



# ADVANCED ELECTRICAL PROTECTION

## *Selection Guide*



# ABOUT CROUZET

100+ YEARS MANUFACTURING THE FUTURE *Together*

We design and manufacture **Mechatronic Products** to turn engineering ideas into real world applications

## OUR MARKETS



AEROSPACE



GROUND  
TRANSPORTATION



INDUSTRY

## OUR PRODUCTS



MOTION  
CONTROL  
& SENSING



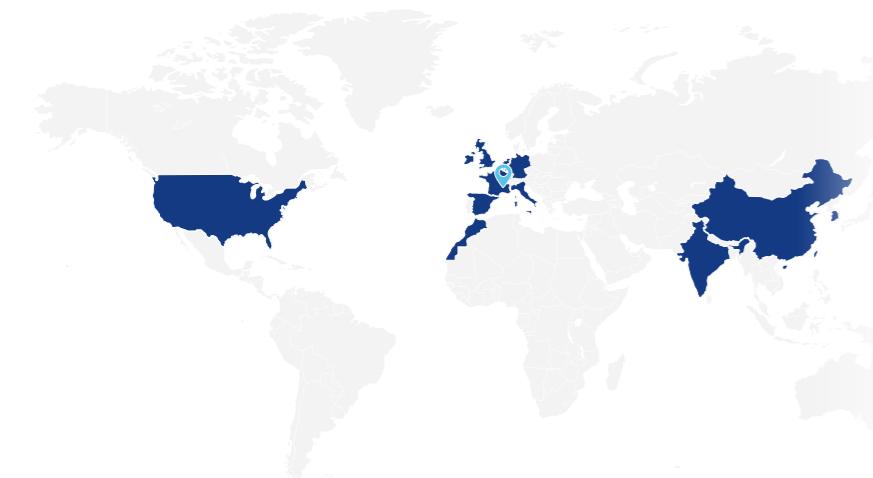
HUMAN-  
MACHINE  
INTERFACES



ELECTRICAL  
CONTROL  
& PROTECTION

## WE ARE GLOBAL

2000+ collaborators,  
10 Manufacturing Plants,  
9 Sales Offices & 4 R&D Labs



HEADQUARTERS

SALES OFFICES



VALENCE, FRANCE



VALENCE NORD, FRANCE



PARIS, FRANCE



NANTES, FRANCE



ORLEANS, FRANCE



VOUVRY, SWITZERLAND



CASABLANCA 1, MOROCCO



CASABLANCA 2, MOROCCO



HUIZHOU, CHINA



BANGALORE, INDIA

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# WIRE PROTECTION

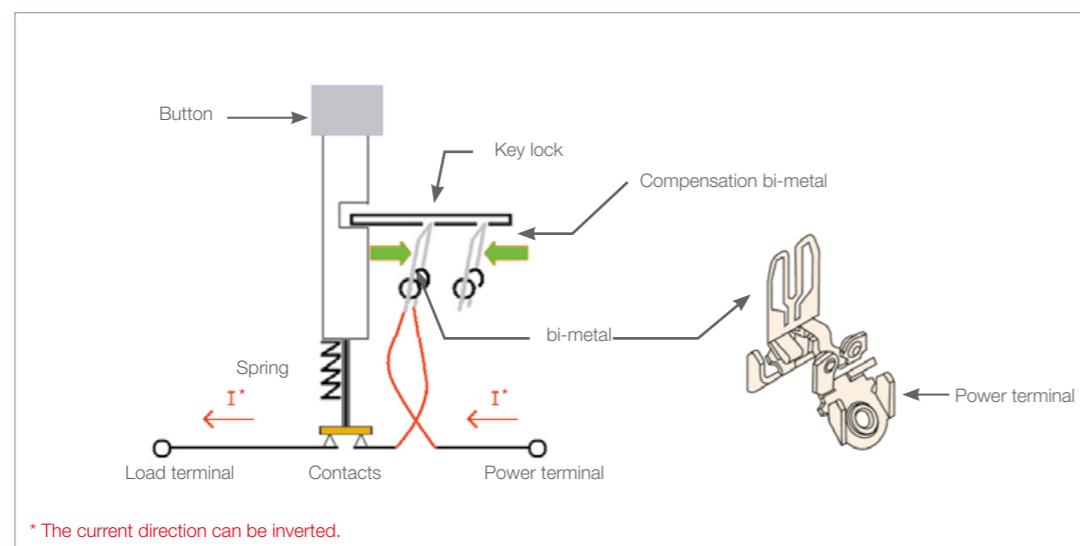
## HOW DOES IT WORK?

### ELECTROMECHANICAL CIRCUIT BREAKERS

In this type of Circuit Breaker, the current sensing is done by a bi-metal. The bi-metal is also part of the actuator that will open the line: the bi-metal is bent by heat coming from the current, the bi-metal moves the key lock, releases the latch and opens the line.

The Circuit Breaker bi-metal bends and releases the latch according to the overload current value and the overload duration (the bending is independant of the current direction).

If any, the auxiliary contact are galvanically isolated from the power and gives the state of the contacts (open or closed).



### «LIGHT, SIMPLE AND SAFE»

#### Light:

Our single phase EN2495 and MIL MS33201 V compliant model is the lightest in the world (<20 g with screws, washers and nut).

#### Simple:

- › Designed to be reused several times, spare components are not required
- › Can sometimes be used as a switch (within the defined endurance limits), they therefore perform a dual function of switching and protecting

#### Safe:

- › Our intrinsic fail safe\*\* and trip free\* conception enable a high level of safety (generally  $10^{-9}$  Flight Hours (FH) of not opening on a short circuit)
- › The temperature compensation ensures high performance over a wide temperature range (usually -60°C to +125°C)
- › Excellent resistance to mechanical stress
- › High current level peaks and high current flows tolerance

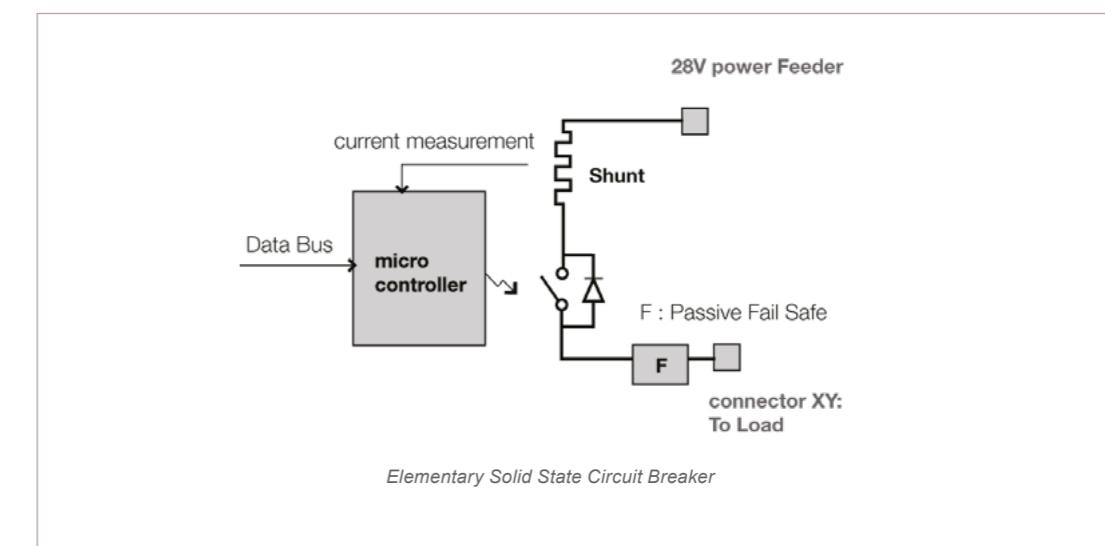
\* Trip free: even if the pushbutton is maintained in the closed position, the opening of the contacts (and therefore of the electric circuit) is ensured in the event of a current surge or short-circuit.

\*\* Intrinsic safety (Fail safe): the Circuit Breaker has been designed with a fuse element to ensure that the electric circuit is opened in the extreme case of a blocked mechanism or glued contacts.

### SOLID STATE CIRCUIT BREAKERS (SSCB)

In this type of Circuit Breaker, the current sensing is done by a shunt or a Hall sensor in DC or a Current Transformer (CT) in AC. A microcontroller or FPGA acquires the current and simulates the  $i^2t$  curve, the switch function is often done by MOSFETS, bipolar transistors, SCR (i.e. thyristors).

The microcontroller will integrate the current going through the shunt and will open the MOSFET according to the current value and overload duration.



The patented fuse **F** gives a  $10^{-9}$  FH safety level (equivalent to mechanical Circuit Breakers) and still gives the possibility of reprogramming the Rated Current value by software.

### «MORE THAN A THERMAL SWITCH»

A SSCB is more than a thermal switch because when it is connected to a data bus, it provides intrinsically functions such as:

- › A remote switching ability (useful in application: contactor or relay function)
- › Dimmer or chopper function (useful in applications such as: motor speed control, light dimming, soft start)
- › Current monitoring (prognostic applications, load failure detection)

Also,

- › They are not susceptible to vibrations (useful in applications with high acceleration (Gs): aircraft, guns...)
- › They generate no audio noise (useful in applications such as: submarines, electric tanks, medical...)
- › The micro controller can run the arc fault protection algorithm
- › They can become a PLD with a protected power output (see p. 37)
- › They can protect the load (see p. 37).

# WIRE & STRUCTURE & FUEL TANK PROTECTION

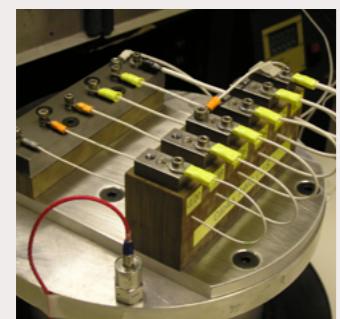
## ARC FAULT DETECTION



Wet arc



Parallel arc



Series arc

### EWIS PROTECTION

The 14CFR Part 25 subpart H requirements asks aircraft OEM to consider the electrical wiring interconnection as a system. This means that the airworthiness of the wiring must be guaranteed for the complete lifetime of the aircraft.

AFCBs are a way to obtain compliancy to AC 25 1701-1.

The Advisory Circular (AC 251701-1) gives guidance for subpart H compliancy and indicates that a safety analysis of the Electric Wiring Interconnection Systems (**EWIS**) has to be done.

To certify the EWIS, the constructor must show a proactive approach to mitigate risks and perform a zonal analysis (EZAP).

When performing this analysis, it is very important to keep in mind that **«regardless of probability, any single arcing failure should be assumed for any power carrying line»** (page 31 of the AC) because the traditional way of thinking which was: «optional systems, like in flight entertainment, cannot cause a catastrophic failure condition» is not a valid assumption.

Locations where arcing must be mitigated:

- A** In flight entertainment area
- B** Cargo and baggage compartment door actuators
- C** Fuel tanks
- D** SWAMP area (Severe Wind And Moisture Problem area) such as wires in landing gear well or cockpit window heater or wing defrost heaters
- E** Galleys to protect electrical socket appliances such as: Cooktop ovens, waste compacting machines, coffee machines etc...
- F** Places where due to vibration, heat, aging or after an incorrect maintenance operation there is a risk of a power line touching:
  1. a critical hydraulic actuator line
  2. pressurized air line (air duct) or flight critical data line
  3. mechanical control system cable
  4. oxygen lines
  5. fuel lines
  6. water and water/waste line (and below them in case of dripping)
  7. hot air ducts

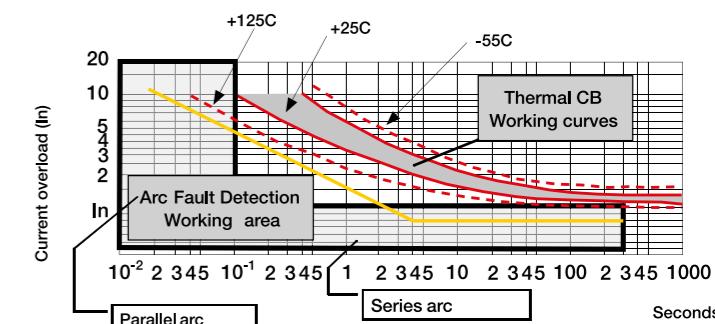
In case of an arc inside a bundle, arc fault technology will preclude a chain reaction in the bundle from inducing the loss of the complete bundle. Instead there will be a «controlled» deterioration of the wire(s) giving time for maintenance to be aware of the fault (by using the information coming from the circuit breaker) and thus avoiding a potential catastrophic situation.



Single pole AFCB

### HOW DOES ARC FAULT PROTECTION WORK?

AFCBs combine the safety of standard Circuit Breakers and high accuracy electronics to mitigate arcing. Each standard thermal Circuit Breaker is equipped with an electronic board in order to analyze the current waveform in real time to detect if arcing is occurring.

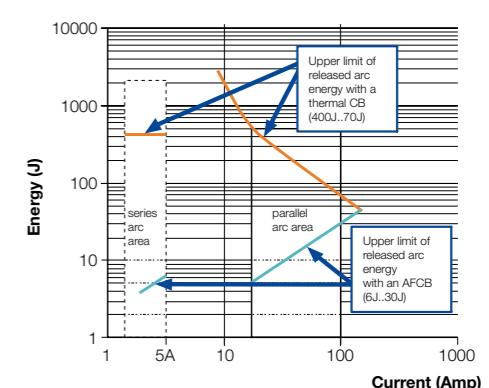


The algorithm in the electric board works faster than the thermal bi-metal function as shown on the adjacent chart.

### ARC FAULT WILL CLEAR THE FAULT FASTER THAN THERMAL PROTECTION

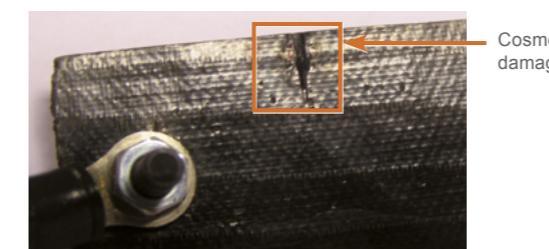
In case of an electric hazard, the arcing energy (thus mechanical damage) is divided by a magnitude (generally 10) as shown in the adjacent chart.

The quick opening time of the GFCB-AFCB (generally 12 msec) will not release sufficient energy to puncture the conduit or the tank's skin (a pure thermal circuit breaker will open on an arc or a shorting current in 200 ms, thus 10 times slower which releases sufficient energy to puncture the tank's skin or conduit).



### CARBON COMPOSITE (CFRP) PROTECTION

Carbon Fibres Reinforced Polymer (CFRP) can be damaged (delamination) and can **ignite** in case of arcing. The use of arc fault protection will **mitigate** damage and risk significantly as illustrated below:

230 VAC Fault with arc fault protection:  
only cosmetic damages appears230 VAC Fault without arc fault protection:  
delamination of the fibers

# WIRE & HUMAN & FUEL TANK PROTECTION

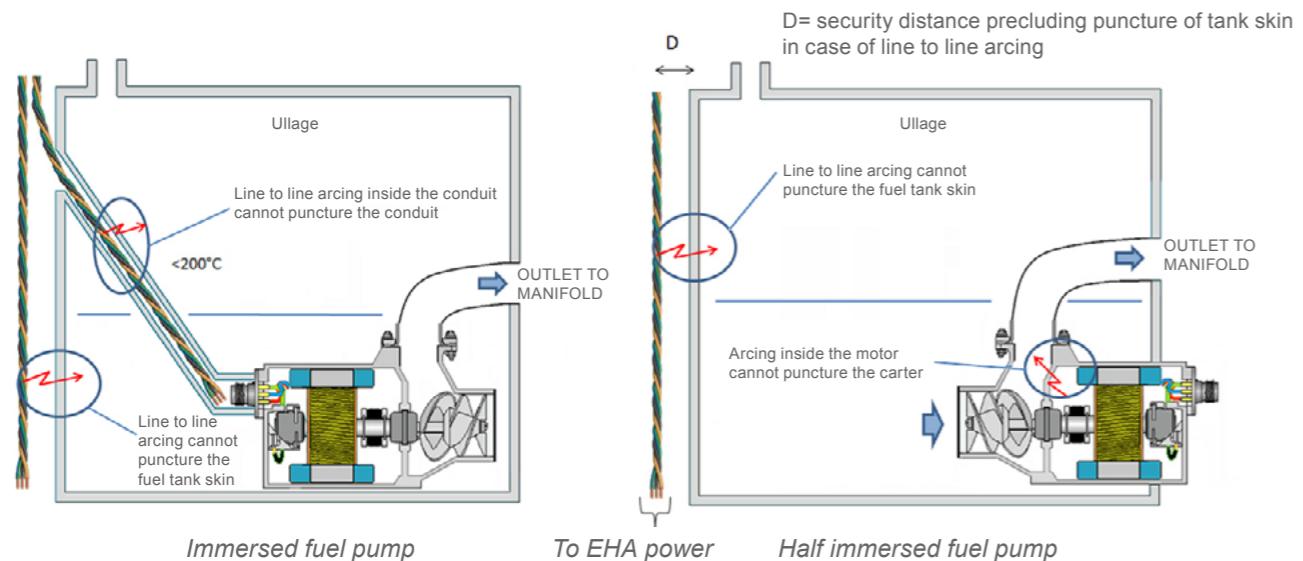
## GROUND FAULT CIRCUIT BREAKER (GFCB) WITH ARC FAULT

### FUEL TANK PROTECTION

Following SFAR88 recommendation, the FAA and EASA have compelled PART 25 aircrafts to protect fuel tanks with Ground Fault. The purpose of these Ground Fault protection device is to preclude fuel tank puncture by reducing drastically the amount energy liberated by a fault.

Documents **AC25981** and **AMC25981(a)** state that:

«any components located in or adjacent to a fuel tank must be qualified to meet standards that assure, during both normal and failure conditions, ignition of flammable fluid vapors will not occur».



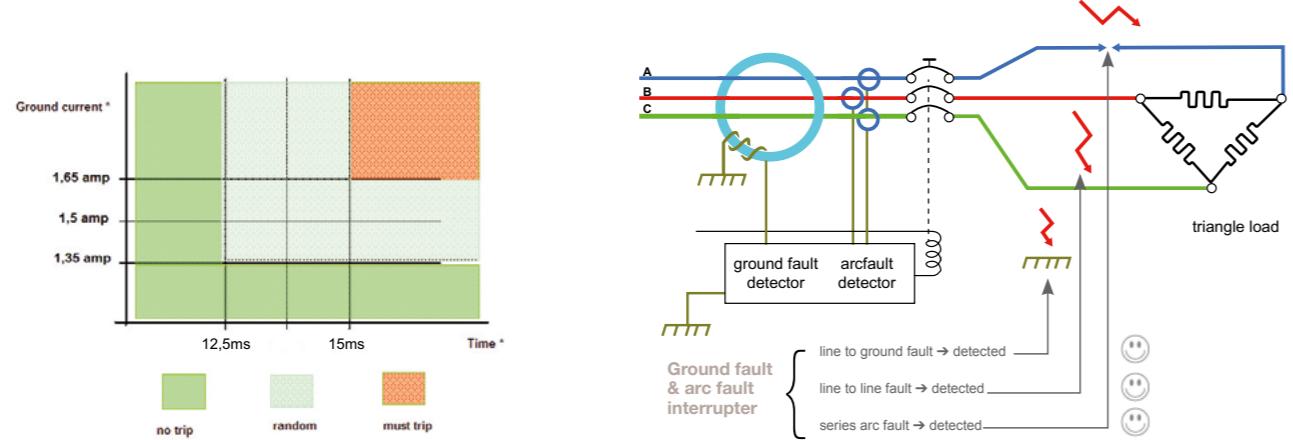
The reduction of damage concerns also:

- › Pylons & nacelles and small dimension aircraft where power line are routed near data buses or hydraulic tubes.
- › Wings where torque tube disconnections can cause severe damage to the wiring.
- › Composite wings with high power electric actuators (EHA, EBHA) in the vicinity of fuel tanks.

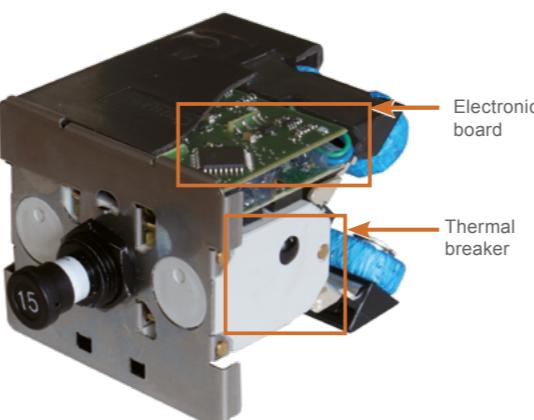
### THE GF-AFCB: A GFI CAPTURING LINE TO LINE ARCING

Traditional Ground Fault protection do not capture series arcing or line to line arcing because these two faults do not create a leakage current to the ground (i.e. the CT that measures the homopolar current will still read «zero» with one of these 2 faults occurring). By adding arc fault detection on each line, the GF-AFCB is a GFI and a circuit breaker that detects these 2 wire faults.

#### THE GF-AFCB STRUCTURE



## ARC FAULT INTERRUPTER



### › The GF-AFCB has 2 thresholds:

- fault time confirmation
- maximum ground fault current.

This enables Crouzet to deliver products adapted to your load configuration. For example, the current threshold can be tuned either for a Delta (Triangle) motor or a Star (Wye) motor.

### HOW DOES IT WORK?

#### › Built in test

The GF-AFCB provides built-in test features that allow aircraft maintenance personal to verify that ground fault protection is functional, or that a ground fault has occurred: data issued from the led on the flat of the threaded barrel gives this information.

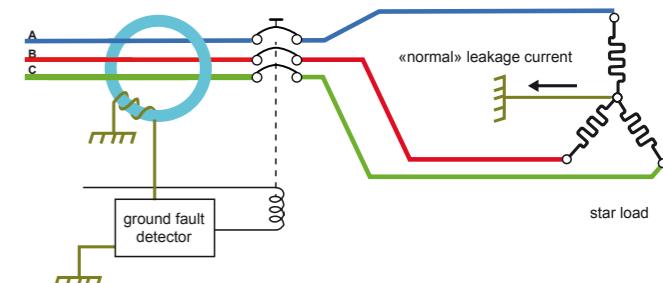
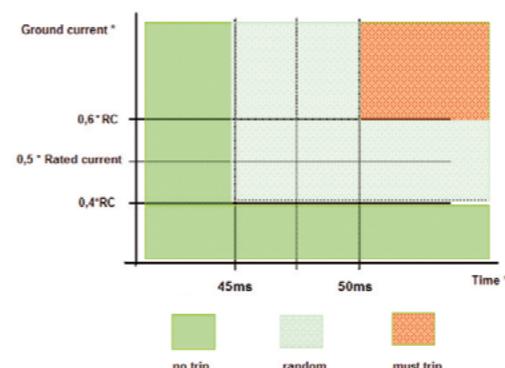
#### › Severed wire detection

The GF-AFCB includes «severed wire detection» (ie broken or cut wire) to preclude the heating of a motor if it is stalled (blocked) or running on only 2 phases (typical time detection is 1 second).

The above has been implemented because **AC25981 states page 9.3.1:**

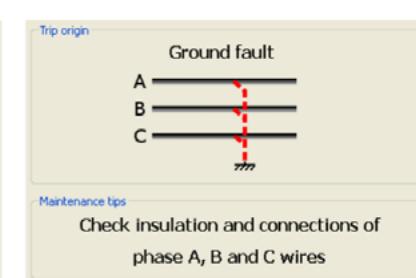
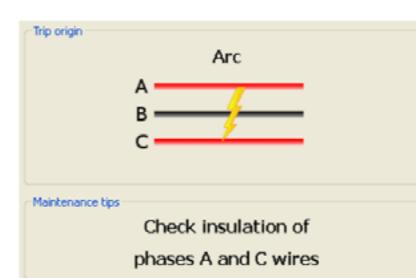
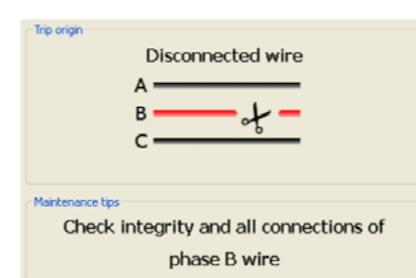
(c) «[...] Automatic protective means, such as arc/ground fault interrupters or other means, should be provided to shut down the pump when a single electrical phase failure occurs. Periodic inspections or maintenance of these features may be required».

#### ON A «STAR» (WYE) LOAD, WITH GROUNDED CENTER, THE BEHAVIOR OF THE GFCB IS THE FOLLOWING



#### TROUBLE SHOOTING THE WIRE WITH INFORMATION FROM THE BREAKER READER

The following pictures are screenshots of the laptop running the breaker reader software after a fault has occurred.



# ELECTRICAL PROTECTION

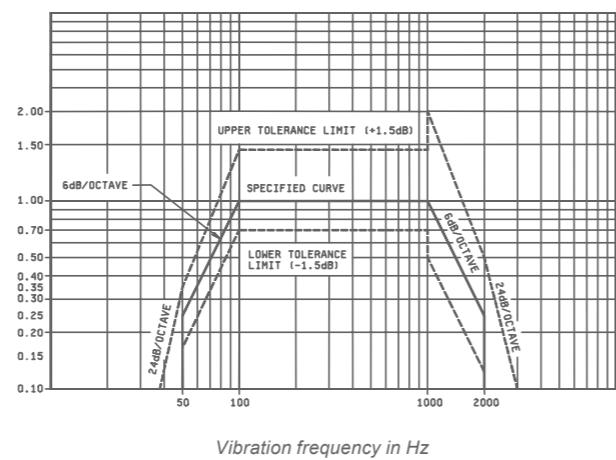
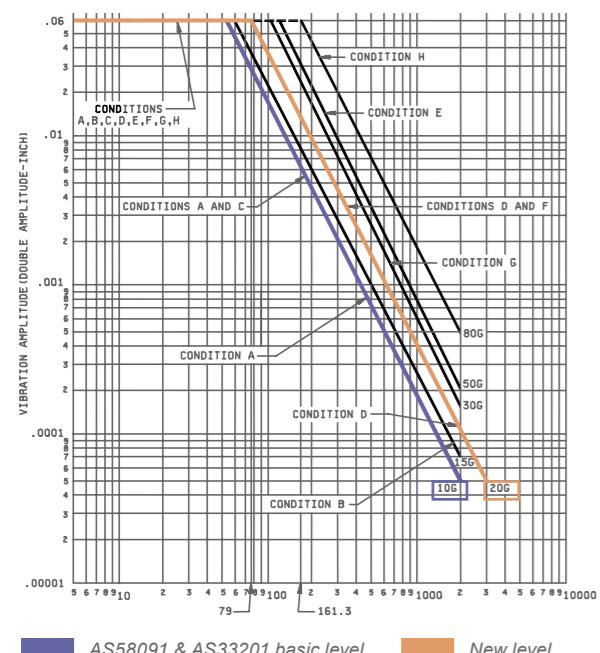
## HIGH SHOCK AND VIBRATION BREAKERS

Our High-Performance Thermal Circuit Breakers exceed the standard for shock and vibration for military applications.

It has always been troublesome for electrical systems engineers to find the best suitable circuit breakers for harsh environments. Crouzet has developed a specific series of circuit breakers which go far beyond the current standards.

When used in the vicinity of cannons or missile launchers and in circuit breaker panels installed next to machine guns (e.g. helicopters, jet fighters or armored vehicles) the high «shock and vibration» family avoids installing silent blocs on panels or on circuit breakers (while maintaining top circuit protection performance).

For the single pole circuit breaker the High Shock and Vibration products multiply by two the endurance level to random and sinus vibrations, compared to AS58091 level or basic MS33201 levels.



Test condition letter	Power spectral density	Overall rms G
A	.02	5.35
B	.04	7.56
C	.06	9.26
D	.1	11.95
E	.2	16.91
F	.3	20.71

Sinusoidal (MIL STD 202 method 204 D)  
Random (MIL STD 202 method 214 A)  
Shock (MIL STD 202 method 213B)

20 g-PK: condition D under 71 °C and RC  
16.91 Grms: condition G under 71° C and RC  
75 g 3 halfsine 6 msec: condition B



Typical circuit protection on following military platforms:

- › Fighter Aircraft
- › Military Helicopters
- › Ground Air Defense Systems
- › Military Land Tracked and Wheeled Vehicles
- › Missile Launchers
- › Naval Shipboard Applications

# ELECTRICAL DISTRIBUTION

## FROM SSCB TO SSPC

### FROM SSCB TO SSPC

Using the most recent solid state technology, Crouzet has developed 2 generic Solid State Circuit Breakers (SSCB): One for 28 VDC applications, the other for 115 VAC applications.

A Solid State Circuit Breaker is composed of a microcontroller, a switch and a data bus.

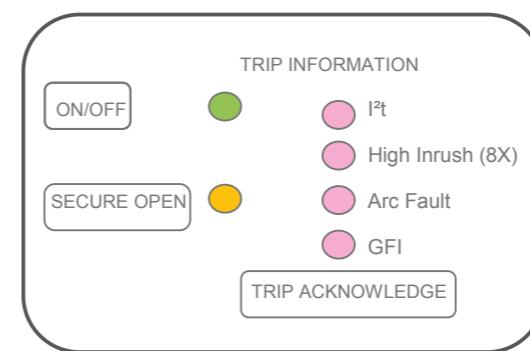
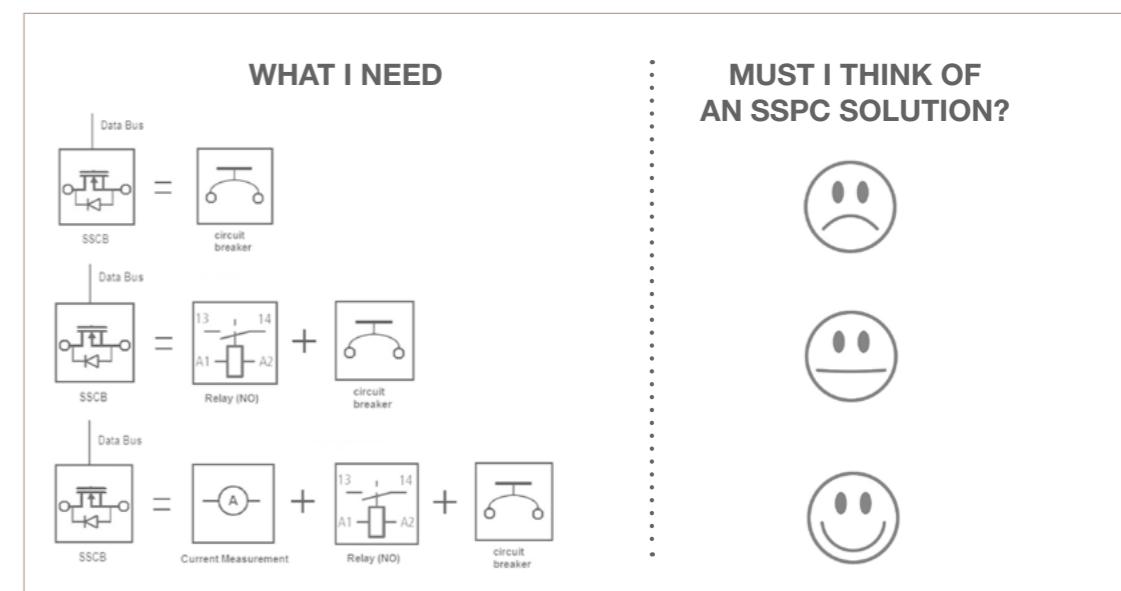
This enables a SSCB to provide more than just thermal protection; its role encompasses electrical functions such as: relay, gradator, chopper, ground fault, soft start, current measurement.

These functions can be used for light dimming, motor speed control, intermittent load command (on/off), inrush current limitation, sequential power ON of loads, load failure detection.

This is why they become Solid State Power Controllers (SSPC).

### WHEN DO I NEED A SSPC?

Cost efficiency will depend on the ability to encompass several of the previous functions. When thinking of an SSPC solution the following chart must be kept in mind:



### EASY TO OPERATE

Both 115 VAC and 28 VDC SSPC components are delivered with a laptop/tablet interface that enables a quick appropriation of SSPC features. Command from the laptop are transferred through CAN bus. The laptop/tablet interface can be replaced by a MCU or Utilities Management System (UMS) that sends and receives data frames through CAN2.0B.

The typical set of orders/queries is:

- ON/OFF** : Powers ON/OFF the load
- RESET** : RESETS the elementary switch after arc or thermal trip
- STATUS** : Asks for trip reason
- CURRENT** : Asks for current (A) value
- BACKUP** : Programs the behavior when data bus is disconnected

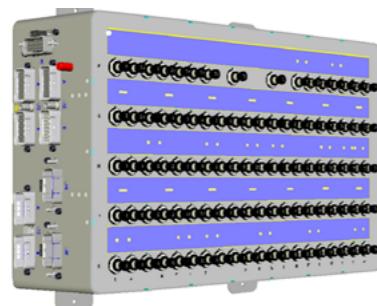
# ELECTRICAL DISTRIBUTION

## CIRCUIT BREAKER PANELS

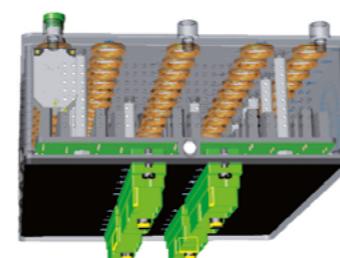
### SUPPLIER OF CIRCUIT BREAKER PANELS

#### ON SEVERAL JET AND HELICOPTER PROGRAMS

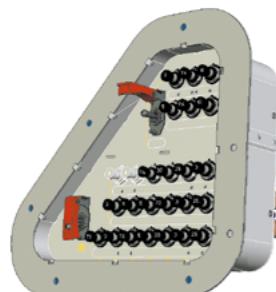
Crouzet has extensive experience in the design, development and production of illuminated and non-illuminated Circuit Breaker panels in Push/Pull or Push/Push versions, wire or PCB-FASTON version.



100 CB regional jet panel  
(wire + casing)



55 CB search and rescue helicopter panel  
(PCB + casing)



25 CB offshore helicopter panel  
(wire + casing)

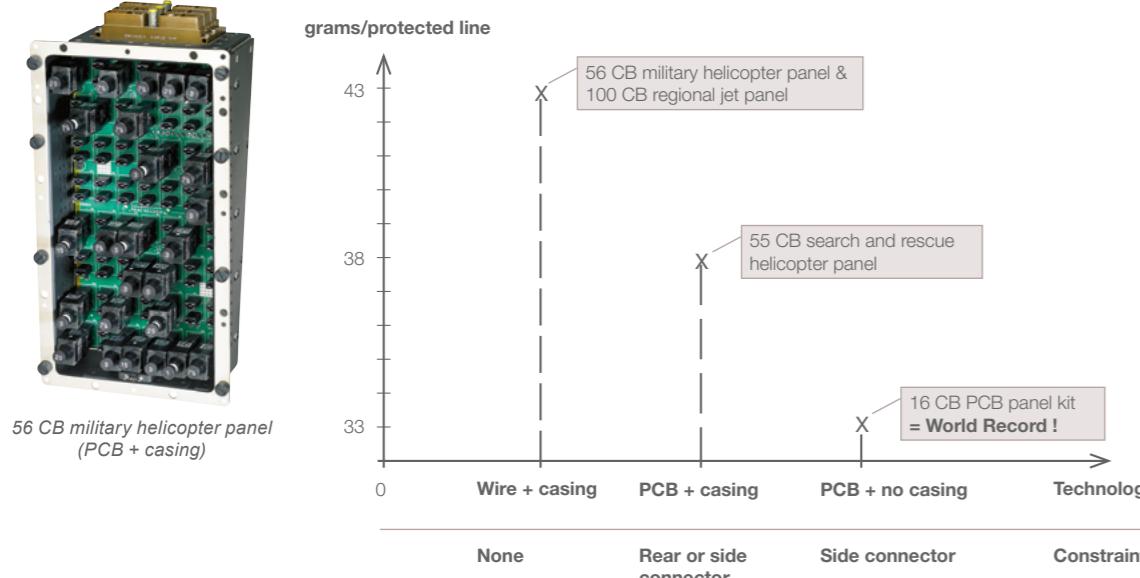
### OUR KNOW HOW

As a manufacturer of CB panels we will optimise your needs:

- › Geometry, connection and mounting as specified by your requirements and constraints
- › Customised marking of the front panel
- › Labelling of Circuit Breaker functions by engraving or easily-modified labels
- › Reduced weight due in part to our specially developed light weight Circuit Breaker and busbars
- › Expertise in mechanical and thermal limits (wire gauges, suitable sizes for Circuit Breakers, optimum distribution of Circuit Breaker, ...)
- › Expertise in busbars and connections with all the safety requirements (segregation, protection, ...)
- › ATP performed by automatic test benches

### PREDICTABLE PANEL MASS FOR PANELS CONTAINING ONLY CBs

grams/protected line



# ELECTRICAL DISTRIBUTION

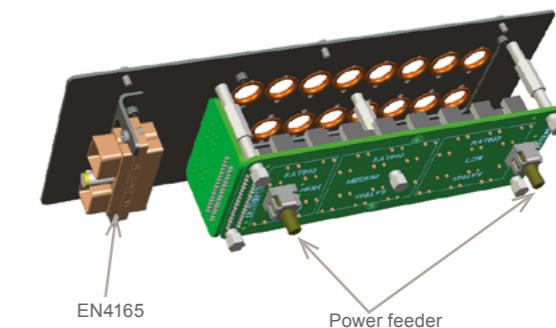
## THE «DO IT YOURSELF» KIT & BUS BARS

### THE KIT:

Crouzet is the first company to invent the concept of «do it yourself» Circuit Breaker panels and with this technique, it has created the **lightest extractable Circuit Breaker panel in the world!** The concept is based on a generic PWB carrying 16 Push Fit CBs that you can duplicate (if several bus bars are needed or if more Circuit Breakers are needed).



The «Do it your self» kit



EN4165  
Power feeder

### KIT CONSTITUTION

The kit is composed of spacers, a PCB board, FASTON Circuit Breakers, and positioning rings. The front plate is compatible with accessories (Circuit Breaker gags and obturators).

### WORLD RECORD

The above kit assembly conveys 150 A at 71°C, it weighs 528 g with 16 Circuit Breakers and thus gives a panel efficiency ratio of 528 g=33g/CB → a world record!

### PREQUALIFICATION

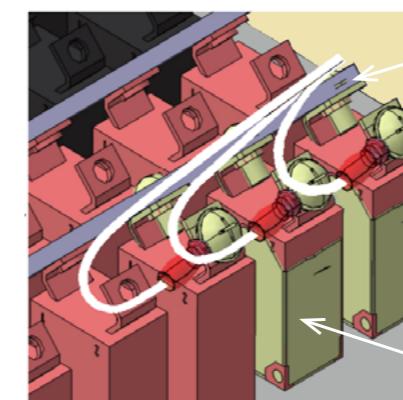
To reduce development time the kit is qualified to harsh environment.

The use of the panel or its sub-sets enables the quick fielding of a qualified solution. If the assembly recommendation and Circuit Breaker locations are respected, Crouzet guarantees the electrical and vibrational behavior of the kit:

- › Temperature and electrically from -55°C to 71°C with a 100% utility factor (150 A output)
- › Vibrations: Random and Sinusoidal rays (Harsh Helicopter Level)
- › Crash, fungus, sand and dust.

### BUS BARS:

Traditional bus bar (rectangular)



Use of frog legs CB (45° or 60°) is necessary

Crouzet bus bar (flexible)



To replace this CB,  
the removal of the bus bar  
is not needed

The flexible bus bar is compatible of many  
CB families

# ELECTRICAL DISTRIBUTION

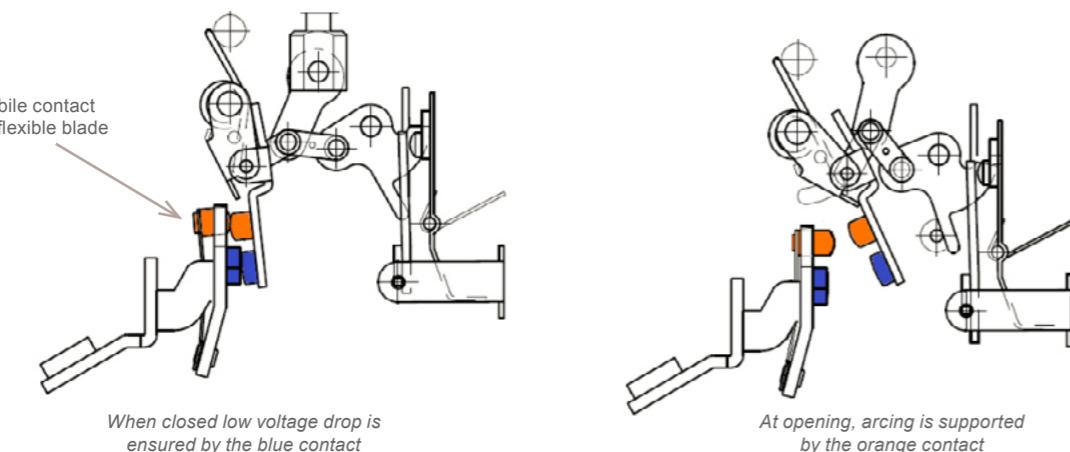
## REMOTE CONTROL CONTACTOR & CIRCUIT BREAKER

The RCCB's primary use is to power loads that do not need to be permanently ON (to optimize energy). This is why it is used:

- › For powering hydraulic actuators of cargo bay doors
- › For powering Electro Hydraulic Actuators (EHA) and Electro Backup Hydraulic Actuators (EBHA)
- › For powering ON and OFF the galleys or In Flight Entertainment (IFE)

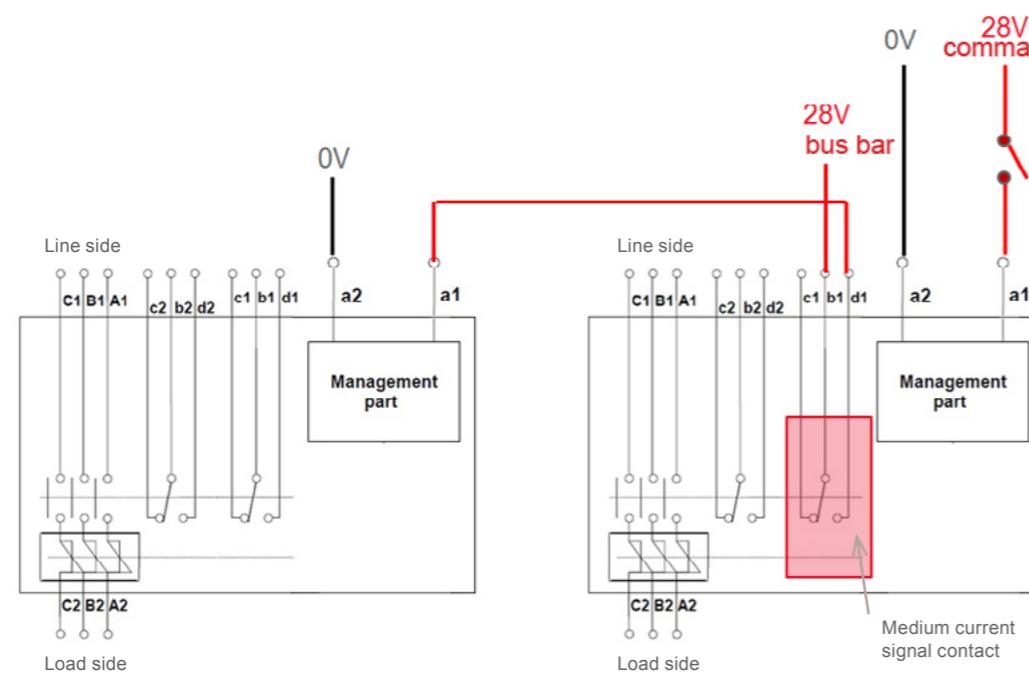
The RCCB contacts are CLOSED and OPENED (load is set ON and OFF) only once or twice during the flight; it is designed to commute at least 100,000 times, giving the aircraft a minimum of 50,000 cycles (take off and landing).

- › A unique feature: a mobile contact (in orange) that closes first and opens last ; this contact rich in tungsten endures rebound at closing time and arcing at opening time. The blue contact rich in silver ensures a low voltage drop during steady state operation ; this association guarantees 100 000 cycles under rated current with a power factor of 0.7.



- › A unique feature: a signal contact withstanding «medium» current:

Using c1 b1 d1 «medium current signal contacts» it is possible to command 2 RCCBs with only one switch (here switch S1) :



The RCCB merges a contactor function and a circuit breaker function in a single unit. The contactor is closed when 28 V is applied on the command input. The RCCB has a status display window and a mechanical «TRIP indicator».

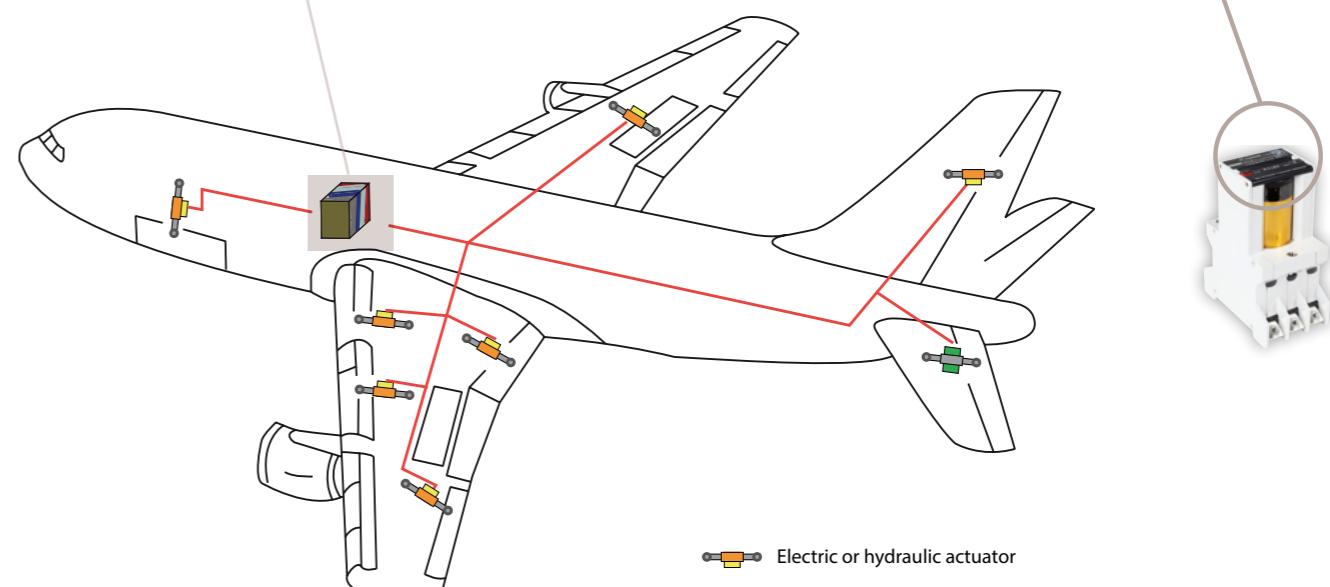
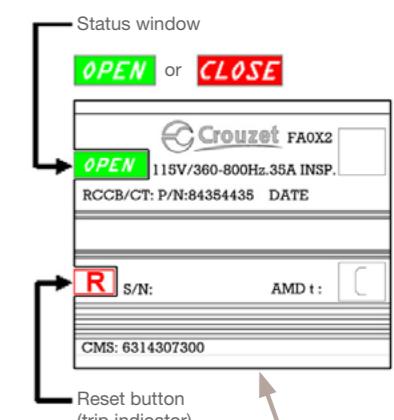
When the CB has tripped, the mechanical «TRIP indicator» is «popped out» and must be pushed back in manually to RESET the circuit breaker.

Our real MTBF figure of 300,000 Flight Hours (field value) during 20 years of service have convinced our customers to mount the RCCB successively on:

- › Galleys feeders
- › Cargo doors actuation motors
- › Flight control power packs (EHA and EBHA) of primary flight control actuators(spoilers; ailerons; rudder)

Hereafter is an illustration of the main aircraft locations of the RCCB:

FIN	Design	Bus bar	P/N
12C	GALLEY	A	84 354 335
1X	BULK FAN HEATER	A	84 354 33 5
3	RECIRC FAN	B	84 354 350
3JV1	HYD PUMP	B	84 354 350
6XN1	L INDB ELEVATOR POWER SPLY	C	84 354 350
1XX	R INDB ELEVATOR POWER SPLY	C	84 354 350
3XX	GND SUPPLY	A	84 354 350
3XX1HG1	RECIRC FAN	A	84 354 350
51N	107XP (IFE)	A	84 354 360
1MC	L-MID AILERON POWER SPLY	A	84 354 350
3J2	L-MID AILERON POWER SPLY	A	84 354 350
3J1	HYD PUMP GND SUPPLY	A	84 354 360
3C2	HYD PUMP	B	84 354 350
1HG	Y UPPER RUDDER POWER SUPPLY	A	84 354 350
5X	G UPPER RUDDER POWER SUPPLY	B	84 354 350
23MC	L SPOILERS POWER SUPPLY	A	84 354 350
3MC	R SPOILERS POWER SUPPLY	B	84 354 350
24M	SLAT E-MOT POWER 1	A	84 354 350
6N2	SLAT E-MOT POWER 2	B	84 354 350
2X	212XP GND SUPPLY	C	84 354 350



# SELECTION GUIDE

## CHOICE BY STANDARD AND RATING

	AS3320 AS33201 Alternate	AS3320 AS33201 QPL	AS3320-L AS33201-L Alternate	AS5692			AS14154 AS14154A Alternate	AS14154 AS14154A QPL	AS26574 Alternate	EN2495		
Rate (A)	DPMU	DPMU	DPMU	AFCB	GF-AFCB	AFCB	DMPT	DMPT	Alternate	Code M	Code U	
1	84 400 001	84 400 048	84 400 148				84 410 001	84 414 001	84 406 001	84 402 001	84 401 001	
2	84 400 002	84 400 049	84 400 149				84 410 002	84 414 002	84 406 002	84 402 002	84 401 002	
2.5	84 400 012	84 400 050	84 400 150				84 410 012	84 414 012	84 406 012	84 402 012	84 401 012	
3	84 400 003	84 400 051	84 400 151	84 411 103	84 411 136	84 401 503	84 410 003	84 414 003	84 406 003	84 402 003	84 401 003	
4		84 400 061	84 400 161									
5	84 400 005	84 400 052	84 400 152	84 411 105	84 411 137	84 401 505	84 410 005	84 414 005	84 406 005	84 402 005	84 401 005	
6												
7.5	84 400 007	84 400 053	84 400 153	84 411 107	84 411 138	84 401 507	84 410 007	84 414 007	84 406 007	84 402 007	84 401 007	
10	84 400 010	84 400 054	84 400 154	84 411 110	84 411 139	84 401 510	84 410 010	84 414 010	84 406 010	84 402 010	84 401 010	
15	84 400 015	84 400 055	84 400 155	84 411 115	84 411 140	84 401 515	84 410 015	84 414 015	84 406 015	84 402 015	84 401 015	
20	84 400 020	84 400 056	84 400 156	84 411 120	84 411 141	84 401 520	84 410 020	84 414 020	84 406 020	84 402 020	84 401 020	
25	84 400 025	84 400 057	84 400 157	84 411 125	84 411 142	84 401 525	84 410 025	84 414 025	84 406 025	84 402 025	84 401 025	
30	84 400 060	84 400 058	84 400 158						84 406 030			
Page	20	20	20	34	34	34	22	22	28	20	20	
	EN2592		EN2665		EN2794		EN2995		EN2996		EN3661	
Rate (A)	Code M	Code U	003	004	003	004	004	005	004	005	004	
	DPMU	DPMU	DGMT	DGMT	DGMU	DGMU	DPMU	DPMU	DPMU	DPMU	DGMU	
1	84 412 001	84 411 001					84 401 801	84 401 601	84 411 801	84 411 601		
2	84 412 002	84 411 002					84 401 802	84 401 602	84 411 802	84 411 602		
2.5	84 412 012	84 411 012					84 401 812	84 401 612	84 411 812	84 411 612		
3	84 412 003	84 411 003					84 401 803	84 401 603	84 401 803	84 411 603		
4	84 412 004											
5	84 412 005	84 411 005					84 401 805	84 401 605	84 411 805	84 411 605		
7.5	84 412 007	84 411 007					84 401 807	84 401 607	84 411 807	84 411 607		
10	84 412 010	84 411 010					84 401 810	84 401 610	84 411 810	84 411 610		
15	84 412 015	84 411 015	84 313 015		84 306 015		84 401 815	84 401 615	84 411 815	84 411 615		
20	84 412 020	84 411 020	84 313 020	84 313 036	84 306 020	84 306 016	84 401 820	84 401 620	84 411 820	84 411 620	84 306 320	
25	84 412 025	84 411 025	84 313 025	84 313 037	84 306 025	84 306 017	84 401 825	84 401 625	84 411 825	84 411 625	84 306 325	
30					84 306 030		84 401 830	84 401 630			84 306 330	
35					84 313 035	84 313 038	84 306 035	84 306 018			84 306 335	
40					84 313 041		84 306 080				84 306 340	
50					84 313 050	84 313 058	84 306 050	84 306 019			84 306 350	
Page	22	22	26	26	24	24	20	20	22	22	24	
	EN3661		EN3662		EN3773		EN3774		GAM TI-TII-40 / Air 6.625-403			
Rate (A)	005	006	004	005	006	004	006	004	006	DPMU		
	DGMU	DGMU	DGMT	DGMT	DGMT	DPMU	DPMU	DPMU	DPMU	DGMU		
1						84 401 050	84 408 001	84 413 001	84 411 001	84 418 001	84 405 001	
2						84 401 051	84 408 002	84 413 002	84 411 002	84 418 002	84 405 002	
2.5						84 401 052	84 408 012	84 413 012	84 411 012	84 418 012	84 405 012	
3						84 401 053	84 408 003	84 413 003	84 411 003	84 418 003	84 405 003	
5						84 401 054	84 408 005	84 413 005	84 411 005	84 418 005	84 405 005	
7.5						84 401 055	84 408 007	84 413 007	84 411 007	84 418 007	84 405 007	
10						84 401 056	84 408 010	84 413 010	84 411 010	84 418 010	84 405 010	
15						84 401 057	84 408 015	84 413 015	84 411 015	84 418 015	84 405 015	
20	84 306 620	84 306 655	84 313 320	84 313 620	84 313 631		84 401 058	84 408 020	84 413 020	84 411 020	84 418 020	84 405 020
25	84 306 625	84 306 653	84 313 325	84 313 625	84 313 632		84 401 059	84 408 025	84 413 025	84 411 025	84 418 025	84 405 025
30	84 306 630		84 313 330	84 313 630								
35	84 306 635	84 306 654	84 313 335	84 313 635	84 313 633							
50	84 306 650	84 306 652	84 313 350	84 313 650	84 313 634							
Page	24	24	26	26	26	20	30	22	22	30	32	
	LN29886 / LN29887		VG 95345-TEIL 6		VG 95345-TEIL 11		FROG LEGS - BUS BARS					
Rate (A)	001 to 014	101 to 114	001 to 014	101 to 114	45°	60°	45°	60°	extended trip	extended trip		
	DPMU	DPMU	DPMU	DPMU	DPMU	DPMU	DPMU	DPMU	DGMU	DGMU		
1	84 402 001	84 402 801	84 412 001	84 412 801	84 437 001	84 437 201	84 417 001	84 417 201				
2	84 402 002	84 402 802	84 412									

# SMALL MODEL CIRCUIT BREAKER SINGLE POLE

DPMU



## REFERENCES

Rating	No signal contact								Non polarised / polarised signal contact							
1 A	84 400 001	84 400 048/148	84 402 001	84 400 248	84 401 001	84 401 050	84 440 001	84 400 801/601	84 401 801/601	84 402 801/601						
2 A	84 400 002	84 400 049/149	84 402 002	84 400 249	84 401 002	84 401 051	84 440 002	84 400 802/602	84 401 802/602	84 402 802/602						
2.5 A	84 400 012	84 400 050/150	84 402 012	84 400 250	84 401 012	84 401 052	84 440 012	84 400 812/612	84 401 812/612	84 402 812/612						
3 A	84 400 003	84 400 051/151	84 402 003	84 400 251	84 401 003	84 401 053	84 440 003	84 400 803/603	84 401 803/603	84 402 803/603						
4 A				84 400 261												
5 A	84 400 005	84 400 052/152	84 402 005	84 400 252	84 401 005	84 401 054	84 440 005	84 400 805/605	84 401 805/605	84 402 805/605						
6 A				84 402 006												
7.5 A	84 400 007	84 400 053/153	84 402 007	84 400 253	84 401 007	84 401 055	84 440 007	84 400 807/607	84 401 807/607	84 402 807/607						
10 A	84 400 010	84 400 054/154	84 402 010	84 400 254	84 401 010	84 401 056	84 440 010	84 400 810/610	84 401 810/610	84 402 810/610						
15 A	84 400 015	84 400 055/155	84 402 015	84 400 255	84 401 015	84 401 057	84 440 015	84 400 815/615	84 401 815/615	84 402 815/615						
20 A	84 400 020	84 400 056/156	84 402 020	84 400 256	84 401 020	84 401 058	84 440 020	84 400 820/620	84 401 820/620	84 402 820/620						
25 A	84 400 025	84 400 057	84 402 025	84 400 257	84 401 025	84 401 059	84 440 025	84 400 825/625	84 401 825/625	84 402 825/625						
30 A	84 400 060	84 400 058	84 402 030	84 400 230				84 400 860/660	84 401 830/630	84 402 830/630						

Ratings 0.5; 0.75; 1.5 A are available.

Mounting hardware	HV									
Threaded barrel	M12-0.75									
	M12-100									
7/16		●	●	●	●	●	●	●	●	●

Button	HV									
Green color	●	●	●	●	●	●	●	●	●	●
Black color		●	●	●	●	●	●	●	●	●
Long neck option		●	●	●	●	●	●	●	●	●

Conformity standard	HV									
EN 2495		M		U		004		004/005		
EN 2995										
EN 3773										
AS33201 - MS3320	●	QPL		QPL						
VG 95345 TEIL 6										
BACC 18Z818AD like										

Mass / MTBF / Vibration / Technical file	HV							
Mass without mounting hardware (g)	< 18	< 18	< 18	< 18	< 18	< 18	< 20	< 20
Mass with mounting hardware (g)	< 21	< 20	< 20	< 20	< 20	< 20	< 22	< 22
MTBF FH (Typical)	> 7.2 M	> 7.2 M	> 7.2 M	> 7.2 M	> 7.2 M	> 7.2 M	> 3.6 M	
Vibrations, for detail see below	MIL	MIL	VG	HV	EN	EN	EN	VG
Technical File	SP4374/9944	SP9930	SP4356					

## GENERAL CHARACTERISTICS

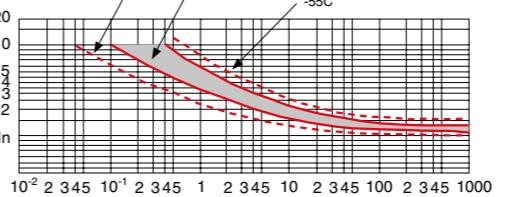
Electrical	28 VDC	115 VAC (400 Hz)	115 VAC 60 Hz-230 VAC 50 Hz
Breaking current 1co + 2OCC	6000 A	2500 A	
Dielectric	1500 V	1500 V	
Endurance cycles	5000 (with L/R: 5 ms)	5000 (with cos fi: 0.7)	
Insulation resistance	above 100 MΩ	above 100 MΩ	
Working life (endurance) at 5x RC	50 cycles	50 cycles	
Auxiliary contact current	0.1..0.2 A	0.1..0.2 A	
Voltage drop compliance	EN2495/2995/MS3320/AS33201	EN2495/2995/MS3320/AS33201	

Mechanical	3,5N< push<45N / 5N<pull<30N
Endurance	without load: 5000 cycles resistive load: 2500 cycles
Tightening torque	barrel nut: recommended: 4 ± 0.25 N.m maximum : 5.0 N.m terminal screw: recommended: 1.6 ± 0.1 N.m maximum : 2.0 N.m

Environmental	48h 5% NaCl	MIL & VG (at 71°C)	MIL (High Vibrations)
Humidity: Test b	RTCA DO160 10 cycles		
Operating temperature	-60°C +125°C for all ratings except 30 A: - 60°C + 90°C		
Acceleration (centrifugal)	17 g		
Vibrations	EN (at 70°C)	10 g-PK and 5g-PK after 500Hz at 90% of RC	20 g-PK at 100 % of RC and 15 g-PK at 0% of RC
Sinusoidal (80..2000 Hz)	10 g-PK and 5g-PK after 500Hz at 90% of RC	9.26 Grms at 100 % of RC	16.9 Grms at 90 % of RC
Random (10.. 2000 Hz)	5.82 Grms at 90% of RC	50 g halfsine 11 msec 6 directions	75 g halfsine 6 msec 6 directions
Shock	50 g halfsine 11 msec 6 directions		

## CURVES

Trip times envelope for temperature from -55°C to 125°C (direct overload)



Maximum and minimum limit of ultimate trip

# SMALL MODEL CIRCUIT BREAKER THREE POLE DPMT



## REFERENCES

Rating	No signal contact				Non polarised/polarised signal contact				
	84 410 001	84 411 001	84 412 001	84 413 001	84 414 001	84 450 001	84 410 801/601	84 411 801/601	84 412 801/601
1 A	84 410 002	84 411 002	84 412 002	84 413 002	84 414 002	84 450 002	84 410 802/602	84 411 802/602	84 412 802/602
2 A	84 410 012	84 411 012	84 412 012	84 413 012	84 414 012	84 450 012	84 410 812/612	84 411 812/612	84 412 812/612
2.5 A	84 410 003	84 411 003	84 412 003	84 413 003	84 414 003	84 450 003	84 410 803/603	84 411 803/603	84 412 803/603
3 A	84 410 004								
4 A	84 410 005	84 411 005	84 412 005	84 413 005	84 414 005	84 450 005	84 410 805/605	84 411 805/605	84 412 805/605
5 A	84 410 006								
6 A	84 410 007	84 411 007	84 412 007	84 413 007	84 414 007	84 450 007	84 410 807/607	84 411 807/607	84 412 807/607
7.5 A	84 410 010	84 411 010	84 412 010	84 413 010	84 414 010	84 450 010	84 410 810/610	84 411 810/610	84 412 810/610
10 A	84 410 015	84 411 015	84 412 015	84 413 015	84 414 015	84 450 015	84 410 815/615	84 411 815/615	84 412 815/615
15 A	84 410 020	84 411 020	84 412 020	84 413 020	84 414 020	84 450 020	84 410 820/620	84 411 820/620	84 412 820/620
20 A	84 410 025	84 411 025	84 412 025	84 413 025	84 414 025	84 450 025	84 410 825/625	84 411 825/625	84 412 825/625
25 A	84 410 030	84 411 030	84 412 030	84 413 030	84 414 030	84 450 030			
30 A									
<b>Mounting hardware</b>									
Threaded barrel	M12-0.75	M12-100							
	7/16								
Terminal Screw	8-32 UNC	M4							
Terminal	Offset	Offset	Offset	Offset	Aligned	Offset	Offset	Offset	
<b>Button</b>									
Green color									
Black color									
Long neck									
<b>Conformity standard</b>									
EN 2592	U	M							
EN 3774	004	003							
EN 2996									
VG 95345 TEIL 11									
AS 14154B/MS14154									
BACC 18AC&18AE like									
<b>Mass / MTBF / Vibration / Technical file</b>									
Mass without mounting hardware (g)	< 46								
Mass with mounting hardware (g)	< 55	< 60							
MTBF FH (Typical)	> 1,2 M								
Vibration, for detail see below	MIL	EN	VG	EN	MIL	EN	EN	EN	
Technical File	-	-	-	-	-	-	-	-	

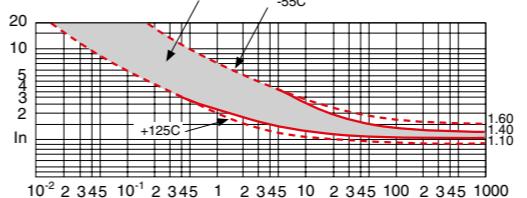
## GENERAL CHARACTERISTICS

Electrical	
Breaking current 1CO + 2OCO	115/200 VAC (400 Hz)
Dielectric	2000 A
Endurance (electrical overloads)	1500 V
Insulation resistance	5000 (with cos fi: 0.7)
Working life (endurance) at 5xRC	above 100 MO
Auxiliary contact current	50 cycles
Voltage drop compliance	0.1..0.2 A
	MS14154/AS14154A/EN2592/2996/3774
Mechanical	
Operating force	8N<push<80N / 5N<pull<30N
Endurance (manual open/close)	no load / 5000 cycles
Tightening torque	on resistive load / 5000 cycles
	barrel nut: recommended: 4 ± 0.25 N.m maximum : 5.0 N.m terminal screw: recommended: 1.6 ± 0.1 N.m maximum : 2.0 N.m
Environmental	
Salt spray	48h 5% NaCl
Humidity: Test b	RTCA DO160 10 cycles
Operating temperature	-60°C +125°C for all ratings except 30 A: -60°C + 90°C
Acceleration (centrifugal)	17 g
Vibrations	EN (at 70°C)
Sinusoidal (80..2000 Hz)	10 g-PK and 5g-PK after 500Hz at 90 % of RC
Random (10..2000 Hz)	5.82 Grms at 90 % of RC
Shock	50 g halfsine 11 msec 6 directions
	MIL & VG (at 71°C)
	10 g-PK at 100% of RC & 15 g-PK at 0% of RC
	9.26 Grms at 100 % of RC
	50 g halfsine 11 msec 6 directions

CONTACT CROUZET

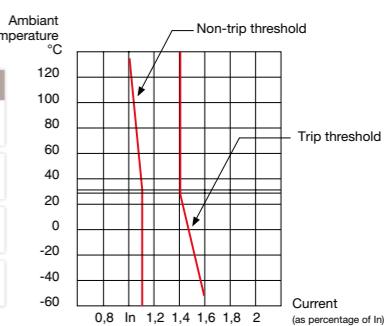
## CURVES

Trip times envelope for temperature from -55°C to 125°C (direct overload)



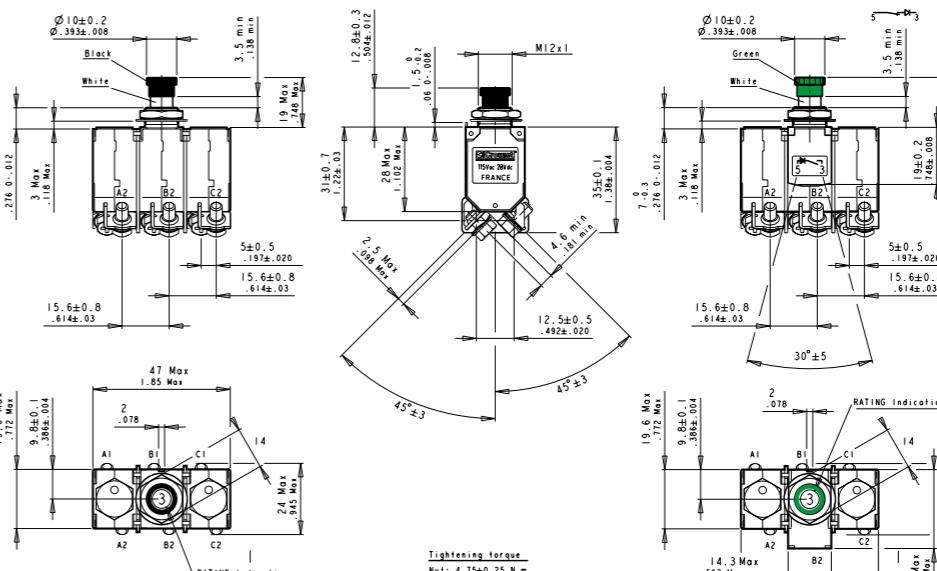
## Maximum and minimum limit of ultimate trip

Rating	1.5 → 5 A	7.5 → 25 A
Non tripping point at 25°C	1.15 * RC	1.15 * RC
Tripping point at 25°C	1.4 * RC	1.4 * RC
Tripping time at 2 * RC	2 s → 15 s	4 s → 20 s
Non tripping point at 125°C	1 * RC	1 * RC



## DIMENSIONS

84 411 0      84 412 0  
84 413 0      84 414 0



Tightening torque  
Nut: 4.75±0.25 N.m  
Screw: 1.7±0.1 N.m

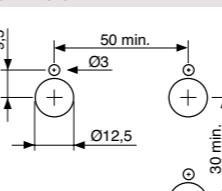
84 411 6      84 411 8  
84 412 8      84 413 6

Tightening torque  
Nut: 4.75±0.25 N.m  
Screw: 1.7±0.1 N.m

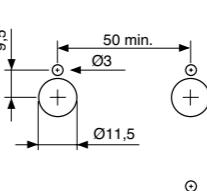
## PANEL CUTOUT RECOMMENDATION

Thickness: 1.6 mm → 3 mm

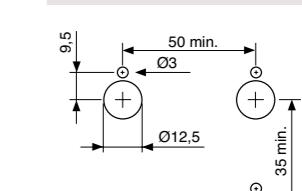
84 411 0      84 412 0  
84 413 0



84 414 0



84 411 6      84 411 8  
84 412 8      84 413 6



# BIG MODEL CIRCUIT BREAKER SINGLE POLE

## DGMU



## REFERENCES

Rating	No signal contact	No signal contact long trip time	Non polarised/polarised signal contact	Polarised signal contact
15 A	84 306 015		84 306 320/620	84 306 316/616
20 A	84 306 020	84 306 016	84 306 325/625	84 306 317/617
25 A	84 306 025	84 306 017	84 306 825	84 306 643/653
30 A	84 306 030		84 306 830	84 306 330/630
35 A		84 306 035	84 306 835	84 306 335/635
40 A		84 306 080	84 306 840	84 306 340/640
50 A	84 306 050	84 306 019	84 306 850	84 306 350/650
60 A			84 306 860	84 306 319/619
				84 306 642/652
				84 306 321/621

## Mounting hardware

Threaded barrel	M12-0.75 M12-100 7/16
Terminal Screw	8-32 UNC M4
Hole ø.5 for Bus-Bar & 40° angle	

## Button

Green color	
Black color	

## Conformity standard

EN 2794	003	004	004/005	004/005	006
EN 3661					
BACC 18R&18X like					

## Mass / MTBF / Vibration / Technical file

Mass without mounting hardware (g)	61	61	66
Mass with mounting hardware (g)	65	65	70
MTBF FH (Typical)	> 10 M	> 10 M	> 6 M
MIL vibration condition Sinus/Random	A & C	A & C	A & C
Technical File	-	SP4393	-
		SP4393	SP9300

## GENERAL CHARACTERISTICS

## Electrical

28 VDC	115 VAC (400 Hz)	115 VAC 60 Hz-230 VAC 50Hz
Breaking current 1co + 2OCC	4000 A ; 2000 A long trip	2000 A ; 1500 A long trip
Dielectric	1500 V	1500 V
Endurance (electric overloads)	5000 (with L/R: 5 ms)	5000 (with cos fi: 0.7)
Insulation resistance	above 100 MΩ	above 100 MΩ
Working life (endurance) at 5xRC	50 cycles	50 cycles
Voltage drop compliance	EN2794/3661	EN2794/3661

CONTACT CROUZET

## Mechanical

Operating force	3,5N<push<55 N / 5N<pull<40 N
Endurance (manual open/close)	no load : 5 000 cycles
Tightening torque	on resistive load : 2 500 cycles

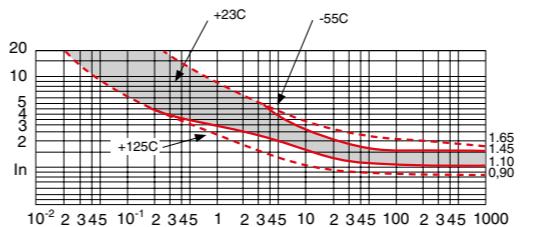
barrel nut: recommended:  $4 \pm 0.25$  N.m maximum : 5.5 N.m terminal screw: recommended:  $2.35 \pm 0.15$  N.m maximum : 2.5 N.m

## Environmental

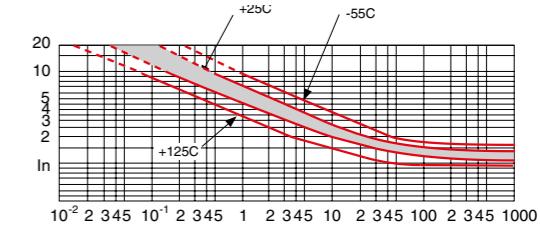
Salt spray	48h / 5% NaCl
Humidity: Test b	RTCA DO160 / 10 cycles
Operating temperature	-60°C +125°C
Acceleration (centrifugal)	up to 17g
Shock	50 g 3 halfsine 1 msec 6 directions
Vibration (sinusoidal)	10 g-PK from 70 to 20000 Hz (MIL STD202 method 204 D condition A with 90 % of RC)
Vibration (random at RC)	9.26 Grms (MIL STD202 method 214 A condition C with 90 % of RC)

## CURVES

## Standard trip time (EN compliant)

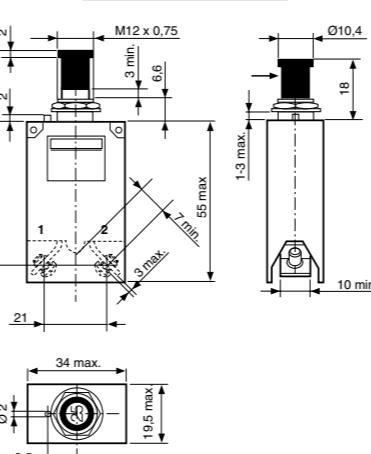


## Long trip time

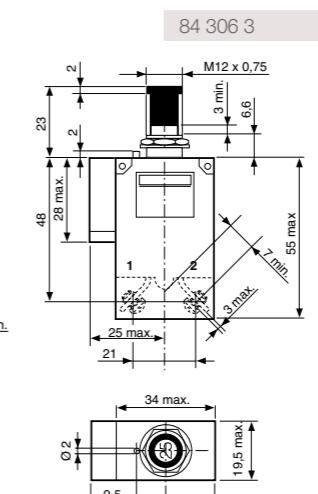


## DIMENSIONS

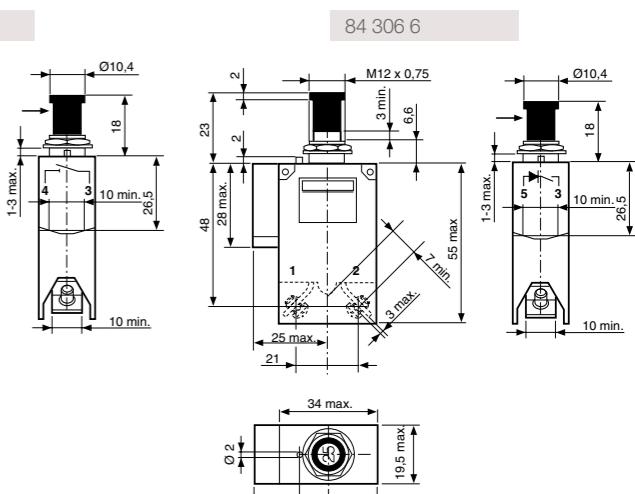
## 84 306 0 &amp; 84 306 8



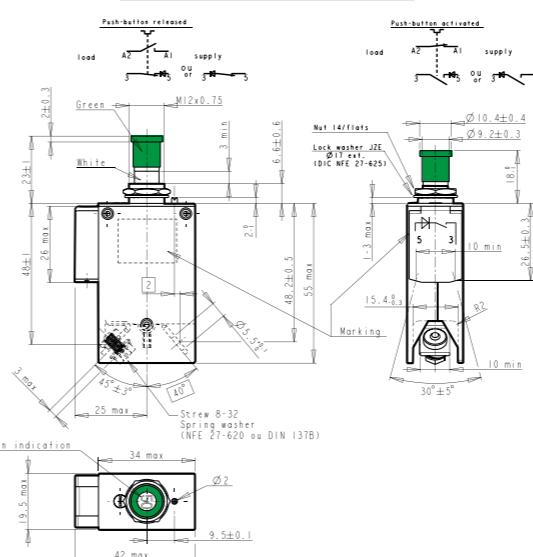
## 84 306 3



## 84 306 6



## 84 306 6 Bus-Bar EN 3661-006

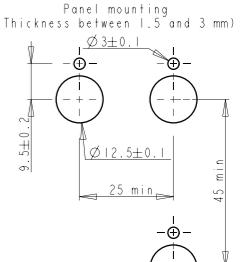
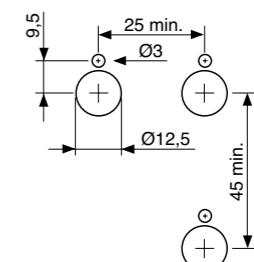


## PANEL CUTOUT RECOMMENDATION

Thickness 1.6 mm → 3 mm

## Versions 84 306 0 - 3 - 6

## 84 306 6 Bus-Bar EN 3661-006



# BIG MODEL CIRCUIT BREAKER THREE POLE

DGMT



## REFERENCES

Rating	No signal contact	No signal contact long trip time	Non polarised/polarised signal contact	Polarised signal contact
15 A	84 313 015			
20 A	84 313 020	84 313 036	84 313 061	84 313 820
25 A	84 313 025	84 313 037	84 313 062	84 313 825
30 A				84 313 830
35 A	84 313 035	84 313 038	84 313 063	84 313 835
41 A		84 313 041		84 313 840
50 A	84 313 050	84 313 058	84 313 066	84 313 850
60 A				84 313 860
<b>Mounting hardware</b>				
Threaded barrel	M12-0.75 M12-100 7/16			
Terminal Screw	8-32 UNC M4			
	Hole ø5.5 for Bus-Bar & 40° angle			
<b>Button</b>				
Green color				
Black color				
<b>Conformity standard</b>				
EN 2665	003	004		
EN 3662			004/005	004/005
10-60806 like			006	
<b>Mass / MTBF / Vibration / Technical file</b>				
Mass without mounting hardware (g)	156	156	161	
Mass with mounting hardware (g)	165	165	170	
MTBF FH (Typical)	> 5 M	> 5 M	> 26 M	
MIL vibration condition Sinus/Random	A & C	A & C	A & C	
Technical File	-	SP4679	ASNE459	-
			SP4340	SP4346

## GENERAL CHARACTERISTICS

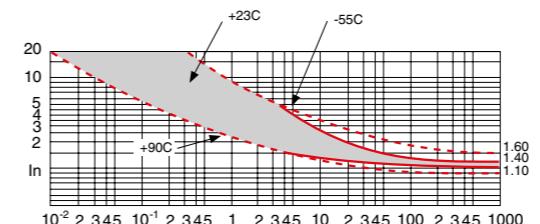
Electrical		115/200 VAC (400 Hz) 2000 A ; 1500 A long trip	115/200 VAC 60 Hz-230/400 VAC 50 Hz	CONTACT CROUZET
Breaking current 1CO + 2OCCO				
Dielectric		1500 V		
Endurance (electric overloads)		5000 (with cos fi: 0.7)		
Insulation resistance		above 100 MΩ		
Working life (endurance) at 5xRC		50 cycles		
Auxiliary contact current		0.1...0.2 A		
Voltage drop compliance		EN2665/3662		
Mechanical		20N<push<80N / 5N<pull<45N no load : 5000 cycles on resistive load : 2500 cycles		
Operating force				
Endurance (manual open/close)				
Tightening torque		barrel nut: recommended: 4 ± 0.25 N.m maximum: 5.5 N.m terminal screw: recommended: 2.35 ± 0.15 N.m maximum: 2.5 N.m		
Environmental				
Salt spray		48h / 5% NaCl		
Humidity: Test b		RTCA DO160 / 10 cycles		
Operating temperature		-55°C +90°C		
Acceleration		up to 40 g		
Shock		50 g 3 halfsine 11 msec 6 directions		
Vibration (sinusoidal)		10 g-PK from 70 to 20000 Hz (MIL STD202 method 204 D condition A with 90 % of RC)		
Vibration (random at RC)		9.26 Grms (MIL STD202 method 214 A condition C with 90 % of RC)		

# BIG MODEL CIRCUIT BREAKER THREE POLE

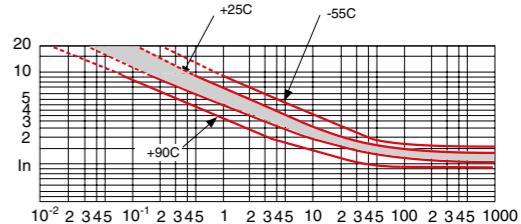
DGMT

## CURVES

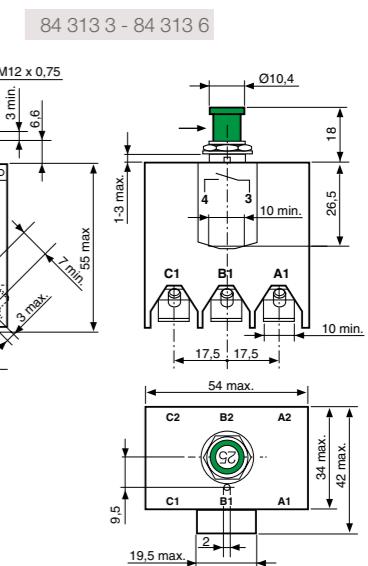
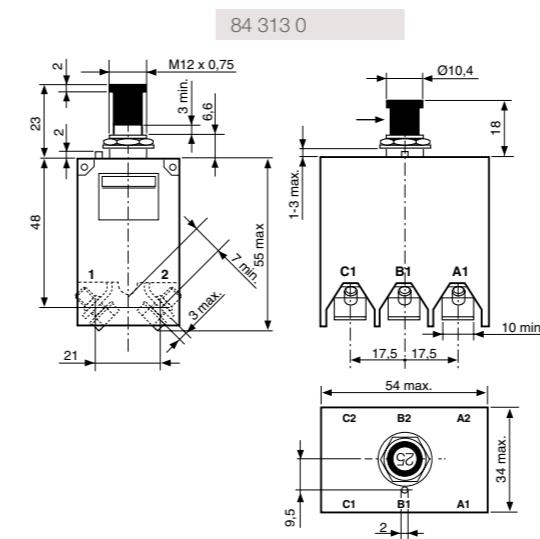
## Standard trip time (EN compliant)



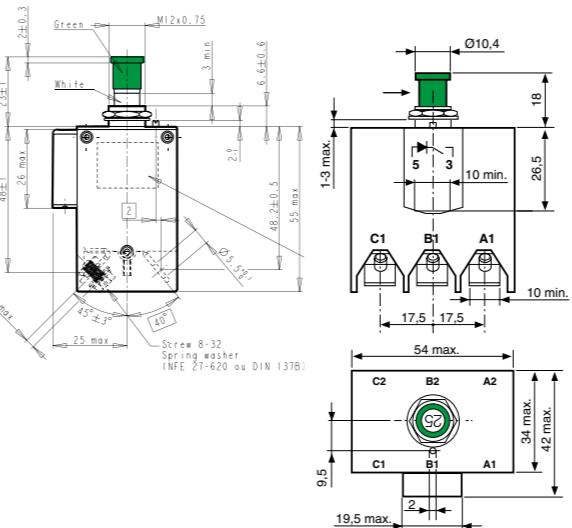
## Long trip time



## DIMENSIONS

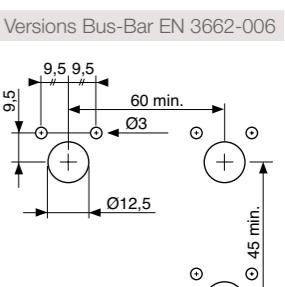
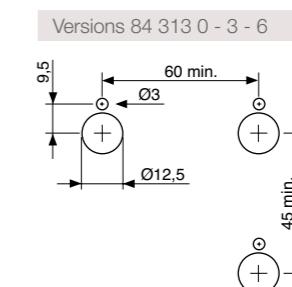


## 84 313 6 Bus-Bar EN 3662-006



## PANEL CUTOUT RECOMMENDATION

Thickness 1.6 mm → 3 mm



# FROG LEGS TERMINALS

## SMALL MODEL CIRCUIT BREAKER



## REFERENCES

Rating	1 pole 45°	1 pole 45°	1 pole 60°	3 pole 45°	3 pole 60°
0.5 A	84 406 011				
1 A	84 406 001	84 437 001	84 437 201	84 417 001	84 417 201
2 A	84 406 002	84 437 002	84 437 202	84 417 002	84 417 202
2.5 A	84 406 012	84 437 012	84 437 212	84 417 012	84 417 212
3 A	84 406 003	84 437 003	84 437 203	84 417 003	84 417 203
4 A*					
5 A	84 406 005	84 437 005	84 437 205	84 417 005	84 417 205
6 A*					
7.5 A	84 406 007	84 437 007	84 437 207	84 417 007	84 417 207
10 A	84 406 010	84 437 010	84 437 210	84 417 010	84 417 210
15 A	84 406 015	84 437 015	84 437 215	84 417 015	84 417 215
20 A	84 406 020	84 437 020	84 437 220	84 417 020	84 417 220
25 A	84 406 025	84 437 025	84 437 225	84 417 025	84 417 225
30 A		84 437 030	84 437 230	84 417 030	84 417 230

\* contact Crouzet for this rating

## Mounting hardware

Threaded barrel	M12-0.75
	M12-100
7/16	
Terminal Screw	6-32 UNC
	M4

## Button color

Green	
Black	

## Conformity standard

EN 2495*	
EN 2995*	
EN 2592*	
EN 2996*	
EN 3774*	
MS26574 **	
* for performance ** for terminal configuration	

## Mass/MTBF/technical file

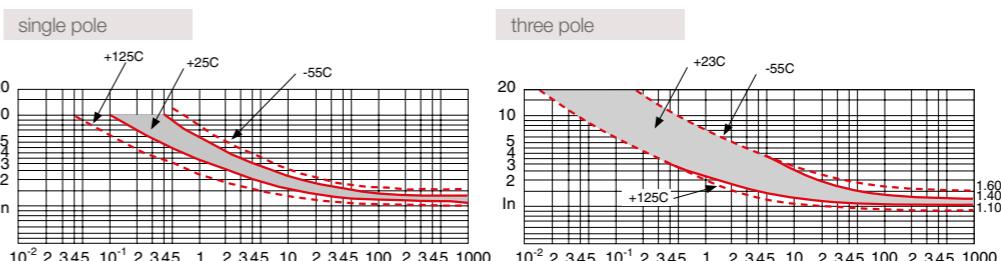
Mass without mounting hardware (g)	< 18	< 18	< 19	< 54	< 56
Mass with mounting hardware (g)	< 20	< 20	< 21	< 63	< 65
MTBF FH (Typical)	> 7.2 M	> 7.2 M	> 7.2 M	> 1.7 M	> 1.7 M
Technical file	SP 990100	SP 991700	SP 992000	SP 991900	SP 992100

## GENERAL CHARACTERISTICS

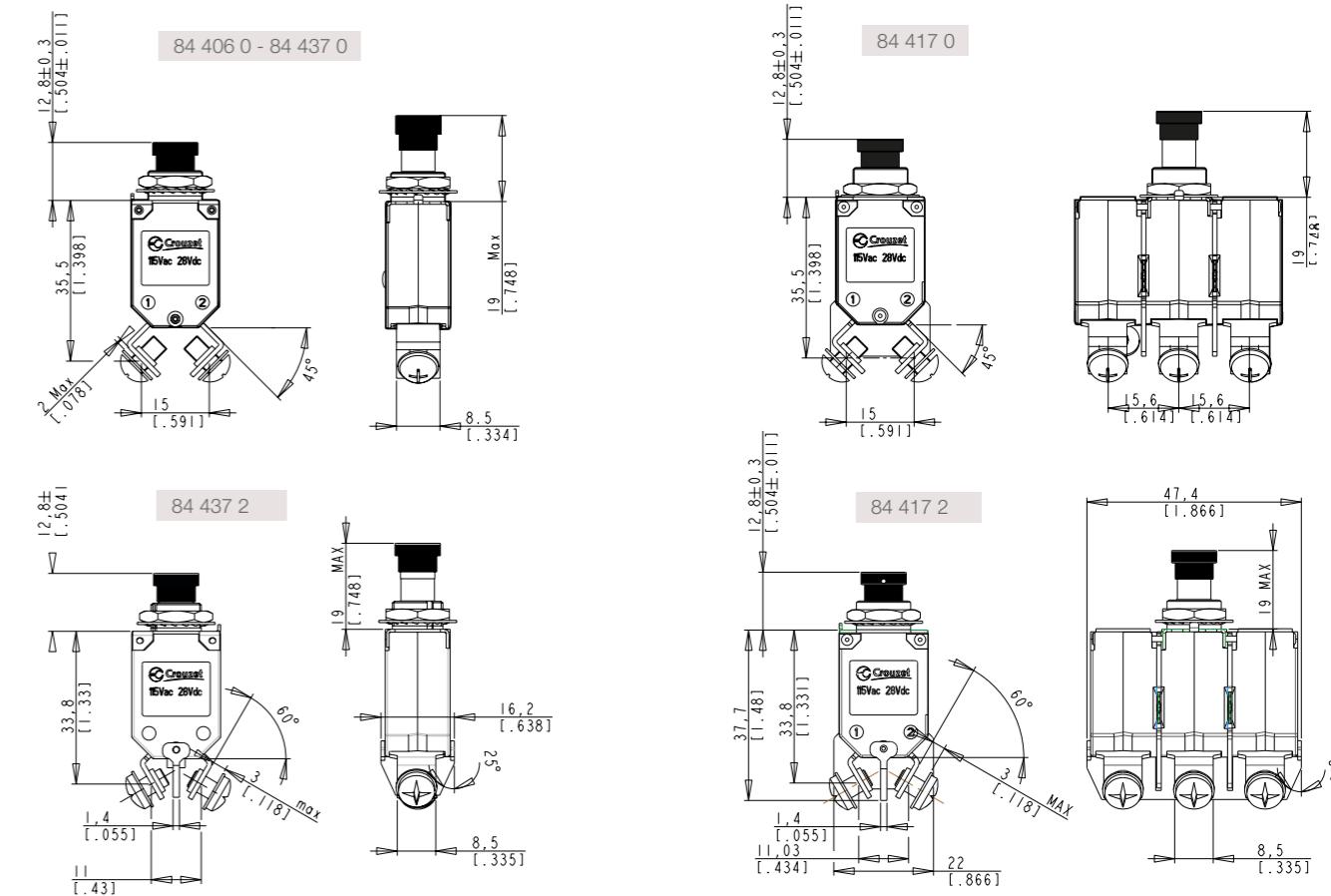
Electrical	Single Pole	Three pole
Breaking current 1CO + 2OCC	28 VDC 6000 A 1500 V	115 VAC (400 Hz) 2500 A 1500 V
Dielectric	5000 (with L/R: 5 ms) above 100 MΩ	5000 (with cos fi: 0.7) above 100 MΩ
Endurance cycles	50 cycles	50 cycles
Insulation resistance	0.1..0.2 A	0.1..0.2 A
Working life (endurance) at 5xRC	EN2495/2995/MS3320/AS33201	EN2495/2995/MS3320/AS33201
Auxiliary contact current (if present)		0.1..0.2 A
Voltage drop compliance	EN2495/2995/MS3320/AS33201	MS14154/AS14154A/EN2592/2996/3774
Mechanical		
Operating force	3.5N<push<45N / 5N-pull<30N mechanical (no load) 5 000 cycles on resistive load 2 500 cycles recommended: 4 ± 0.25 N.m maximum : 5.0 N.m recommended: 1.6 ± 0.1 N.m maximum : 2.0 N.m	8N-push<80N / 5N-pull<80N mechanical (no load) 5000 cycles on resistive load 2500 cycles recommended: 4±0.25 N.m maximum: 5.0 N.m recommended: 1.6±0.1 N.m maximum: 2.0 N.m
Endurance		
Tightening torque (barrel nut)		
Tightening torque (terminal screw)		
Environmental		
Salt spray	48h 5% NaCl	
Humidity: Test b	RTCA DO160 10 cycles	
Operating temperature	-60°C +125°C for all ratings except 30 A: - 60°C + 90°C	
Acceleration (centrifugal)	up to 40 g	
Shock	50 g alfsine 11 msec	

## CURVES

Trip times envelope for temperature from -55°C to 125°C (direct overload)

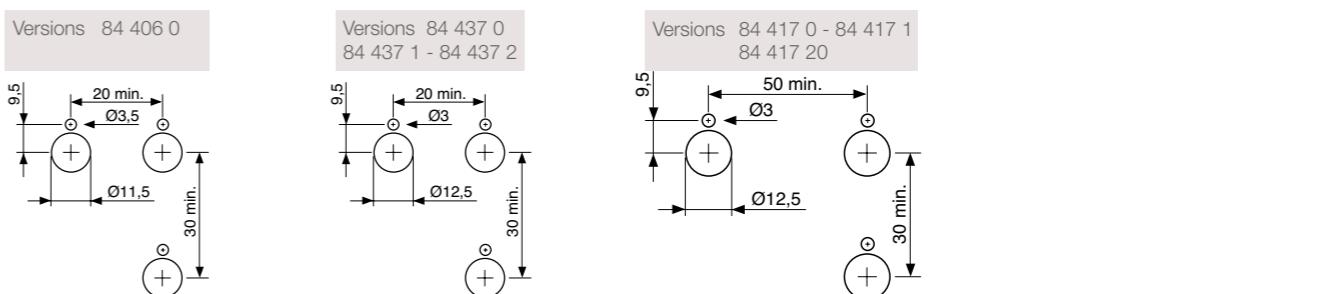


## DIMENSIONS



## PANEL CUTOUT RECOMMENDATION

Thickness 1.6 mm → 3 mm



## Maximum and minimum limit of ultimate trip

Rating	1.5 → 5 A	7.5 → 25 A
Non tripping point at 25°C	1.15 * RC	1.15 * RC
Tripping point at 25°C	1.4 * RC	1.4 * RC
Tripping time at 2 * RC	2 s → 15 s	4 s → 20 s
Non tripping point at 125°C	1 * RC	1 * RC

# PUSH-PULL PUSH-FIT 6.3 MM BLADE

## SMALL MODEL CIRCUIT BREAKER



### REFERENCES

Rating	no auxiliary contacts	no auxiliary contacts	no polarised/polarised	no auxiliary contacts
0.5 A		84 408 111		84 418 011
1 A	84 408 001	84 408 101	84 408 801/601	84 418 001
2 A	84 408 002	84 408 102	84 408 802/602	84 418 002
2.5 A	84 408 012	84 408 112	84 408 812/612	84 418 012
3 A	84 408 003	84 408 103	84 408 803/603	84 418 003
4 A	84 408 004	84 408 104	84 408 804/604	84 418 004
5 A	84 408 005	84 408 105	84 408 805/605	84 418 005
6 A	84 408 006	84 408 106	84 408 806/606	84 418 006
7.5 A	84 408 007	84 408 107	84 408 807/607	84 418 007
10 A	84 408 010	84 408 110	84 408 810/610	84 418 010
15 A	84 408 015	84 408 115	84 408 815/615	84 418 015
20 A	84 408 020	84 408 120	84 408 820/620	84 418 020
25 A	84 408 025	84 408 125	84 408 625/825	84 418 025
<b>Mounting hardware</b>				
Straight terminals without screws	●	●	●	●
Barrel threadings				
Conical barrel	●	●	●	●
<b>Button</b>				
Green color	●			
Black color		●		
Long neck (long button)		●	●	●
<b>Conformity standard</b>				
EN 2495*	●			
EN 2995*		004	005	
EN3773-006	●	●		
EN3774-006		●		
AS 33201	●		●	
* for thermal performance and auxiliary contact performance				
<b>Mass/MTBF / Technical file</b>				
No mounting hardware	< 14,5	< 15,5	< 16,5	< 51
MTBF FH (typical)	> 7,2 M	> 7,2 M	> 3,6 M	> 1,7 M
Technical file	SP 991600	SP 991800	SP 991800	SP 991500

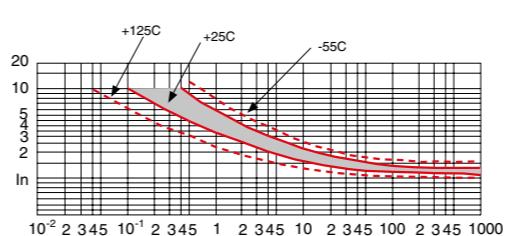
### GENERAL CHARACTERISTICS

Electrical		Single pole	Three pole	
28 VDC	115 VAC (400 Hz)	115/200 VAC (400 Hz)	2000 A	
Breaking current 1CO + 2OCC	6000 A	2500 A	1500 V	
Dielectric	1500 V	1500 V	5000 (with L/R: 5 ms)	
Endurance cycles	5000 (with L/R: 5 ms)	5000 (with cos fi: 0.7)	5000 (with cos fi: 0.7)	
Insulation resistance	above 100 MΩ	above 100 MΩ	above 100 MΩ	
Working life (endurance) at 5xRC	50 cycles	50 cycles	50 cycles	
Auxiliary contact current (if present)	0.1..0.2 A	0.1..0.2 A	0.1..0.2 A	
Voltage drop compliance	EN2495/2995/MS3320/AS33201	EN2495/2995/MS3320/AS33201	MS14154/AS14154A/EN2592/2996/3774	
Mechanical				
Operating force	3,5N < push < 45N / 5N < pull < 30N mechanical (no load) 5 000 cycles on resistive load 2 500 cycles	8N < push < 80N / 5N < pull < 80N mechanical (no load) 5000 cycles on resistive load 2500 cycles	6,3 ± 0,1 [0.248 ± 0.003]	13 ± 0,6 [0.512 ± 0.023]
Endurance			recommended: 4 ± 0.25 N.m maximum : 5.0 N.m recommended: 1.6 ± 0.1 N.m maximum : 2.0 N.m	15,6 ± 0,8 [0.614 ± 0.031]
Tightening torque (barrel nut)	recommended: 4 ± 0.25 N.m maximum : 5.0 N.m			22 [0.866]
Tightening torque (terminal screw)	recommended: 1.6 ± 0.1 N.m maximum : 2.0 N.m			0.8 [0.032]
Environmental				
Salt spray	48h 5% NaCl			12,8 ± 0,3 [0.504 ± 0.011]
Humidity: Test b	RTCA DO160 10 cycles			1,8 [0.071]
Operating temperature	-60°C +125°C for all ratings except 30 A: -60°C +90°C			1,8 [0.071]
Acceleration (centrifugal)	up to 40 g			1,8 [0.071]
Shock	50 g 3 halfsine 11 msec			1,8 [0.071]
Vibration (sinusoidal) single pole	10 g-PK from 70 to 2000 Hz (MIL STD 202 method 204 D condition B with 90% of RC)			1,8 [0.071]
Vibration (random) single pole	9.26 Grms (MIL STD 202 method 214 A condition E with 90% of RC)			1,8 [0.071]

# PUSH-FIT 0.25 INCH TAB

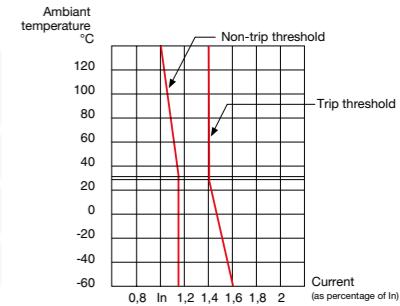
### CURVES

Trip times envelope for temperature from -55°C to 125°C (direct overload)



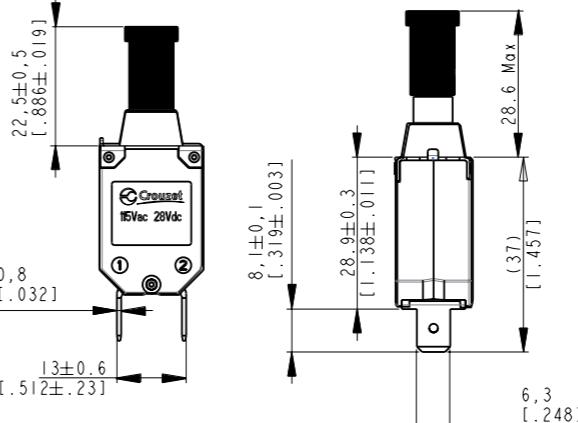
### Maximum and minimum limit of ultimate trip

Rating	1.5 → 5 A	7.5 → 25 A
Non tripping point at 25°C	1.15 * RC	1.15 * RC
Tripping point at 25°C	1.4 * RC	1.4 * RC
Tripping time at 2 * RC	2 s → 15 s	4 s → 20 s
Non tripping point at 125°C	1 * RC	1 * RC

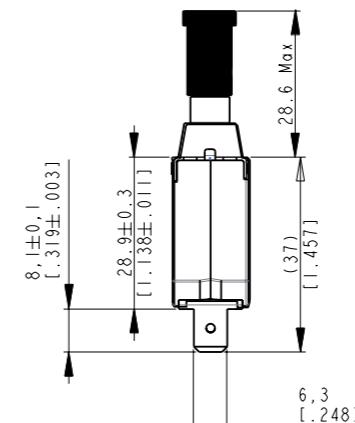


### DIMENSIONS

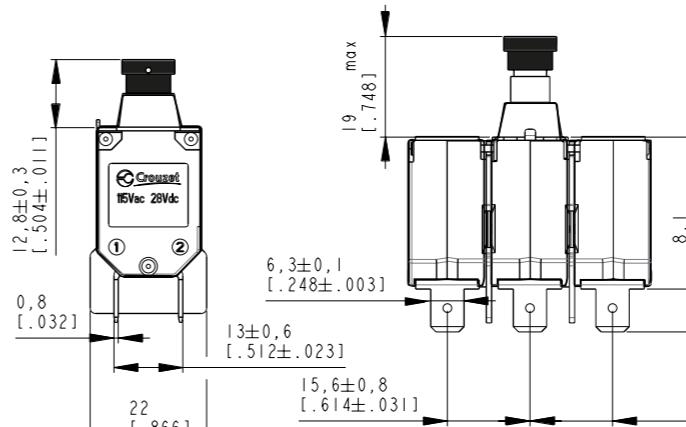
84 408 1



84 408 0

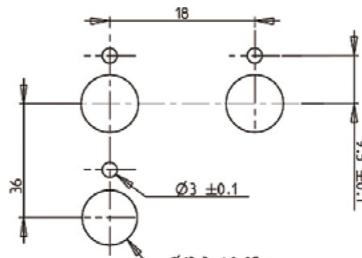


84 418 0



### PANEL CUTOUT RECOMMENDATION

Required panel thickness for centring grommet 79219333: 1.6 mm



# PUSH-PUSH & FLYING LEADS VERSION

## SINGLE POLE SMALL MODEL CIRCUIT BREAKER

Read also p. 48

### REFERENCES

Rating	Faston	Flying leads
1 A	84 405 001	
1.5 A		
2 A	84 405 002	
2.5 A	84 405 012	
3 A	84 405 003	
5 A	84 405 005	84 405 045
7.5 A	84 405 007	
10 A	84 405 010	
15 A	84 405 015	
20 A	84 405 020	
25 A	84 405 025	

### Mounting hardware

	Faston terminal	Barrel nut M12-100 + 500mm flying leads

### Button color

White	●	●

### Conformity standard

Air 6 625-403	●
GAM TI-II-40	
EN 3773-3774*	●

\* our equipment complies with EN standards

### Mass / MTBF / Technical file

Weight	< 15	< 25
MTBF FH (Typical)	> 3.6 M	> 3.6 M
Technical file		SP 4397 & SP 9925

### GENERAL CHARACTERISTICS

#### Electrical

28 VDC	115 VAC (400 Hz)	115 VAC 60 Hz-230 VAC 50 Hz
3000 A	1500 A	
Dielectric	1500 V	1500 V
Endurance cycles	5000	5000
Insulation resistance	above 100 MΩ	above 100 MΩ
Working life (endurance) at 5° RC	1000 cycles	1000 cycles
Auxiliary contact current	0.1..0.2 A	0.1..0.2 A
Voltage drop compliance	EN2495/2995/MS3320/AS33201	EN2495/2995/MS3320/AS33201

CONTACT Crouzet

#### Mechanical

Operating force	no load	40 000 cycles
Endurance	on resistive load	40 000 cycles
Tightening torque (barrel nut)	recommended: 4 N.m ; Max.: 5 N.m	
Tightening torque (terminal screw)	1.7 N.m ±0.1	

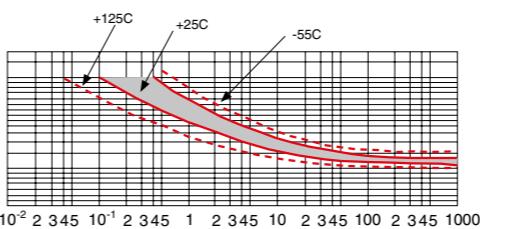
#### Environmental

Salt spray	48h	5% NaCl
Humidity: Test b	RTCA DO160	10 cycles
Operating temperature	-60°C +125°C	
Acceleration	up to 20 g	
Shock	up to 50 g (11 ms)	
Vibration (sinusoidal)		10 g-PK from 10 to 2000 Hz
Vibration (random at RC)		up to 9.26 Grms from 10 to 2000 Hz



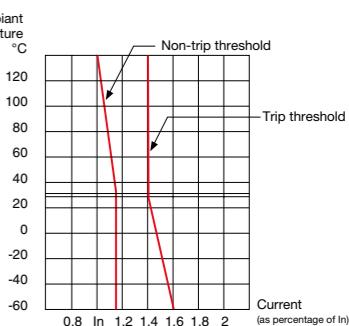
### CURVES

Trip times envelope for temperature from -55°C to 125°C (direct overload)

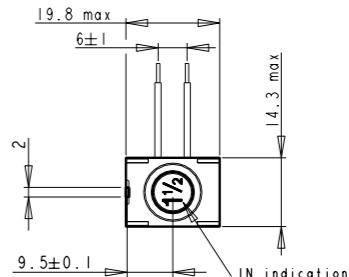
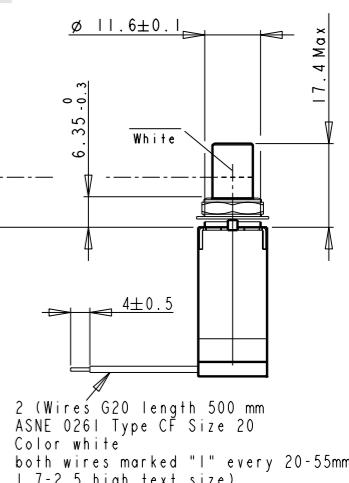
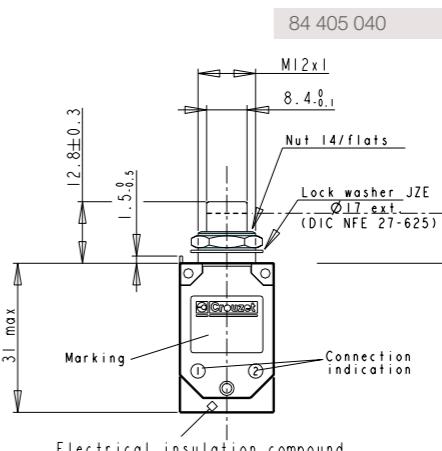
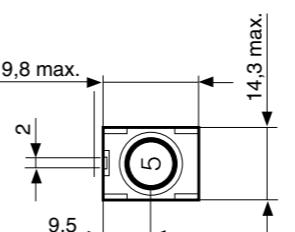
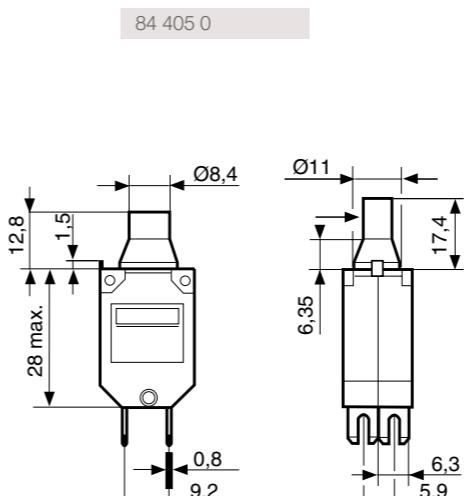


### Maximum and minimum limit of ultimate trip

Rating	1 → 3 A	5 → 25 A	5 → 25 A
Non tripping point at 25°C	1.15 In	1.15 In	1.15 In
Tripping point at 25°C	1.4 In	1.4 In	1.4 In
Tripping time at 2 °RC	2 s → 15 s	4 s → 16 s	6 s → 20 s
Non tripping point at 125°C	In	In	In



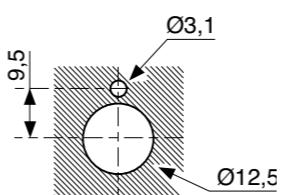
### DIMENSIONS



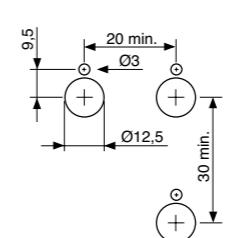
### PANEL CUTOUT RECOMMENDATION

Thickness 1.6 mm → 3 mm

Version 84 405 0



Version 84 405 04X



# GROUND FAULT & ARC FAULT CIRCUIT BREAKER

GF-AFCB 115/200 VAC 360 .. 800 Hz

Read also p. 8-11

## REFERENCES

Rating	GF-AFCB**	Three pole AFCB	Single pole AFCB	Software + Breaker reader
1 A				
3 A	84 411 136	84 411 103	84 401 503	
5 A	84 411 137	84 411 105	84 401 505	
7.5 A	84 411 138	84 411 107	84 401 507	
10 A	84 411 139	84 411 110	84 401 510	
15 A	84 411 140	84 411 115	84 401 515	
20 A	84 411 141	84 411 120	84 401 520	
25 A	84 411 142	84 411 125	84 401 525	
Accessories: breaker reader + CD				84 411 101

\*\* on request the GFCB is available in star or triangle configuration with different thresholds



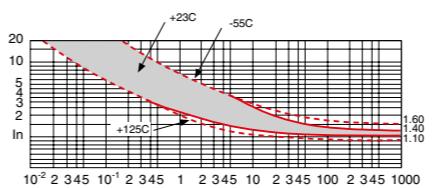
## GENERAL CHARACTERISTICS

Mounting hardware		
Threaded barrel	M12-0.75	
Threading	M12-100	
7/16		
Terminal screw	8-32 UNC	
Screw	M4	
Button color		
Green		
Black		
Conformity standard		
EN 2592 - EN 2996*		
EN 2495*		
AS 5692		
* for thermal part		
Mass / MTBF / Technical file		
Without mounting hardware	< 141	< 141
With mounting hardware	< 150	< 150
MTBF FH (Typical)	> 150 000	> 150 000
GENERAL CHARACTERISTICS		
Electrical		
Breaking current 1CO + 2OCO 2000 A 2000 V 1500 V 5000 (with cos fi: 0.7) above 100 MΩ Working life (endurance) at 5° RC Auxiliary contact current Voltage drop compliance		
115/200 VAC (400 Hz) 2000 A 1500 V 5000 (with cos fi: 0.7) above 100 MΩ 50 cycles 0.1..0.2 A MS14154/AS14154A/EN2592/2996/3774		
Mechanical		
Operating force Endurance Tightening torque (barrel nut) Tightening torque (terminal screw)		
8N<push<80N no load on resistive load recommended: 4 N.m ; Max.: 5 N.m 1.7 N.m ±0.1		
Environmental		
Salt spray Humidity Operating temperature (1 to 15 A) Operating temperature (20 and 25 A) Operating temperature (Arc fault and ground fault detection) Acceleration (centrifugal) Shock Vibration (sinusoidal) Vibration (random at RC)		
According DO160 section 14 category B According DO160 section 6 category B -60°C +125°C -60°C +90°C -40°C +71°C 17g up to 50 g (11 ms) -1/2 sine 10 g-PK from 5 to 2000 Hz 5.82 Grms from 10 to 2000 Hz		

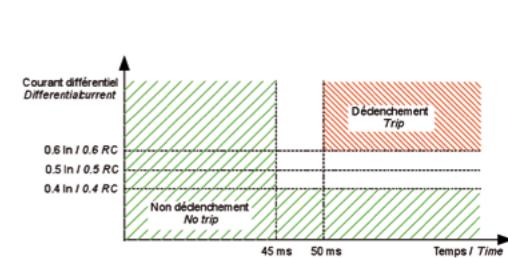
## CURVES

### Thermal trip

Trip times envelope for temperature from -60°C to 125°C (direct overload)

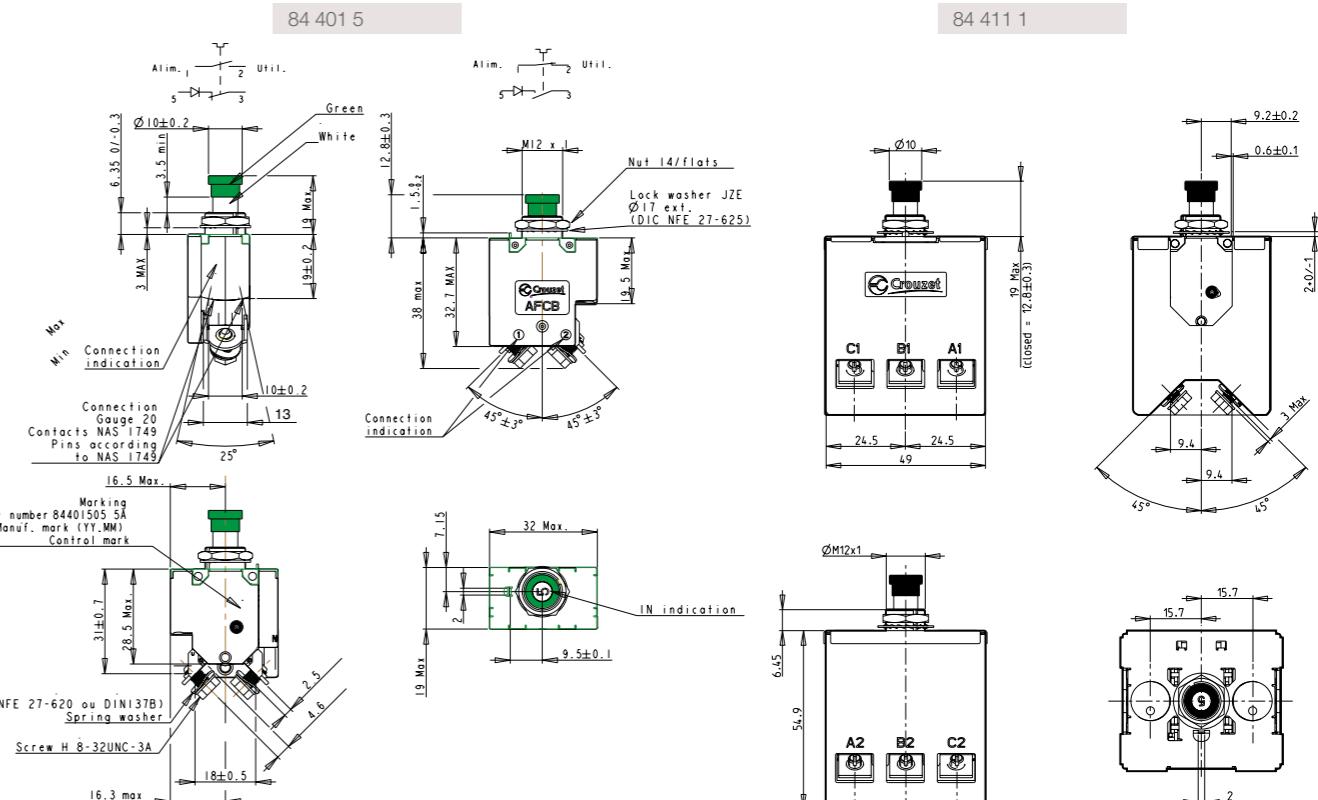


### Ground fault trip thresholds



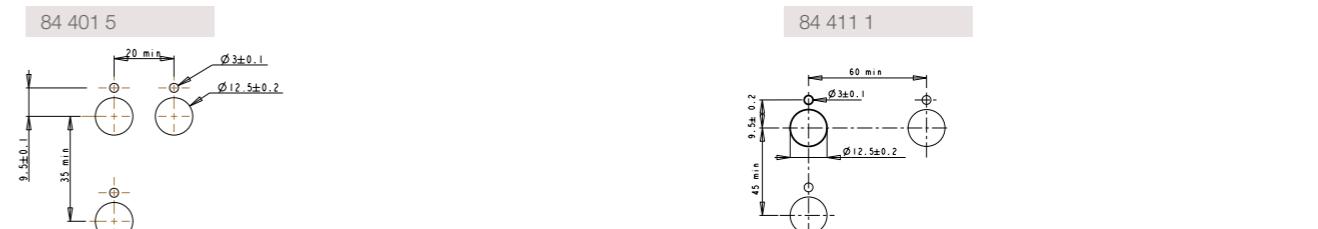
### Arc fault trip: Compliant with AS5692

## DIMENSIONS



## PANEL CUTOUT RECOMMENDATION

### Thickness 1.6 mm → 2.4 mm



# DUMMY CIRCUIT BREAKER

## DUMMY & WATERTIGHT PUSH PULL CB



### CHOICE BY CIRCUIT BREAKER SIZE

#### Small Model Single Pole DPMU

Initial Family	Signal contact	Ref.	Conformity	Barrel threadings	Terminal screw	Control button	Technical file
Reset button	Yes	84 404 001	ABS0064	M12-0.75	M12-100	7/16	
84 401 0xx	Yes	84 404 002	E0486A01				SP4361
84 405 0xx (push-push)	No	84 404 003				Pushed in	SP4362
84 400 0xx (MS3320)	No	84 404 004				Without	SP4365
84 402 0xx	No	84 404 005	E0486B01			Pushed in	SP4369
84 401 8xx	Yes	84 404 006	E0486B01			Without	SP9903
Frog legs	No	84 404 009				Without	SP9904
Frog legs	Yes	84 404 010				Pushed in	SP9910
84 402 0xx	No	84 404 011				Without	SP9914
Frog legs	Yes	84 404 013				Without	
84 401 6xx	Yes	84 404 015	E0486B05			Without	

#### Small Model Three Pole DPMT

Initial Family	Signal contact	Ref.	Conformity	Barrel threadings	Terminal screw	Control button	Technical file
84 411 8xx	Yes	84 404 007	E0486B03	M12-0.75	M12-100	7/16	
84 411 860	Yes	84 411 860	E0486A03				SP4361

#### Big Model Single Pole DGMU

Initial Family	Signal contact	Ref.	Conformity	Barrel threadings	Terminal screw	Control button	Technical file
84 306 65x	Yes	84 404 016	E0486B06	M12-0.75	M12-100	7/16	

#### Big Model Three Pole DGMT

Initial Family	Signal contact	Ref.	Conformity	Barrel threadings	Terminal screw	Control button	Technical file
84 313 6xx	Yes	84 313 626	E0486A04	M12-0.75	M12-100	7/16	SP4347
84 313 0xx	No	84 313 044				Pushed in	SP4335
84 313 6xx	YES	84 404 014	E0486B04			Without	

### CHOICE BY STANDARD

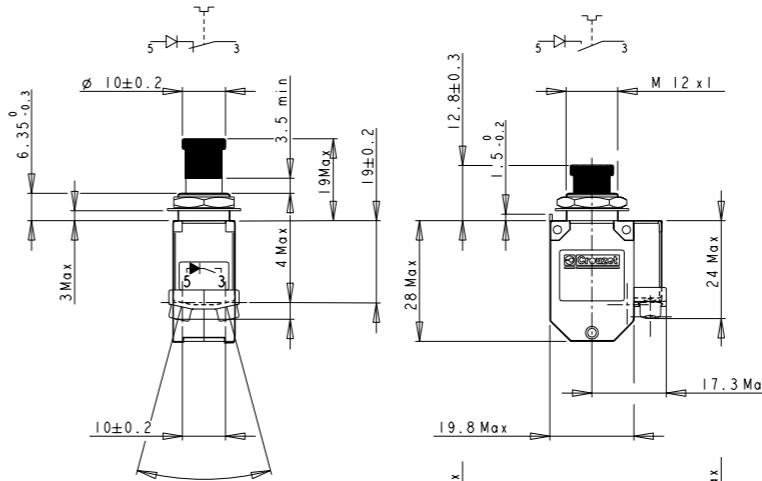
ASNE0486	EN4728	Corresponding functional Circuit Breaker	Model code	Dimension & Alt Hardware	Part-number
E0486B01	EN4728B01C	EN2995-004	B (no control button)	01 C	84 404 006
E0486B03	EN4728B03C	EN2996-004	B (no control button)	03 C	84 404 007
E0486B04	EN4728B04C	EN3672-006	B (no control button)	04 C	84 404 014
E0486B05	EN4728B05C	EN2995-005	B (no control button)	05* C	84 404 015
E0486B06	EN4728B06C	EN3661-006	B (no control button)	06 C	84 404 016

\* No power terminals

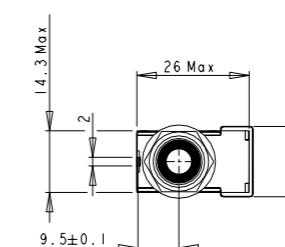
To understand attachment hardware codification, please see page 19.

### DIMENSIONS

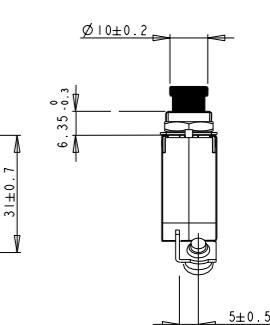
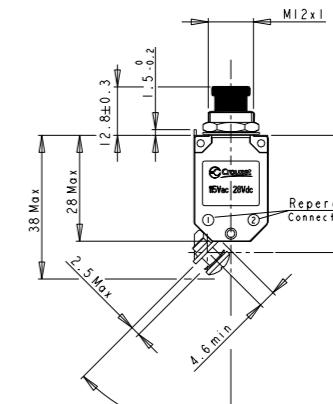
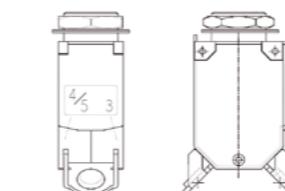
84 404 001



84 404 006



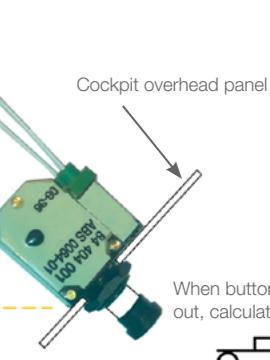
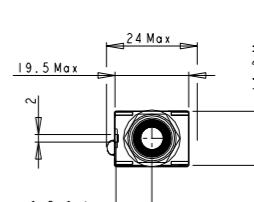
84 404 011



### PANEL CUTOUT RECOMMENDATION

Thickness 1.6 mm → 3 mm

Please, refer to the according technical file



Watertight according to MIL PRF8805-E  
Due to the upside down position of the CB and watertightness, there is no water ingress even with condensation

# ACCESSORIES

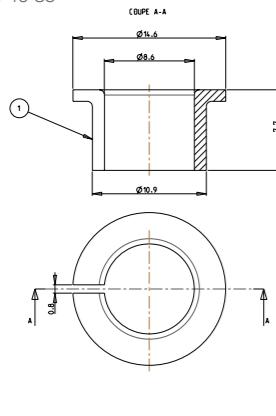
## ACCESSORIES



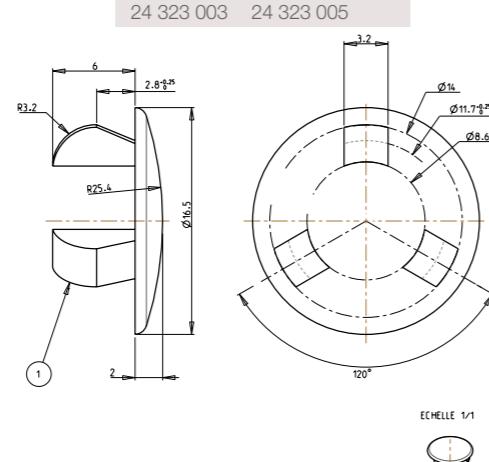
### REFERENCES

Rating	Gag	Caps	Covers	Auxiliary contact pin
red gag	23 422 009			
grey cap	panel hole diam 12.5mm	24 323 003		
brown cap	panel hole diam 12.5mm	24 323 005		
opaque covers	Barrel M12*1 Barrel M12*0.75 Barrel 15/32 Barrel 7/16 Barrel M12*1 Barrel M12*0.75 Barrel 15/32 Barrel 7/16		79 254 157 79 254 154 79 254 155 79 254 156 79 254 150 79 254 151 79 254 152 79 254 153	
clear covers (see through)				25 637 611
male pin	EN 3155 -016M 2018			
<b>Other information</b>				
crimping tool for pin 25637611:	crimp tool: M22520/1-01 and crimp locator: M22520/1-02			
insertion extraction tool:	Ref. Deutsch: 020-0008-20			
male pin	Ref. Deutsch: 006-0912-20			
<b>Conformity Standard</b>				
IP66 & 67				
VG 95345 chap.23				
<b>DIMENSIONS</b>				
79 254 -150 to -157				
Safety guard				
Nut				
Seal				
<b>Caution:</b> For good water proofness: the CB panel must be 2.5 mm thick and positioning key hole must be «blind». Torque of 4 N.m must be applied to the nut ; not on the cover.				

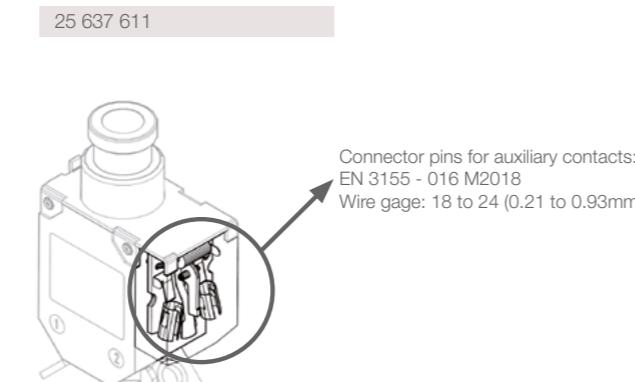
23 422 009  
EC 79 25 40 85



24 323 003 24 323 005



Coupe A-A  
Connector pins for auxiliary contacts:  
EN 3155 - 016 M2018  
Wire gage: 18 to 24 (0.21 to 0.93mm²)



# ELECTRICAL DISTRIBUTION

## WIRE & LOAD PROTECTION

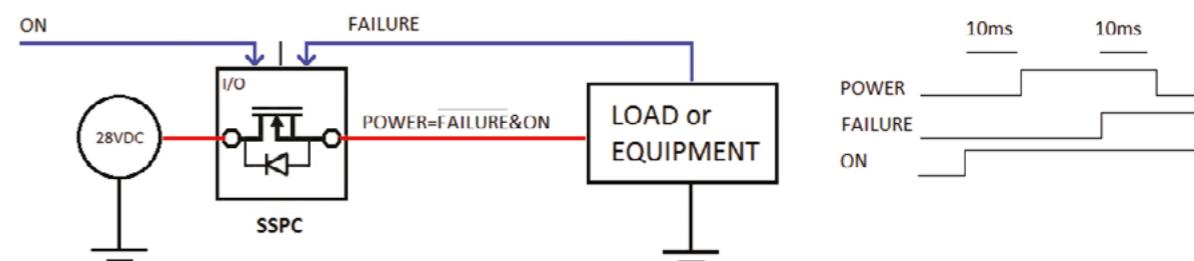
Crouzet is proud to contribute towards the “greener Aircraft” through its bus connected components and through its never ending quest for more compact and lighter solutions.

Crouzet delivers 3 standard distribution components:

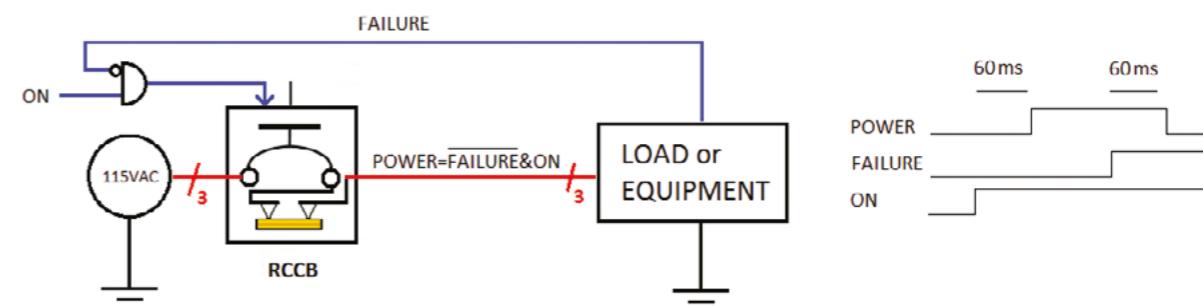
- › RCCB
- › A Circuit Breaker panel Kit
- › Solid State Circuit Breakers

With smart management, loads can be powered off during some flight phases and in rush current can be reduced. This technique will decrease the electrical network complexity and weight. Using information provided by the load, SSCB and RCCB's role can encompass wire protection and load protection

### LOAD AND WIRE PROTECTION WITH SSPC



### LOAD AND WIRE PROTECTION WITH RCCB



# CIRCUIT BREAKER PANEL KIT

## PANEL KIT FOR PUSH-FIT 6.3 MM BLADE CB

Read also page 15

### REFERENCES

complete panel large	84 341 641	complete panel	PCB	Right angle 90°	Spacers	Straight 180°
complete panel small	84 341 640					
spacer						
receptacle						
centring grommet						
EN 4165 connector support						
PWB with 32 receptacles						
front plate						



Spacer kit	5 spacers	16 grommets	32 receptacles	79 219 443
<b>Connection possibilities</b>				
EN4165 (2 modules of 8 size 16 pins) with pins soldered on the vertical PCB				
EN4165 (2 modules of 8 size 16 pins) held by 79219440 with crimped contact pins				

<b>Circuit Breaker type</b>	
Faston without auxiliary contact	84 408 0xx
Faston with auxiliary contact non polarised	84 408 8xx
Faston with auxiliary contact polarised	84 408 6xx
<b>Weight (g)</b>	
Without standard CB (only mechanical panel)	< 351
Panel with 16 Circuit Breakers	< 528
MTBF FH (Typical)	> 60 000

### GENERAL CHARACTERISTICS

<b>Electrical</b>	
Vehiculated current	15*4+6*10+6*5=150 A
Vehiculated power	150*28=4200 W
Prospective current (blocked mechanism)	1800 A
Dielectric	500 VDC between 2 copper tracs and between each track and power feeder

<b>Mechanical</b>	
Power stud (M6)	torque (max) N.m
Every screw/spacer (M3)	3.9
Locklite	2

DO160 section	Test	category	method
4	Altitude		similarity
5	Temperature	from -60°C..71°C (with power)	test
6	Humidity		test
7	Crash		test
8	Vibration	80 ms 1/2 sine (20 g on all axes) MIL STD 810E helicopter random wide band+ sine strips	test
9	Explosion proofness		demonstration
10	Waterproof		N/A
11	Fluids		N/A
12	Sand and dust		similarity
13	Fungus resistance	no tested	no tested
14	Salt spray		test
15	Magnetic effect		demonstration
16 → 23	EMI		N/A
25	Inflammability		demonstration

### HOW DOES IT WORK?

The assembly is qualified and distributes securely up to 150 A under 71°C with a configuration carrying four 15 A, six 10 A and six 5 A Circuit Breakers (thus a total of 16 CBs).

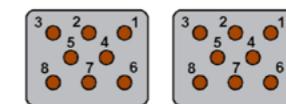
The distribution connector can be mounted on the vertical PCB or distribution leads can be soldered on the vertical PCB.

- If leads are soldered directly on the vertical PCB, the maximum currents are:

Red zone: 15 A max  
Yellow zone: 10 A max  
Green zone: 5 A max

$$\text{Max output: } 4*15+6*10+6*5=150 \text{ A}$$

- If EN 4165 is soldered and used with leads the size 16 pins limit the current to 13 A:

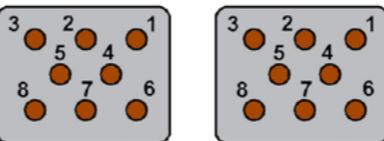


$$\text{Max output: } 4*13+6*10+6*5=142 \text{ A}$$

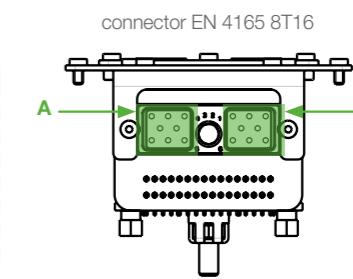
### PIN TO CB AFFECTATIONS

EN4165

Layout 0816: 8 contacts size 16 x 2

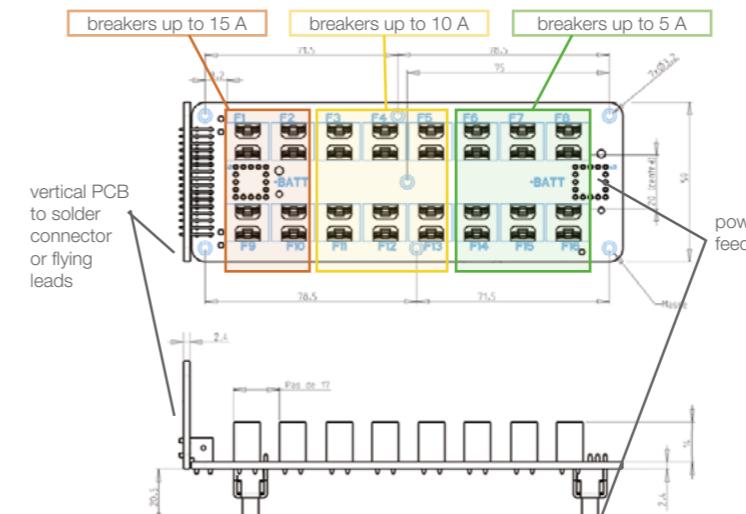


Module A	CB#
1	F6
2	F2
3	F1
4	F7
5	F3
6	F8
7	F5
8	F4

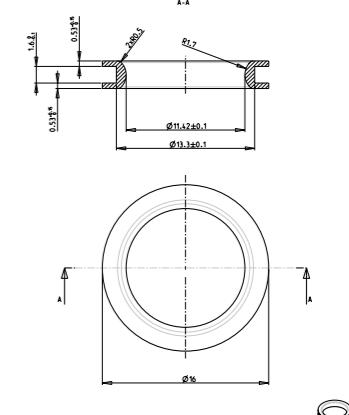


Module B	CB#
1	F9
2	F10
3	F14
4	F11
5	F15
6	F12
7	F13
8	F16

### DIMENSIONS AND SPECIFIC ZONES FOR CB RATINGS

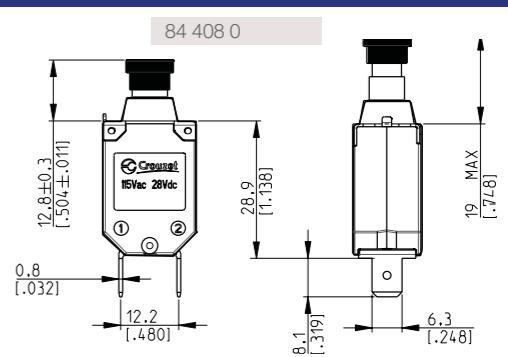
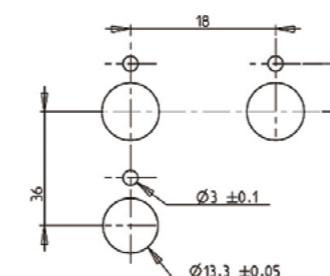


### CENTRING GROMMET



### PANEL CUTOUT RECOMMENDATION FOR CB 84 408 XXX FAMILY

- Required panel thickness for centring grommet 79219333: 1.6 mm



# REMOTE CONTROL CONTACTOR & CIRCUIT BREAKER

RCCB 115/200 VAC 360-80



Read also page 16

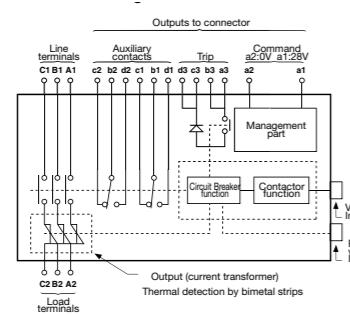
## REFERENCES

Rating	Without current transformer	With current transformer
35 A	84 354 335	84 354 435
50 A	84 354 350	84 354 450
60 A	84 354 360	84 354 460

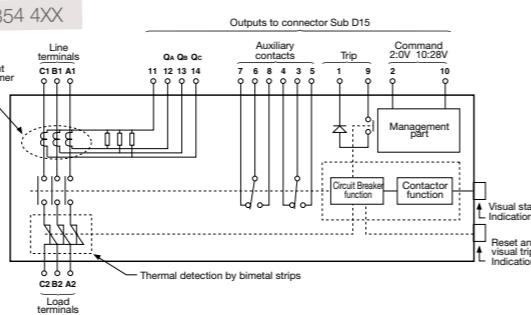
## GENERAL CHARACTERISTICS

Mounting hardware	3 screws 10-32 UNF-3B 6 screws 8-32 UNC-3A Matched connector for control signals Connector retaining screw	3 screws 10-32 UNF-3B 6 screws 8-32 UNC-3A Sub D 15 Female M3x0.5
Contactor Function		
Actuating voltage	17 V = U ≤ 32 V (a2 - a1 pins)	17 V = U ≤ 32 V (10 - 2 pins)
Max Pull-in current	3A during max 50 ms	3A during max 50 ms
Max. continuous hold-in current	300 mA	300 mA
Min. Hold-in voltage	10 V =	10 V =
Response time (off to on)	< 60 ms	< 60 ms
Release time (on to off)	< 60 ms	< 50 ms
Direct visual indication of contacts position on front plate	OPEN / CLOSE	OPEN / CLOSE
Auxiliary contact n°1 SPDT type	Common/NC/NO: b1/c1/d1 28 VDC 3A (L/R 5 ms) - 5 VAC 250 mA	Common/NC/NO: 3/4/5 28 VDC 3A (L/R 5 ms) - 5 VAC 250 mA
Intermediate current level		Common/NC/NO: 6/7/8 3 VDC 0 to 20 mA resistive 28 VDC 200 mA (L/R 5 ms)
Auxiliary contact n°2 SPDT type	Common/NC/NO: b2/c2/d2 3 VDC 0 to 20 mA resistive 28 VDC 200 mA (L/R 5 ms)	Common/NC/NO: 6/7/8 3 VDC 0 to 20 mA resistive 28 VDC 200 mA (L/R 5 ms)
Low level current	I leakage < 1 mA @ 1500 V~	I leakage < 1 mA @ 1500 V~
Dielectric strength	≥ 100 MΩ	≥ 100 MΩ
Insulation resistance		
Contactor Endurance cycles with RC at 40°C cos Fi=0.7	100 000 cycles	100 000 cycles
Current measurement & Breaker function		
Current transformer ratio	-	0.5 Volt rms for 10 A rms
Integrated load resistance (on current transformer output)	-	50 Ω
Breaking at 115 VAC 360-800 Hz	2000 A	2000 A
Trip status auxiliary contact (incorporated diode)	28 VDC 10 to 200 mA	28 VDC 10 to 200 mA
Visual indication of trip status by R button on front plate	Yes	Yes
Operating circuit disable after break	Yes	Yes
Resetting after trip	By push on front R button	By push on front R button
Endurance at 2°RC	1 000 cycles	1 000 cycles
Mechanical		
Operating force (R push button)	< 10 N	< 10 N
Max. admissible force (R push button)	50 N	50 N
Tightening torque (barrel nut)	3 +/- 0.2 Nm	3 +/- 0.2 Nm
Tightening torque (terminal screw)	2.3 +/- 0.1 Nm	2.3 +/- 0.1 Nm
Weight	< 550 g	< 700 g
MTBF FH (Typical)	> 300 000	> 300 000
Environmental		
Salt spray	48h at 5% NaCl	48h at 5% NaCl
Operating temperature	-40°C to +85°C	-40°C to +85°C
Acceleration (centrifugal)	up to 10 g	up to 10 g
Shock	25 g - 11 ms	25 g - 11 ms
Vibration (sinusoidal)	10 g from 5 to 2000 Hz	10 g from 5 to 2000 Hz
Vibration (random)	5.8 g from 10 to 2000 Hz	5.8 g from 10 to 2000 Hz

84 354 3XX



84 354 4XX



## HOW DOES IT WORK?

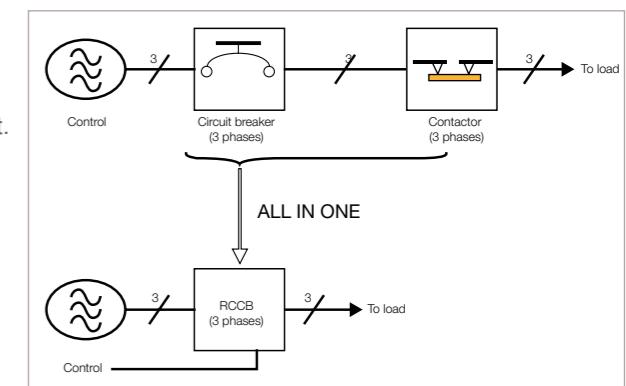
The RCCB merges a contactor function and a circuit breaker function in a single unit. This association gives the following unique advantages:

- › Reduction of the length of generally large cross-sections wires (mass reduction and harness simplification)
- › Reduction of voltage drop (reduced number of contacts)
- › Reduction of envelope
- › Improved reliability (less components)

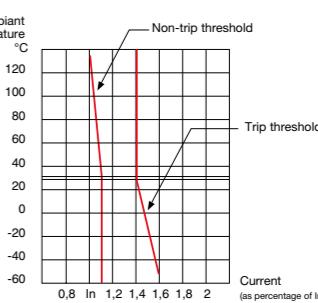
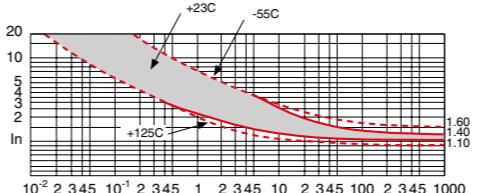
The contactor is closed when 28 V is applied on the command input.

The RCCB has a status display window and a mechanical «TRIP indicator». When the CB has tripped, the mechanical «TRIP indicator» is «popped out» and must be pushed back in manually to RESET the circuit breaker (see page 16).

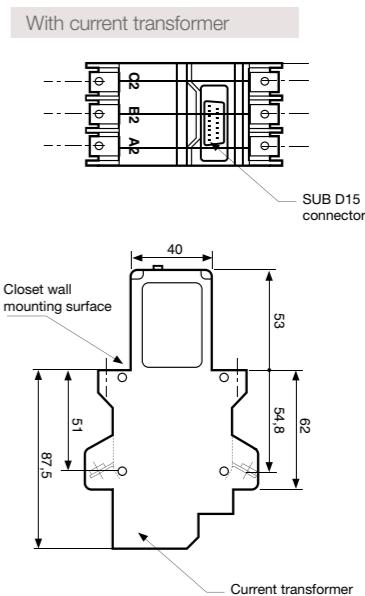
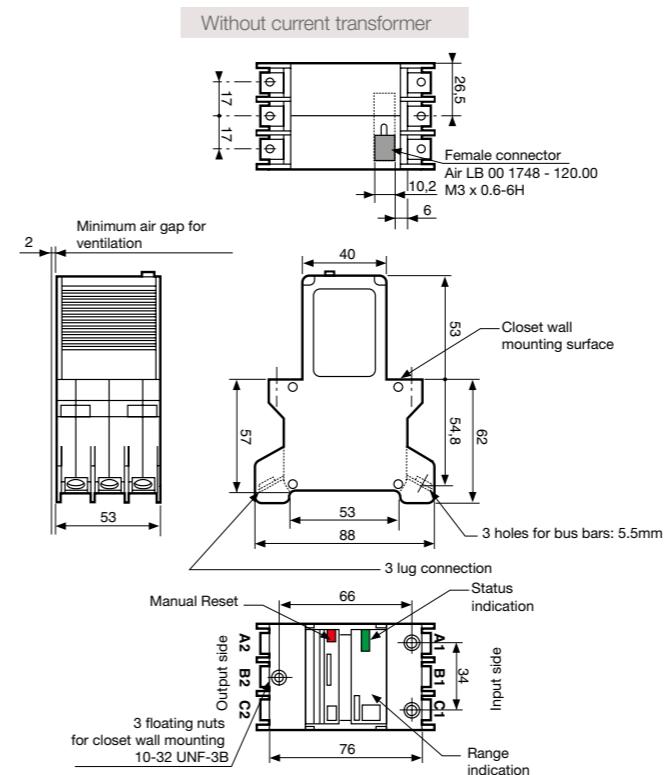
The «protection function» overrides the «contactor function». After tripping, the RCCB must therefore be reset manually, this avoids any risk of spurious restarting.



## TRIPPING CHARACTERISTICS



## DIMENSIONS





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