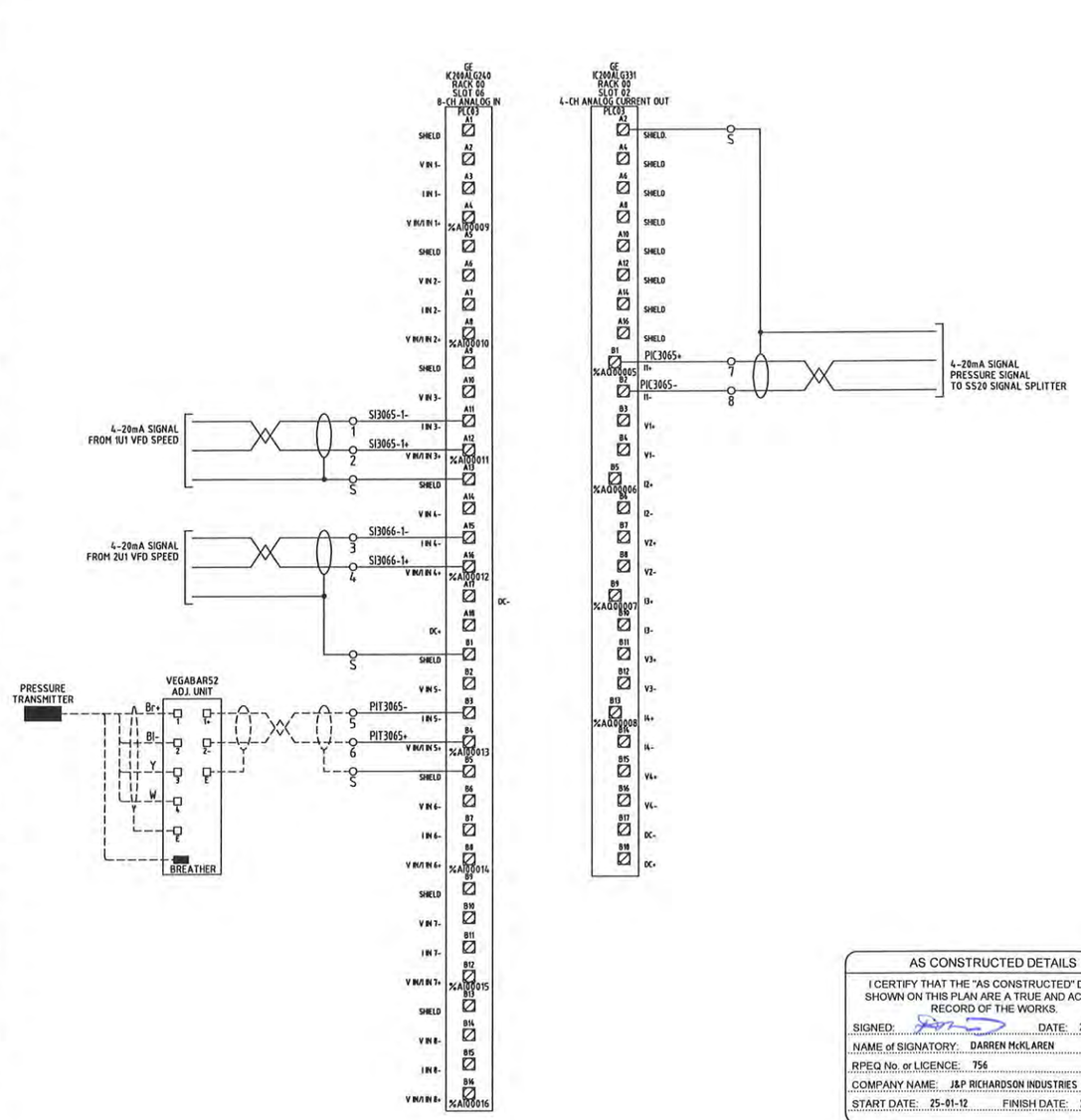
DRAWING TITLE
EFFLUENT PUMP STATION PUMP No.2 SCHEMATIC WIRING DIAGRAM

SHEET No. 2 OF 10

QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0164-002

AMEND. B





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FUNDING		DRAFTED	DARREN McKLAREN
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CONSTRUCTION W.O. No.	PB006558	CAD FILE	55-0164-003_B.dwg
FUNDED BY Q.U.U. (✓) EXTERNAL ( )		Q.U.U. FILE No.	

ORIGINAL SIGNED BY DARREN McKLAREN		15-12-11		
DESIGN	R.P.E.Q. No.	DATE	APPROVED BY	SIGNATURE DATE
DESIGN CHECK	R.P.E.Q. No.	DATE	CONSTRUCTION MANAGER	SIGNATURE DATE

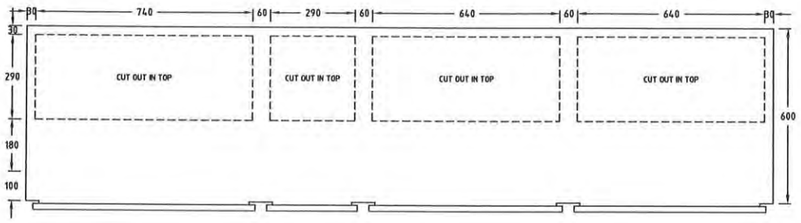
ASSET/PROJECT
LUGGAGE POINT WASTE WATER TREATMENT PLANT

DRAWING TITLE
EFFLUENT PUMP STATION SCHEMATIC WIRING DIAGRAM

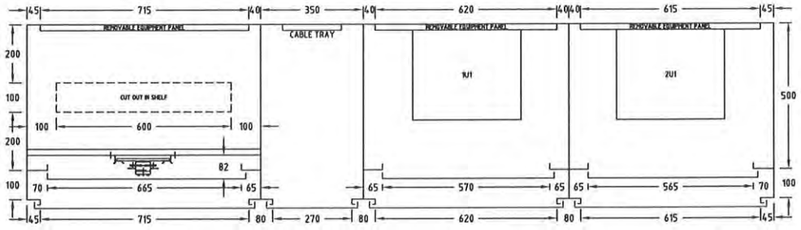
SHEET No. 3 OF 10

QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0164-003

AMEND. B



SECTION F - F



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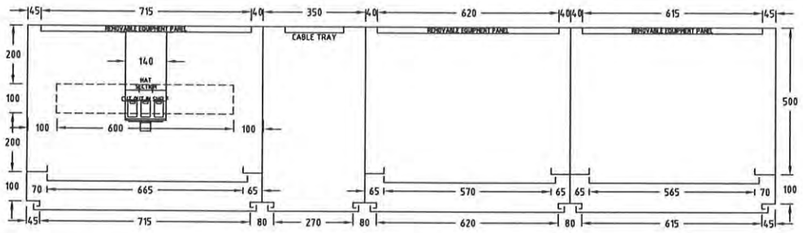

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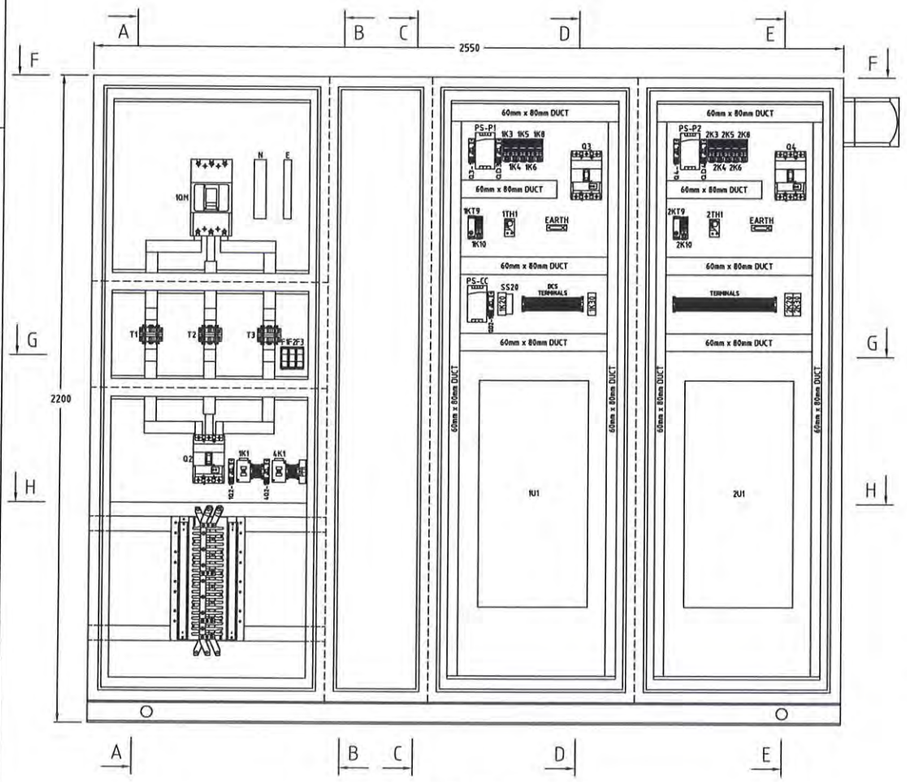
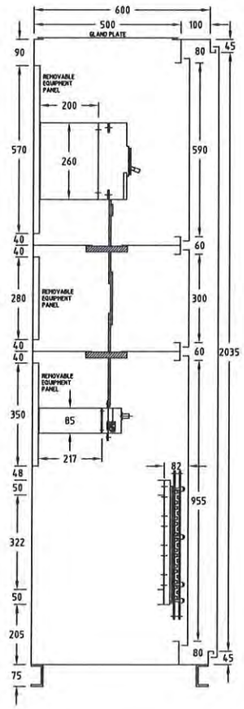
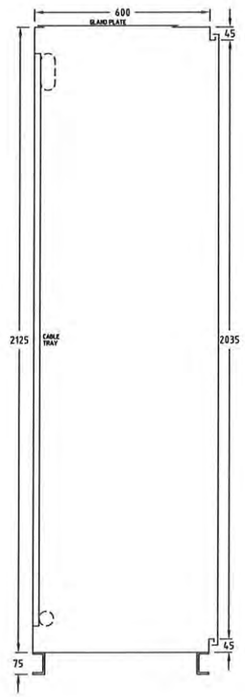


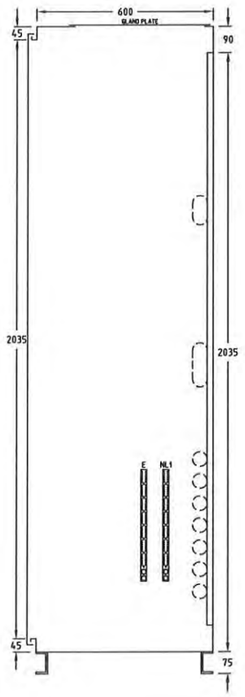
FRONT VIEW
DOORS AND HINGED PANEL NOT SHOWN



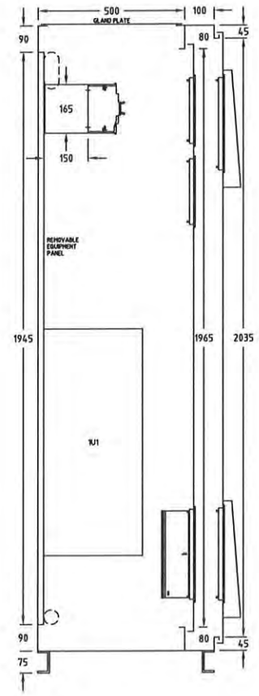
SECTION A - A



SECTION B - B



SECTION C - C



SECTION D - D

AS CONSTRUCTED DETAILS

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RPEQ No. or LICENCE: 756

COMPANY NAME: J&P RICHARDSON INDUSTRIES

START DATE: 25-01-12 FINISH DATE: 24-04-12

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JPR Project No.: E12-C54500

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QUEENSLAND Urban Utilities

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FUNDING			
DESIGN W.O. No.	PB006558	DRAFTED	DARREN McKLAREN
CONSTRUCTION W.O. No.	PB006558	DRAFTING CHECK	DARREN McKLAREN
FUNDED BY Q.U.U. (✓)	EXTERNAL ( )	CAD FILE	55-0164-004_B.dwg
		Q.U.U. FILE No.	

ORIGINAL SIGNED BY DARREN McKLAREN			15-12-11
DESIGN	R.P.E.Q. No.	DATE	
DESIGN CHECK	R.P.E.Q. No.	DATE	

APPROVED BY	SIGNATURE	DATE
CONSTRUCTION MANAGER	SIGNATURE	DATE

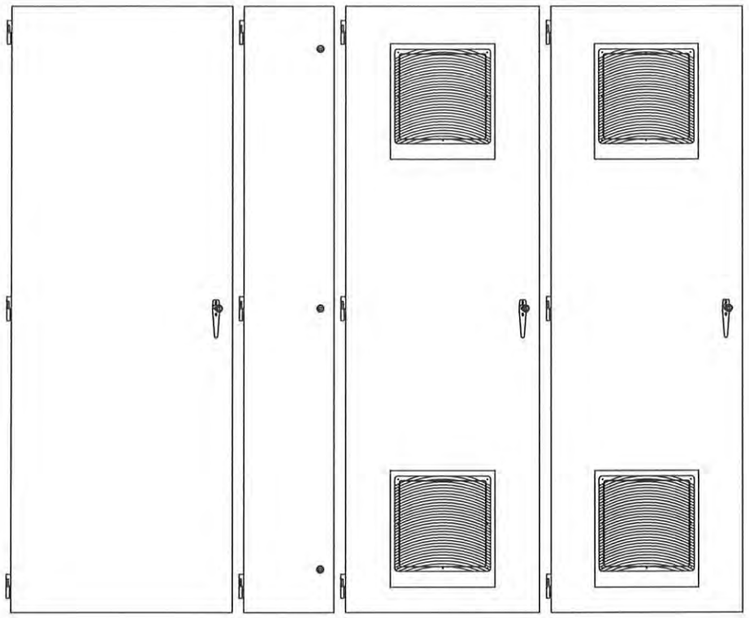
ASSET/PROJECT
LUGGAGE POINT WASTE WATER TREATMENT PLANT

DRAWING TITLE
EFFLUENT PUMP STATION SWITCHBOARD GENERAL ARRANGMENT

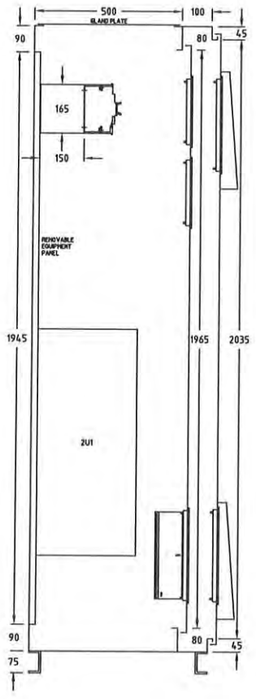
SHEET No. 4 OF 10

QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0164-004

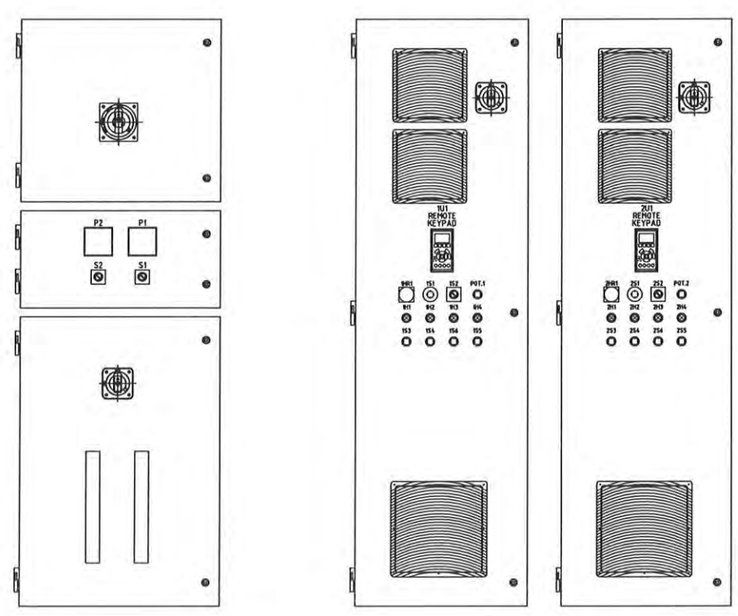
AMEND. B



DOORS



SECTION E - E



HINGED PANELS AND REMOVABLE COVERS

AS CONSTRUCTED DETAILS

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SIGNED: DATE: 26-02-13

NAME of SIGNATORY: DARREN McKLAREN

RPEQ No. or LICENCE: 756

COMPANY NAME: J&P RICHARDSON INDUSTRIES

START DATE: 25-01-12 FINISH DATE: 24-04-12

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PH. (07) 3271 2911
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EMAIL. jpr@gtr.com.au

JPR Project No.: E12-C54500

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A	01.13	AS CONSTRUCTED	B.A.	D.Mc		

FUNDING			
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CONSTRUCTION W.O. No.	PB006558	DRAFTING CHECK	DARREN McKLAREN
FUNDED BY Q.U.U. (✓)	EXTERNAL ( )	CAD FILE	55-0164-005_B.dwg
		Q.U.U. FILE No.	

ORIGINAL SIGNED BY DARREN McKLAREN	15-12-11		
DESIGN	R.P.E.Q. No. DATE	APPROVED BY	SIGNATURE DATE
DESIGN CHECK	R.P.E.Q. No. DATE	CONSTRUCTION MANAGER	SIGNATURE DATE

ASSET/PROJECT: LUGGAGE POINT WASTE WATER TREATMENT PLANT

DRAWING TITLE: EFFLUENT PUMP STATION SWITCHBOARD GENERAL ARRANGEMENT

SHEET No. 5 OF 10

QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0164-005

AMEND. B

CONSTRUCTION - EXTERNAL SWITCHBOARD

Cubicle construction 3mm marine grade aluminium.
Equipment panels to be 3mm marine grade aluminium.
Lifting via 38mm holes in plinth.
Plinth construction 160x63 channel 6061 T6 grade aluminium.
Fully welded on fascia of cubicle and stiffened to prevent warping and form a rigid enclosure.
Cubicle is to be sealed to prevent the ingress of sewer well gases.
External doors and covers fitted with Dore Electrics ES60-051 seal.
All Fixings shall be 316 grade stainless steel.
M6 earth buttons fixed to the interior of all doors and hinged escutcheons and on adjacent cubicle interior surfaces.
Earth all doors/escutcheons with 4mm^2 flexible earth wire.
Door dropstay arms to be S/Steel and of sufficient strength to prevent being deformed when subjected to reasonable loads. Minimum 3mm S/Steel.
Gland plates manufactured from 3mm aluminium, unless otherwise shown.
Inspection/Access plates manufactured from 3mm aluminium.
Gland/Inspect/Access plate openings fitted with M6x1.0 flat head closed end rivet nuts.
Cable glands to be fitted with compression side installed within cubicle.
Gland/Inspection/Access plates to be fitted with seals attached to cubicle.
Gland/Inspection/Access plate fixings at 150mm with hex head bolts.
Gland/Inspection/Access plates are NOT to be split.
Inspection/Access plates are NOT to be earthed.
Hinges (external) lift-off type. Stainless steel with star washers fitted under all hinge screws.
Hinged escutcheons fixed with 1/4 turn coin lock with a square insert.
All equipment to be removable via front access.
All escutcheons to open a minimum of 90°
Ventilation via punched louvers (Refer drawings for detail)
Switchboard Ventilation to be backed with stainless steel mesh gauze and removable filter material.
Fit laptop tray to rear of common control door.
Fit drawing holder to rear of common control door.

Locks Doors

DORE ELECTRICS - Stainless steel 1/4 8mm square insert

OPERATING PARAMETERS

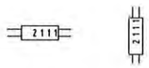
Standard	AS 3439.1
Current & Frequency	AC 50Hz
Rated Operational Voltage Ue	415 VAC
Rated Insulation Voltage Ui	0.6/1kV
Rated Auxiliary Voltage	240 VAC / 24 VDC
Short Circuit Current Isc	20 kA
Duration of Isc	.2 sec
Degree of Protection	Weather Resistant
Internal Degree of Protection	IP20B / IP10A to AS3000:2007
Service Conditions	Outdoors
Mass	Not exceeding 2000kg
Forms of Segregation	Form 2 / 3 bih
Earthing System	MEN
MEN Link	Not Required

PAINTING

Paint Type	Polyester Powdercoat to 50 micron thickness.
Preparation	Grind smooth all welds, descale and degrease.
Exterior/Doors Colour	Mist Green
Interior Colour	Mist Green
Equipment Panel Colour	Bright White
Escutcheon Colour	Bright White
Plinth Colour	Mist Green

WIRING

All wiring to be PVC V90 HT 0.6/1Kv Grade with tinned conductor.
Control and instrumentation wiring has flexible copper conductors, and is colour coded as detailed below, each individual wire shall be numbered each end, and terminated by the use of appropriate pre-insulated crimp lugs or pins.
Separate lugs or pins shall be used for each conductor. A proprietary double pin lug may be used to terminate two conductors.
Use proprietary bridging links when required to common up terminals.
Not more than two wires shall be connected to any terminal.
Power wiring to be minimum 2.5mm^2 stranded copper conductors, phase colour coded as detailed below.
Control wiring to be minimum 1.0mm^2 flexible copper conductors, colour coded as detailed below.
Low level control signals to be minimum 0.5mm^2 flexible copper conductors, colour coded as detailed below.
4-20mA analog signals (internal & external) wired in shielded pair minimum size 0.5mm^2 , and earthed at one end only. (Switchboard end for external signals)
All 240VAC terminals in the Multismart section shall be shouded and labelled - ' Danger 240VAC'
Earth cables minimum 2.5mm^2 flexible.
Doors and hinged escutcheons bonded with flexible earth wire.
Switchboard to have dedicated earthing cable bonding directly to main earth bar.
Wire numbering will be equal to Brady marking system.
Wire numbers are readable left to right,bottom to top as shown.



COLOUR CODE

Phase wiring (A,B &C)	Red, White, Blue	2.5mm? (min)
Potential Metering (240/415 VAC)	Red, White, Blue, Black	1.5mm?
Current Metering (Secondary)	Red, White, Blue, Grey	2.5mm?
240 VAC Control Active	Red	1.0mm?
240 VAC Neutral	Black	1.0mm?
Extra Low VDC Positive supplies	Orange	1.0mm?
Extra Low VDC Negative supplies	Violet	1.0mm?
General Extra Low VDC Wiring	Grey	1.0mm?
RTU & PLC Wiring	Grey	0.5mm?
Electrode Wiring	Salmon	1.0mm?
Intrinsically safe wiring	Light Blue	1.5mm?
Earth	Green/Yellow	2.5mm? (min)
Door & Escutcheon Earth Bonds	Green/Yellow	4 mm?

LABELS

Internal labels - W/B engraved Gravoply, to label schedule.
Warning labels - R/W engraved Gravoply, to label schedule.
E/Stop labels - Y/B engraved Gravoply, to label schedule.
First letter = Background colour, Second letter = Lettering colour.

Main switch label	MAIN SWITCH 400A	10mm / 4mm	Material ABS PLASTIC Colour B/W
Pump CB labels	PUMP No1 250A	6mm / 4mm	Material ABS PLASTIC Colour W/B
Compartment labels	PUMP No1	10mm	Material Stainless Steel
E/Stop labels	LOCK-OFF STOP	4mm	Material ABS PLASTIC Colour Y/B
Warning labels	DANGER 415V ISOLATE ELSE WHERE	7mm / 5mm	Material ABS PLASTIC Colour R/W

Internal labels secured by M3 316 grade stainless steel metal threads and adhesive.
Labels obstructed by switchboard wiring are relocated to adjacent duct lid and secured by M3 nylon threads. Lid to be secured by a single cable tie at one corner.
External labels 1mm thick 316 grade s/steel secured by M3 316 s/steel metal threads.
All internal and external labels are to have bevelled edges.
Label on the internal side of the escutcheon for all equipment mounted on escutcheon. Affix labels with double sided tape only.

PROJECT:	Client Details
JOB NO:	C54500
ITEM:	Effluent Pumping Station Switchboard Construction Notes
DOCUMENT NO:	Drawing No. 486/5/5-0164-006
DESIGN DETAILS: -	
Place of installation	Indoor
Type of installation	Stationary
S.C.A. Design	Custom
S.C.A. Detail	Front Access. Front Connect, Bottom / Top Entry & Exit
Current Rating	400 A
Frequency	50 Hz
Rated Voltage (operational)	415 VAC 3 Phase and Neutral
Control Voltage	240 VAC / 24VDC
Insulation Rating	0.6 / 1 kV
Short Circuit withstand Current	20 kA for 1 second
Segregation Classification	Form 1 to AS/NZS 3439.1:2002
Degree of Protection	IP54 to AS60529-2004 / Additional Sealing Measures Required for Demcon
Internal Degree of Protection	IP20B / IP10A to AS/NZS 3000:2007 Appendix G (See equipment shrouding measures below)
Design Ambient Temperature	40°C
Design Busbar Temperature Rise	50°C above Ambient
Earthing System	MEN
MEN Link	Not Required
CONSTRUCTION DETAILS: -	
Cubicle Material	3mm thick Marine Grade Aluminium Sheet
Equipment Panels	3mm thick Marine Grade Aluminium Sheet
Fixings	All Fixings shall be 316 Grade Stainless Steel
Welding	Fully Welded
Stiffening	To prevent warping and form a rigid enclosure
Plinth - Material Type	Aluminium Channel
Plinth - Material Dimensions	75 x 40 x 6 mm
Plinth - Finish	Painted
Lifting	Via 38mm holes in Plinth
Gland Plates	3mm thick Aluminium Steel fitted with Gasket and fixed with M6 Hex Head Bolts, Earthed as necessary
Door Sealing	Door Electrics ES60-051
Hinges Doors / Hinged Panels	External Stainless Steel with Star Washer under Hinge Screws Lift Off Type / Internal Chrome Plated Lift Off Type
Door Locks	1/4 turn with 8mm Square Insert
Escutcheon Locks	1/4 turn with 8mm Square Insert
Cable Zones Fixings	1/4 turn with 8mm Square Insert
Bus Zones Fixings	1/4 turn with 8mm Square Insert
Three Point Locking	Not Required
Door Earthing	Fit Earthing Stud to all Doors / Hinged Panels fitted with Electrical Equipment, Earth Doors with 6 mm² Tinned Copper Braid
Door Opening	110 ° min
Door Stays	Drop Stay
Drawing Holder	Fit to Rear Door ??
Legend Card Holder	Fit to Rear of Door Over Circuit Breakers
Ventilation	Louvres with Stainless Steel Mesh Gauze and Removable Filter Material, Refer drawing for detail
Cowls	Cowl Louvres with Stainless Steel Mesh Gauze and Removable Filter Material, Refer drawing for detail
EQUIPMENT SHROUDING: -	
IP20B (finger)	Line Side of Main Switch. Line Side of Compartment Isolators and Protective Devices
	Compartments where access is NOT restricted by the use of door interlocks e.g. Isolator or Protective Device
IP10A (back of hand)	Compartments where access is restricted by the use of door interlocks e.g. Isolator or Protective Device
Busbar Zones	Provide warning labels on doors and removable covers which provide direct access to live busbars
	Restrict access to live busbars with door locking devices and removable covers that require the use of a tool to gain access
	Shroud any live busbars (to IP10A) that are 100mm or closer to access openings and below 1800mm from the floor
PAINTING: -	
Paint Type	Polyester Powdercoat to 40 Micron Minimum thickness
Preparation	Grind Smooth all Welds, Descale and Degrease
Exterior / Doors Colour	Mist Green (Dulux - *nominate equivalent colour*)
Interior Colour	Mist Green (Dulux - *nominate equivalent colour*)
Equipment Panel Colour	White
Escutcheon Colour	White
Plinth Colour	Mist Green (Dulux - *nominate equivalent colour*)
BUSBARS: -	
Material	Hard Drawn, High Conductivity, Round Edge Copper
Finish	Tinned Busbars
Joints	J & P Richardson Standard Bus Bar Jointing Methods Refer Q55-01/0
Coating	Not Required / Heat Shrink Required in CT Section over Busbars
Identification	50mm Painted Band Every 500mm
Bus Bar Size / Rating:	
Main Incoming Vertical Bus / Phases	1 x 40 x 6.3mm Per Phase
Main Incoming Neutral	1 x 40 x 6.3mm
Main Horizontal Bus / Phases	1 x 40 x 6.3mm Per Phase
Earth Bar	1 x 25 x 6.3mm
Bus Bar Supports:	
Type	20mm Densified Wood (Permali) & Polyester Resin
Distance Between Centres	80 mm
Distance Between Supports	200 mm (Maximum)
Main Neutral	40mm Long Busbar Bobbins
Main Earth	10mm Bolts Welded to the Cubicle Body / Brackets
CABLE DETAILS: -	
Power	V90 0.6 / 1 kV Multi-Stranded, Min. Size 2.5mm² (7/0.67)
Control	V90 0.6 / 1 kV Tinned Flexible, Min. Size 1.0mm² (30/0.25)
Protection / Metering	V90 0.6 / 1 kV Tinned Flexible, Min. Size 2.5mm² (50/0.25)
Low Level Control	V90 0.6 / 1 kV Tinned Flexible, 0.50mm² (16/0.25)
Colours:	
Power Wiring to 16mm	Red, White, Blue
Power Wiring above 16mm	Red with Phase Identification at Cable Ends
Phase Neutral	Black
Earth	Green Yellow
Control Active 240VAC	Red
Control Neutral 240VAC	Black
Extra Low VDC Positive Supplies	Orange
Extra Low VDC Negative Supplies	Violet
General Extra Low VDC Wiring	Grey
RTU & PLC Wiring	Grey
Electrode Wiring	Salmon
Intrinsically Safe Wiring	Light Blue
Screen Analog Positive	White
Screen Analog Negative	Black
Terminations:	
Control Cable Identification	Brady Marking System (Clear Plastic Sleeves with Insertable Tabs)
Cable Ends	Metal Ferrules / Crimp Lugs as Necessary
Mains Incoming	Copper Tags / Terminals
Outgoing	Direct onto Equipment / Terminals
Control	Terminals
LABELS: -	
Material	Gravoply
Fixings External	316 Grade Stainless Steel Metal Threads and Adhesive
Fixings Internal	316 Grade Stainless Steel Metal Threads and Adhesive
Mounting	Labels to be secured to Equipment Panels Above Equipment
General Labels	WB / 4mm Letters
Warning Labels	RW / 7mm Letters
Danger Labels	WR / 6mm Letters
Drive Labels	WB / 6mm Letters
Main Switch Labels	RW / 10mm Letters
S.C.A. Main Label	Fit label with the following wording in a prominent position on the front of the cabinet
	"Note: provide appropriate label wording when required"
	WB / 20mm Letters

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 26-02-13

NAME of SIGNATORY: DARREN McKLAREN

RPEQ No. or LICENCE: 756

COMPANY NAME: J&P RICHARDSON INDUSTRIES

START DATE: 25-01-12 FINISH DATE: 24-04-12

J. & P. RICHARDSON
INDUSTRIES PTY LTD
ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 23 001 952 325
114 CAMPBELL AVE WACOL QLD 4076
PH. (07) 3271 2911
FAX. (07) 3271 3823
EMAIL. jpr@jpr.com.au

JPR Project No.: E12-C54500

NAME SIGNATURE DATE

QUEENSLAND URBAN UTILITIES DELEGATE
(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)

QUEENSLAND Urban Utilities

No.	DATE	AMENDMENT	DRAFTED	DESIGNED	RPEQ NO.	APPROVED
B	02.13	AMENDED TITLE BLOCK	B.A.	D.Mc		
A	01.13	AS CONSTRUCTED	B.A.	D.Mc		

FUNDING		DRAFTED	DARREN McKLAREN	ORIGINAL SIGNED BY DARREN McKLAREN 15-12-11				ASSET/PROJECT	DRAWING TITLE	SHEET No. 6 OF 10	
DESIGN W.O. No.	PB006558	DRAFTING CHECK	DARREN McKLAREN	DESIGN	R.P.E.Q. No.	DATE	APPROVED BY	SIGNATURE DATE	LUGGAGE POINT WASTE WATER TREATMENT PLANT	EFFLUENT PUMP STATION SWITCHBOARD CONSTRUCTION NOTES	QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0164-006	AMEND. B
CONSTRUCTION W.O. No.	PB006558	CAD FILE	55-0164-006_B.dwg								
FUNDED BY Q.U.U. (✓)	EXTERNAL ( )	Q.U.U. FILE No.		DESIGN CHECK	R.P.E.Q. No.	DATE	CONSTRUCTION MANAGER	SIGNATURE DATE			

EFFLUENT

Item	Qty	Make & Number	Description	Label
Q1M	1	TERASAKI S400NN3 + T2CF403SLNG SHROUDS + T2HS40R5GM HANDLE	3P 400AMP NON-AUTO CIRCUIT BREAKER	MAIN SWITCH
Q2	1	TERASAKI E250NJ3100 + T2CR253SG SHROUDS + T2CF253SSNBA SHROUDS + HANDLE	3P 100AMP CIRCUIT BREAKER	DISTRIBUTION BOARD ISOLATOR
Q3	1	TERASAKI E250NJ3250 + T2CR253SG SHROUDS + T2CF253SSNBA SHROUDS + HANDLE	3P 250AMP CIRCUIT BREAKER	PUMP No.1
Q4	1	TERASAKI E250NJ3250 + T2CR253SG SHROUDS + T2CF253SSNBA SHROUDS + HANDLE	3P 250AMP CIRCUIT BREAKER	PUMP No.2
	1	TERASAKI CD2-42/18-3U	42P CHASSIS	
1Q2, 3Q2-6Q2	5	TERASAKI DTCB10316C + DSRCM-32-30-3PN	3P 16AMP EARTH LEAKAGE CIRCUIT BREAKER	REFER LEGEND CARD
2Q2	1	TERASAKI DTCB10332C + DSRCM-32-30-3PN	3P 32AMP EARTH LEAKAGE CIRCUIT BREAKER	REFER LEGEND CARD
7Q2, 8Q2	1	TERASAKI DSRCBH-16-30A	1P 16AMP EARTH LEAKAGE CIRCUIT BREAKER	REFER LEGEND CARD
9Q2	1	TERASAKI DTCB10104C	1P 4AMP CIRCUIT BREAKER	REFER LEGEND CARD
F1-F3	3	NHP NV32FW + NNS4 FUSE LINK	32AMP FUSE HOLDER	F1, F2, F3
T1-T3	3	IME TAI 400 400 5A	400/5A CURRENT TRANSFORMER	T1, T2, T3
S1	1	KRAUS & NAIMER CA10-A058/AUN0180 E-FT2	AMMETER SELECTOR SWITCH	AMMETER
P1	1	IME RQ96 E ACT 5A 5X 400A	0-400A AMMETER	AMMETER
S2	1	KRAUS & NAIMER CA10-A007/AU2123 E-FT2	VOLTMETER SELECTOR SWITCH	VOLTMETER
P2	1	IME RQ 96 E VAC 500V	0-500V VOLTMETER	VOLTMETER
PFR	1	CARLO GAVAZZI DPA-01-C-M44	PHASE FAILURE RELAY	PFR
TEST LINKS	1	WEIDMULLER AA0028	TERMINAL TEST LINKS	
NL	1	JPR MANUFACTURED BUSBAR	NEUTRAL BAR	MAIN NEUTRAL
EL	1	JPR MANUFACTURED BUSBAR	EARTH BAR	MAIN EARTH
NL1	1	DORE ELECTRICS 250E36 c/w E/NFEET	36HOLE NEUTRAL BAR	NEUTRAL NL1
EL1	1	DORE ELECTRICS 250E36	36HOLE EARTH BAR	EARTH
Q3-1, Q4-1	2	TERASAKI DTCB10104C	1P 4AMP CIRCUIT BREAKER	Q3-1, Q4-1
QD3, QD4, QD2-9	3	TERASAKI DTCB10110C	1P 10AMP CIRCUIT BREAKER	QD3, QD4, QD2-9
PS-P1, PS-P2, PS-CC	3	PULS SL5.100	24VDC 5AMP POWER SUPPLY	PS-P1, PS-P2, PS-CC
1U1, 2U1	2	DANFOSS FC-202P75KT4E55H1TGCXXXSXXXXAXBXCXXXXDX (131L0262) + LCP KIT (130B1117)	VARIABLE SPEED DRIVE	1U1, 2U1
1 POT, 2 POT	2	SPRECHER & SCHUH DPP-POT3	1K OHM POTENTIOMETER	PUMP No.1, No.2 MANUAL SPEED ADJUST
1S1, 2S1	2	SPRECHER & SCHUH D7P-MT44-PX01	EMERGENCY STOP PUSHBUTTON	PUMP No.1, No.2 EMERGENCY STOP
1S2, 2S2	2	KRAUS & NAIMER CA10-A213-623-FT2 ENGRAVED "REMOTE OFF LOCAL"	SELECTOR SWITCH	PUMP No.1, PUMP No.2
1S3, 2S3	2	SPRECHER & SCHUH D7P-F402-PX01	RED STOP PUSHBUTTON	PUMP No.1, No.2 STOP
1S4, 2S4	2	SPRECHER & SCHUH D7P-F301-PX10	GREEN START PUSHBUTTON	PUMP No.1, No.2 START
1S5, 2S5	2	SPRECHER & SCHUH D7P-F607-PX10 + D7-X10	BLUE RESET PUSHBUTTON	PUMP No.1, No.2 STARTER FAULT RESET
1S6, 2S6	2	SPRECHER & SCHUH D7P-F607-PX10	BLUE RESET PUSHBUTTON	PUMP No.1, No.2 NO FLOW FAULT RESET
1H1, 2H1	2	SPRECHER & SCHUH D7P-P4-PN3R	RED PILOT LIGHTS	PUMP No.1, No.2 RUNNING
1H2, 2H2	2	SPRECHER & SCHUH D7P-P0-PN3A	AMBER PILOT LIGHTS	PUMP No.1, No.2 FAULT
1H3, 2H3	2	SPRECHER & SCHUH D7P-P7-PN3W	WHITE PILOT LIGHTS	PUMP No.1, No.2 CONTROL HEALTHY
1H4, 2H4	2	SPRECHER & SCHUH D7P-P0-PN3A	AMBER PILOT LIGHTS	PUMP No.1, No.2 NO FLOW FAULT
1K3, 2K3	2	FINDER 55.34.0074 24VDC + 94.04 BASE	RELAY	1K3, 2K3
1K4, 2K4	2	FINDER 55.34.0074 24VDC + 94.04 BASE	RELAY	1K4, 2K4
1K5, 2K5	2	FINDER 55.34.0074 24VDC + 94.04 BASE	RELAY	1K5, 2K5
1K6, 2K6	2	FINDER 55.34.0074 24VDC + 94.04 BASE	RELAY	1K6, 2K6
1K8, 2K8	2	FINDER 55.34.0074 24VDC + 94.04 BASE	RELAY	1K8, 2K8
1KT9, 2KT9	2	CARLO GAVAZZI DAA-01-D-M24	DELAY ON TIMER	1KT9, 2KT9
1K10, 2K10	2	FINDER 55.34.0074 24VDC + 94.04 BASE	RELAY	1K10, 2K10
1K20, 2K20	2	FINDER 55.34.0074 24VDC + 94.04 BASE	RELAY	1K20, 2K20
1K30, 2K30	2	FINDER 55.34.0074 24VDC + 94.04 BASE	RELAY	1K30, 2K30
1TH1, 2TH1	2	COSMOTEC KTS01141	THERMOSTAT	1TH1, 2TH1
1HR1, 2HR1	2	IME RQ480 10-80VDC	HOUR RUN METER	PUMP No.1, No.2
SIR	1	KLAXON KL980554	SIREN	
1E1, 2E1	2	COSMOTEC GKV30A1220	CUBICLE FAN	
	4	COSMOTEC GKF25	GRILL & FILTER	
	4	COSMOTEC GKF30	GRILL & FILTER	

AS CONSTRUCTED DETAILS

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SIGNED: DATE: 26-02-13

NAME of SIGNATORY: DARREN McKLAREN

RPEQ No. or LICENCE: 756

COMPANY NAME: J&P RICHARDSON INDUSTRIES

START DATE: 25-01-12 FINISH DATE: 24-04-12

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FAX. (07) 3271 3623
EMAIL. jpr@jpr.com.au

JPR Project No.: E12-C54500

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(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)

QUEENSLAND UrbanUtilities

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A	01.13	AS CONSTRUCTED	B.A.	D.Mc		

FUNDING
DESIGN W.O. No. PB006558
CONSTRUCTION W.O. No. PB006558
FUNDED BY Q.U.U. (✓) EXTERNAL ( )

DRAFTED DARREN McKLAREN
DRAFTING CHECK DARREN McKLAREN
CAD FILE 55-0164-007_B.dwg
Q.U.U. FILE No.

ORIGINAL SIGNED BY DARREN McKLAREN 15-12-11
DESIGN R.P.E.Q. No. DATE
DESIGN CHECK R.P.E.Q. No. DATE

APPROVED BY SIGNATURE DATE
CONSTRUCTION MANAGER SIGNATURE DATE

ASSET/PROJECT
LUGGAGE POINT WASTE WATER TREATMENT PLANT

DRAWING TITLE
EFFLUENT PUMP STATION SWITCHBOARD EQUIPMENT SCHEDULE

SHEET No. 7 OF 10
QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0164-007
AMEND. B

PLC PANEL

PLC No: 03	CABINET: 03
RACK No: 02	SLOT No: 02
MODULE : IC200MDL640	

16 POINT DIGITAL INPUT MODULE

A1	3244	1Bk	
A2	3245	2W	
A3	3246	2Bk	
A4	3247	3W	
A5	3248	3Bk	
A6	3249	4W	
A7	3250	4Bk	
A8	3251	5W	
A9	3252	5Bk	
A10	3253	6W	
A11	3254	6Bk	
A12			
A13			
A14			
A15			
A16	3259	8W	
A17	R2S2+VE (24VDCXTO R2/112)		
A18			

3655

1W -VE (0VDCXTO R2/225)

8Bk -VE (0VDCXTO R3/236)

PLC No: 03	CABINET: 03
RACK No: 03	SLOT No: 07
MODULE : IC200MDL940	

16 POINT DIGITAL OUTPUT MODULE

B1	A1			
B2	A2			
B3	A3			
B4	A4			
B5	A5	3402A	R3/32 500mA	3402 7W
B6	A6			
B7	A7	3403A	R3/31 500mA	3403 7Bk
B8	A8			
B9	A9			
B10	A10			
B11	A11			
B12	A12			
B13	A13			
B14	A14			
B15	A15			
B16	A16	R3S7+VE (24VDCXTO R3/117)		
B17	A17			
B18	A18			

EFFLENT PUMP STATION SWITCHBOARD

	PUMP No1		
1W	1	112	112
1Bk	2	100-	100-
2W	3	111	111
2Bk	4	SPARE	
3W	5	130	130
3Bk	6	131	131
4W	7	SPARE	3246
4Bk	8	3246	
5W	9	-VE	-VE
	10	-VE	
1Bk	11	3244	3244
2W	12	3245	3245
2Bk	13	3246	3246
3W	14	3247	3247
3Bk	15	3248	3248
4W	16	3249	3249
4Bk	17	3250	3250
5W	18	3251	3251
5Bk	19	3252	3252
6W	20	3253	3253
6Bk	21	3254	3254
7W	22	3402	3402
7Bk	23	3403	3403
8W	24	3259	3259
8Bk	25	-VE	-VE
	26	-	
1W	27	-	
	28	-	
	29	-	
	30	-	

TO NO FLOW TIMER

TO 1U1 VSD

-VE

3244 START 1S4 -VE — LOCAL START

3245 STOP 1S3 -VE — LOCAL STOP

3247 1K5 B129 -VE — CONTROL POWER AVAILABLE

3248 1K4 -VE — STARTER FAULT

3249 RESET 1S5 B123 -VE — RESET

3250 1K3 -VE — RUNNING

3251 1S2 B121 -VE — REMOTE SELECTED

3252 REMOTE OFF LOCAL — LOCAL SELECTED

3253 1K10 -VE — NO FLOW FAULT

3254 1KT9 B145 -VE — NO FLOW

3259 B143 PFR B020 -VE — PHASE FAILURE

3402 1K20 -VE — PUMP No.1 START RELAY

3403 1K30 -VE — PUMP No.1 FAULT RESET RELAY

FIELD

3656

FIELD ISOLATOR

1W	1	112	Bk
1Bk	2	100-	BL
2W	3	111	Br
2Bk	4		
3W	5	130	BL
3Bk	6	131	Br

REFLUX VALVE PROXIMITY SWITCH

MOTOR THERMISTORS

ISOL1. 5W 4Bk

FROM SWITCHBOARD

TO MOTOR

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 26-02-13

NAME of SIGNATORY: DARREN McKLAREN

RPEQ No. or LICENCE: 756

COMPANY NAME: J&P RICHARDSON INDUSTRIES

START DATE: 25-01-12 FINISH DATE: 24-04-12

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FUNDING		DRAFTED	DARREN McKLAREN
DESIGN W.O. No.	PB006558	DRAFTING CHECK	DARREN McKLAREN
CONSTRUCTION W.O. No.	PB006558	CAD FILE	55-0164-008_B.dwg
FUNDED BY Q.U.U. (✓)	EXTERNAL ( )	Q.U.U. FILE No.	

ORIGINAL SIGNED BY DARREN McKLAREN		15-12-11		
DESIGN	R.P.E.Q. No.	DATE	APPROVED BY	SIGNATURE DATE
DESIGN CHECK	R.P.E.Q. No.	DATE	CONSTRUCTION MANAGER	SIGNATURE DATE

ASSET/PROJECT: LUGGAGE POINT WASTE WATER TREATMENT PLANT

DRAWING TITLE: EFFLUENT PUMP STATION PUMP No.1 TERMINATION DIAGRAM

SHEET No. 8 OF 10

QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0164-008

AMEND. B

PLC PANEL

PLC No: 03 | CABINET: 03
RACK No: 03 | SLOT No: 06
MODULE : IC200MDL640

16 POINT DIGITAL INPUT MODULE

A1	3260	1Bk	3657
A2	3261	2W	
A3	3262	2Bk	
A4	3263	3W	
A5	3264	3Bk	
A6	3265	4W	
A7	3266	4Bk	
A8	3267	5W	
A9	3268	5Bk	
A10	3269	6W	
A11	3270	6Bk	
A12			
A13			
A14			
A15			
A16			
A17	R3S6+VE (24VDCXTO R3/116)		
A18			

1W -VE (24VDCXTO R3/233)

PLC No: 03 | CABINET: 03
RACK No: 02 | SLOT No: 01
MODULE : IC200MDL940

16 POINT DIGITAL OUTPUT MODULE

B1	A1				
B2	A2				
B3	A3				
B4	A4				
B5	A5	3418A	R2/33 500mA B234	3418	7W
B6	A6				
B7	A7	3419A	R2/34 500mA B235	3419	7Bk
B8	A8				
B9	A9	3420A	R2/35 500mA B236	3420	8W
B10	A10				
B11	A11				
B12	A12				
B13	A13				
B14	A14				
B15	A15				
B16	A16				
B17	A17	R2S1+VE (24VDCXTO R2/111)			
B18	A18				

8Bk -VE (VDCXTO R2/222)

EFFLENT PUMP STATION SWITCHBOARD

	PUMP No1		
1W	1	212	212
1Bk	2	200-	200-
2W	3	211	211
2Bk	4	SPARE	
3W	5	230	230
3Bk	6	231	231
4W	7	SPARE	
4Bk	8	3262	3262
5W	9	-VE	
1W	10	-VE	-VE
1Bk	11	3260	3260
2W	12	3261	3261
2Bk	13	3262	3262
3W	14	3263	3263
3Bk	15	3264	3264
4W	16	3265	3265
4Bk	17	3266	3266
5W	18	3267	3267
5Bk	19	3268	3268
6W	20	3269	3269
6Bk	21	3270	3270
7W	22	3418	3418
7Bk	23	3419	3419
8W	24	3420	3420
8Bk	25	-VE	-VE
	26	-	
	27	-	
	28	-	
	29	-	
	30	-	

TO NO FLOW TIMER

TO 2U1 VSD

-VE

START 2S4 — 3260 -VE — LOCAL START

STOP 2S3 — 3261 -VE — LOCAL STOP

3263 2K5 -VE — CONTROL POWER AVAILABLE

3264 B229 2K4 -VE — STARTER FAULT

RESET 2S5 — 3265 B223 -VE — RESET

3266 2K3 -VE — RUNNING

3267 2S2 B221 -VE — REMOTE SELECTED

3268 REMOTE OFF LOCAL 2K10 — LOCAL SELECTED

3269 -VE — NO FLOW FAULT

3270 2KT9 B245 -VE — NO FLOW

B243 -VE

3418 2K20 -VE — PUMP No.2 START RELAY

3419 2K30 -VE — PUMP No.2 FAULT RESET RELAY

3420 SIR — START UP WARNING SIREN

FIELD

3658

FIELD ISOLATOR

1W	1	212	Bk
1Bk	2	200-	BL
2W	3	211	Br
2Bk	4		
3W	5	230	BL
3Bk	6	231	Br

ISOL1. 5W 4Bk

FROM SWITCHBOARD

TO MOTOR

REFLUX VALVE PROXIMITY SWITCH

MOTOR THERMISTORS

AS CONSTRUCTED DETAILS

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JPR Project No.: E12-C54500

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FUNDING: DESIGN W.O. No. PB006558; CONSTRUCTION W.O. No. PB006558; FUNDED BY Q.U.U. (✓) EXTERNAL ( )

DRAFTED	DARREN McKLAREN	ORIGINAL SIGNED BY DARREN McKLAREN 15-12-11	
DRAFTING CHECK	DARREN McKLAREN	DESIGN R.P.E.Q. No. DATE	APPROVED BY SIGNATURE DATE
CAD FILE	55-0164-009_B.dwg		
Q.U.U. FILE No.		DESIGN CHECK R.P.E.Q. No. DATE	CONSTRUCTION MANAGER SIGNATURE DATE

ASSET/PROJECT: LUGGAGE POINT WASTE WATER TREATMENT PLANT

DRAWING TITLE: EFFLUENT PUMP STATION PUMP No.2 TERMINATION DIAGRAM

SHEET No. 9 OF 10

QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0164-009

AMEND. B

PLC PANEL

PLC No: 03	CABINET: 03
RACK No: 00	SLOT No: 06
MODULE : IC200ALG240	

8CH ANALOG INPUT MODULE

A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17 A18 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16

A10 — SI3065-1- — 21W
A11 — SI3065-1+ — 21Bk
A14 — SI3066-1- — 22W
A15 — SI3066-1+ — 22Bk
B2 — PIT3065- — 23W
B3 — PIT3065+ — 23Bk

PLC No: 03	CABINET: 03
	SLOT No: 01
MODULE : IC200MDL940	

A2 A4 A6 A8 A10 A12 A14 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B18

B1 — 0VDC
B2 — PIC3065- — 24Bk
0VDC
PIC3065+ — 24W

3657

EFFLENT PUMP STATION SWITCHBOARD

1W	1	SI3065-1+
1Bk	2	SI3065-1-
2W	3	SI3066-1+
2Bk	4	SI3066-1-
3W	5	PIT3065+
3Bk	6	PIT3065-
4W	7	PIC3065+
4Bk	8	PIC3065-
	S	
	S	
	S	
	S	
	S	

SI3065-1+ SI3065-1- SI3066-1+ SI3066-1- PIT3065+ PIT3065- PIC3065+ PIC3065-

FIELD

SI3065-1+ / SI3065-1- → 1U1 VSD

SI3066-1+ / SI3066-1- → 2U1 VSD

PIT3065+ / PIT3065- → VEGABAR 52 ADJ. UNIT (Br+, Bl-, Y, W, BREATHER) → PRESSURE TRANSMITTER

PIC3065+ / PIC3065- → SS20 SIGNAL SPLITTER

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 26-02-13

NAME of SIGNATORY: DARREN McKLAREN

RPEQ No. or LICENCE: 756

COMPANY NAME: J&P RICHARDSON INDUSTRIES

START DATE: 25-01-12 FINISH DATE: 24-04-12

J. & P. RICHARDSON
INDUSTRIES PTY LTD
ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 23 001 952 325
114 CAMPBELL AVE WACOL QLD 4076
PH. (07) 3271 2911
FAX. (07) 3271 3623
EMAIL. jpr@jpr.com.au

JPR Project No.: E12-C54500

NAME SIGNATURE DATE

QUEENSLAND URBAN UTILITIES DELEGATE
(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)

QUEENSLAND UrbanUtilities

No.	DATE	AMENDMENT	DRAFTED	DESIGNED	RPEQ NO.	APPROVED
B	02.13	AMENDED TITLE BLOCK	B.A.	D.Mc		
A	01.13	AS CONSTRUCTED	B.A.	D.Mc		

FUNDING			
DESIGN W.O. No.	PB006558	DRAFTED	DARREN McKLAREN
CONSTRUCTION W.O. No.	PB006558	DRAFTING CHECK	DARREN McKLAREN
FUNDED BY Q.U.U. (✓)	EXTERNAL ( )	CAD FILE	55-0164-010_B.dwg
		Q.U.U. FILE No.	

ORIGINAL SIGNED BY DARREN McKLAREN		15-12-11	
DESIGN	R.P.E.Q. No.	DATE	APPROVED BY SIGNATURE DATE
DESIGN CHECK	R.P.E.Q. No.	DATE	CONSTRUCTION MANAGER SIGNATURE DATE

ASSET/PROJECT: LUGGAGE POINT WASTE WATER TREATMENT PLANT

DRAWING TITLE: EFFLUENT PUMP STATION COMMON CONTROL TERMINATION DIAGRAM

SHEET No. 10 OF 10

QUEENSLAND URBAN UTILITIES DRAWING No: 486/5/5-0164-010

AMEND.: B

6 SERVICE AND MAINTENANCE

This product is designed to operate under specific environmental, supply and load conditions. Should these conditions change, consult a licenced electrician or electrical engineer before operating this product.

These procedures are to be performed only by a licenced electrician as they may expose live equipment.

The Switchgear and Controlgear Assembly is essentially maintenance free, however the following safety measures and routine maintenance is recommended.

- Where fitted, ensure cabinet vents and filters are clear and clean.
- During operation, ensure all doors and covers are secure and closed.
- All faults are to be investigated and repaired by an appropriately licenced electrician.
- All components to be operated in accordance with manufacturers data.
- The protective devices within switchboards are designed to operate in the event of a short circuit or overload condition. In the event of these devices operating under such conditions the device or devices must be inspected and tested by a suitably trained person to ascertain its condition prior to reconnecting the protective device to the supply.

<u>Periodic checks should ensure</u>

- The switchboard is clean and free of any contaminants, which could reduce the insulation properties of the switchboard.
- All entries are sealed to ensure no vermin can enter.
- There is no evidence of overheating, arcing or moisture.
- The earthing system is maintained and is adequate to allow correct operation of protective devices.
- Insulation resistance is maintained to appropriate levels.
- Check terminations for correct tension.
- Test operation of protective devices.
- Re-calibrate instrument loops as required.

Refer to AS-INSTALLED electrical drawings for details of protection equipment settings.

No special tools or equipment are required to perform routine maintenance.