

MANUFACTURING THE FUTURE Of Aerospace Industry

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ABOUT CROUZET 100+ YEARS MANUFACTURING THE FUTURE Togethen

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



WE ARE GLOBAL

2000+ collaborators.

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







NANTES, FRANCE

NCE, FRANCE

PARIS, FRANCE



DRLEANS, FRANCE









2. MOROCCO

VOUVRY, SWITZERLAND

HUIZHOU, CHINA

BANGALORE, INDIA

PROGRAMS

OUR REPUTATION IS RECOGNIZED GLOBALLY BY THE MAJOR PLAYERS IN THE AEROSPACE MARKET. A NON-EXHAUSTIVE LIST OF CUSTOMERS INCLUDES:



AIRBUS, AIRBUS HELICOPTERS, ANTONOV, BELL, BOEING, BOMBARDIER, DASSAULT, EMBRAER, GULFSTREAM, HAL, IAI, IRKUT, LEONARDO, LIEBHERR, MIL HELICOPTER, NH INDUSTRIE, NORDAM, PILATUS, SAFRAN LANDING SYSTEMS, SAFRAN NACELLES, SOCATA, SUKHOI, UTAS, WOODWARD...



QUALITY OF SERVICE THROUGHOUT THE LIFE OF THE PROGRAM

- We have the internal expertise to ensure manufacturing engineering goes smoothly
- We use up-to-date logistic tools such as IDE to provide quality service
- Our quality is of the highest level: ISO 9001, ISO 14001, OHSAS 18001, AS/JIS Q/ EN 9100, NADCAP Welding, FAA approved (FAR 21 & FAR 145)
- Our production organisation is EASA part 21 approved
- Our after-market services, EASA part 145 approved, include a specific customer support department, distributors all around the world, and an AOG service
- NATO code: FAOX2

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CUSTOMER PROGRAMS OUR EXPERIENCE

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		OSITION SENSORS LECTRICAL PROTECTION OCKPIT CONTROLS	HELICOPTERS		WITCHES & OSITION SENSORS LECTRICAL PROTECTION	OCKPIT CONTROLS	
AIRBUS	A318 / A319		LEONARDO	A109P			
	A320 / 321			A119			
	A330			A129			
	A340			AW139			SWITCHES &
	A350XWB			AW149 / 169 / 189			POSITION SENSORS
	A380			EH101			
ANTONOV	AN148 / 158 / 178		BELL	CH146			Limit switches, proximity switch
ATR	42 / 72		DENEL	412 / 427 / 430			and sensors:
AVIC	ARJ 21		DENEL	AH2 ROOIVALK			O task shall be the first second at the first
BAE	146		AIRBUS	CARACAL H225M			2 technologies available for all
BOEING	717		HELICOPTERS	COUGAR AS532			applications
	737 MAX						
	747-8			AS 355 / H130			
	//7 X			FENNEC AS 550 / AS			
	787			555			
BOMBARDIER	GLOBAL EXPRESS / GLOBAL 5000/6000			NH 90 PANTHER AS 565			
	G 7000 / 8000			SUPER PUMA			
	CRJ 700			AS 332 / AS 225			
	CHALLENGER 300/350			LIDER LIDE / 125 / 145 / 175			
	CHALLENGER 601		HAL				
			KAI	КНР	•		
CAIGA	LEARJET 45		MIL	MI-38			
CASA	(717						
CESSNA	SOVEREIGN						
DASSAULT	FALCON 50				je		
DittorioLi	FALCON 900 / 900 EX / 2000 / 2000 EX		MILITARY	AIRCRAFI	SORS	ROLS	
	FALCON 5X, 7X, 8X				E EN	ž	
EMBRAER	ERJ 135 / 145				S Z Z	B	
	PHENOM 100 / 300				HOLE R	Ē	
	ERJ 170					ģ	and the second second
	C 150				NG W	Ŭ	
GULFSTREAM	6 280		AIRBUS	A400M			C
	G 450		AIRBUS	CN235	•		
	6 600			C295			
	G 650		FURGEIGHTER	RAFALE / MIRAGE			9
HAWKER	HORIZON		EUROFIGHTER	EFA (TYPHOON)			
LOCKHEED MARTIN	LM100-J		HAL				
MITSUBISHI	MRJ		KAI	T50 (Goldon Facio)			
PILATUS	PC-7 / PC-9		MIG	MIG 29/35			
	PC-12 / PC-24		PANAVIA	TORNADO	•		
SINO SWEARIGEN	SJ-30		RAYTHEON	JPATS			
SUKHOI	SUPERJET 100		SAAB	GRIPEN (JAS 39)	-		
IRKUT	MC-21		SUKHOL	CUDE			





ELECTRICAL PROTECTION

A complete range of circuit breakers and modular panels to optimise your total performance

Feeling, ergonomics, tactile effects, electrical functions:

each program requires numerous parameters



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POSITION DETECTORS



POSITION DETECTORS

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IN ALL CASES CROUZET WILL FIND A WAY!

CUSTOMISED PRODUCTS

Crouzet, with over 50 years of aerospace expertise, has the ability and capacity to develop and produce position detectors dedicated to a customer's specification. As one of the world leaders in electronic and mechanical detection technology, we offer specific components fully adapted to requested applications and environments.

A - MECHANICAL DETECTORS

LIMIT SWITCHES

- •Extended temperature range
- Multi pole function
- Specific housing in terms of fixing upon request
- Activation by plunger, roller or lever upon request
- Extended attack speed range for activation
- Multi electrical output (wires, cable or connector)



Mechanical limit switches

B - ELECTRONIC DETECTORS

PROXIMITY SWITCHES WITH FULL INTEGRATED ELECTRONIC

- Contactless detection
- Multi electrical output (wires, cable or connector)
- Full hermetic stainless steel housing
- High pressure exposure
- Extended temperature range
- Good resistance to EMI/EMC susceptibility

PROXIMITY SENSORS (PASSIVE CONCEPT) COMBINED TO REMOTE ELECTRONIC BOARD LOCATED IN SOFTER ENVIRONMENT

- Enhanced reliability with the capability to place the sensor in a harsh environment and the electronic board in a remote soft environment
- One board can multiplex 8 sensors at a time
- Contactless proximity detection and distance measurement based on a passive sensor combined to our sensor interface module (SIM) developed according to DO 254 DAL A
 Detection range up to 8 mm, distance coded over 10 bits
 Possibility of health monitoring through built in test





Sensor Interface Module (SIM)

| PRODUCTS FOR AIRCRAFT



Proximity switches

 Rectangular or circular sensors available in full hermetic stainless steel housing



Proximity sensors

THERMAL **CIRCUIT BREAKERS**

HIGH SHOCK & VIBRATION BREAKERS

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Three pole





Long pushbutton

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Single pole

Three pole



Flying lead connection



Accessories

- 1 Intrinsic safety: the Circuit Breaker has been designed with a fuse element to ensure that the electric circuit is opened in the extreme case of stuck or soldered contacts.
- 2 Trip free: even if the pushbutton is maintained in a closed position. the opening of the contacts (and therefore the electric circuit) is ensured

LIGHT, SIMPLE, SAFE

> Light:

Our single phase EN2495 and MIL MS33201 V compliant model is the lightest in the world (<20g 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 safety¹ (Fail safe) and trip free² conception enable a high level of safety (above 10-6 FH)
- The temperature compensation ensures high performance over a wide temperature range (usually -55°C to +125°C)
- Excellent resistance to mechanical stress

WIDE RANGE OF TERMINALS

Depending on your need, Crouzet provides 4 types of terminals: FASTON, MS3320, EN & MS26574



MS26574

Frog legs 45°







EN 3773-006

FASTON

EN/M53320



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

level or basic MS33201 levels.

Standard pushbutton

Random Vibration improvement

Test condition letter	Power spectral density	Overall rms G		Sinusoidal (MIL STD 202 method 204 D)	Contact us
А	.02	5.35		Random	Contact us
В	.04	7.56		(MIL STD 202 method 214 A)	
С	.06	9.26	-	Shock	75 g 3 halfsine 6 msec: condition B
D	.1	11.95		(MIL STD 202 method 213B)	
E	.2	16.91			
F	.3	20.71	1		
G	.4	23.91			
Н	.6	29.28			

AS58091 & AS33201 basic level New level

• Typical circuit protection on the following military platforms:

- Fighter Aircraft
- Military Helicopters
- Ground Air Defense Systems



It has always been troublesome for electrical system engineers to find the best suitable circuit breakers for military applications. 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 three the endurance level to random and sinus vibrations, compared to AS58091

New levels

- Military Land Tracked and Wheeled Vehicles
- Missile Launchers
- Naval Shipboard Applications

DISTRIBUTION BOXES WITH PRINTED CIRCUIT BOARD TECHNOLOGY

SOLID STATE **CIRCUIT BREAKERS**







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Single pole

Three pole

SSPC 28 VDC

NEW CONCEPT

Using standardized EN-3373-006 and EN3774-006 FASTON circuit breakers (0.25 inch tab circuit breakers), you can design very compact and nearly "wire free" circuit breaker panels. This tremendously reduces EWIS compliancy assessment for power distribution boxes.

> Technical Advantages:

- Boxes are more compact (volume decrease)
- Each CB is lighter
- Quality is improved (no human error in wiring and quick testing)
- No nail bed needed to industrialize bundles
- Retarded circuit breaker rating definition & fast maintenance
- Automatic testing

› Commercial Advantages:

- With high volume, PCB is cheaper than human labor
- There is much less bundles definition (reducing the projects non-recurrent costs)

Retrofit with conservation of Form Fit Function:

Crouzet has proven it is possible to redesign a PCB with the same volume and connector disposition without increasing weight. Thus bringing more flexibility and less EWIS concern to the re-designed distribution box.

FROM SSCB TO SSPC

Using the most recent solid state technology, Crouzet has developed 2 generic Solid State Circuit Breaker (SSCB) families. One for 28VDC applications, the other for 115VAC 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 and 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 and load failure detection.

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





Ouick installation and removal

24 Circuit Breaker prototype



PCB base carrvina up to 16 breakers

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Seasy 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 is 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.





- 5 Optional Battery 28V 6 - 0 VAC feeder return (neutral)
- 7 0 VAC load return

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ARC FAULT CIRCUIT BREAKERS

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GROUND FAULT INTERRUPTER CIRCUIT BREAKERS



Single pole AFCB

Single pole AFCB

Three phase GFI

ARC FAULT TECHNOLOGY IS TARGETED TOWARDS EWIS¹ PROTECTION, CARBON COMPOSITE PROTECTION AND ENHANCED FUEL TANK PROTECTION

How do AFCBs work?

Arc Fault Circuit Breakers 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 that analyzes the current waveform in real time to detect arcing.

• EWIS protection:

The new FAA Part 25 subpart H requirements ask aircraft OEM to consider EWIS as a system. This means that the airworthiness of the wiring must be guaranteed for the complete lifetime of the aircraft. By incorporating AFCBs your aircraft will be compliant to this new rule.

> Carbon Composite protection:

Carbon composite (CFRP) is vulnerable to arcing. The use of AFCB will mitigate damages and smoke hazard on CRFP material.

> Enhanced Fuel tank Protection:

Traditional Ground Fault Interrupters (GFI) measure current leakage to the airframe and open the line as soon as maximum current limit is detected by the current transformer. The weakness of the traditional GFI is that it does not capture line-toline arcing and series arcing downstream of the breaker, the AGFCB (Arc and Ground Fault Circuit Breaker) does this thus going beyond:

- EASA CS-25 Book2, AMC25.981(a) fuel tank ignition precautions
- FAA-PART 25, AC25.981-1B fuel tank ignition precautions

Compliant to

AS5692, AS6019, ARD5568.

• Why use GFI circuit breakers?

Following SFAR88 recommendation (after Swissair 111 and TWA 800 incidents), the FAA and EASA have compelled PART 25 aircrafts to protect fuel tanks with Ground Fault Interrupters. GFI products mitigate fuel tank ignition by reducing the amount of

leakage current to the airframe inside the fuel tank.

• What about people?

In addition to fuel tank protection, the increasing presence of higher voltages in the passenger area (115 VAC) - for instance in business class current outlets - has brought Crouzet to develop circuit breakers to protect from electrocution (the leakage current to detect is then around 30 mA).



¹EWIS: Electrical Wiring Interconnection Systems



Three phase AGFCB



ELECTRICAL PROTECTION

Arcing test

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WORLD LEADER FOR CONTROL WHEEL AND PILOT GRIPS

Bizjet





Side stick



Commercial aircraft

MORE THAN 19,000 GRIPS ARE FLYING EVERYWHERE IN THE WORLD

EXPERIENCE

Crouzet's expertise allows us to pride ourselves in being able to assist Aircraft manufacturers in specification finalisation, thus avoiding costly mistakes.

BECAUSE THE FIRST FEELING OF THE COCKPIT IS THE CONTROL WHEEL

Based on aluminum castings or molded in plastic composite, our control wheels combined with a large range of pushbuttons, trims, triggers or digital thumbsticks will **fit naturally under your** fingers.

The quality of the man machine interface in an Aircraft cockpit is a major concern to the Aircraft designer and the operator alike. The comfort and aesthetics of Crouzet handwheels are of great importance to us.

CONTROL GRIPS

Our man machine interfaces for both Commercial and Military aerospace markets have been designed, manufactured and delivered for more than four decades. Crouzet's wide range of grip designs enable us to provide quick and accurate responses to any customer's needs or

CHOOSE FROM OVER 200 REFERENCES OR LET US HELP YOU DESIGN YOUR CUSTOM COMPONENT

Trim 5-way









4D Fliaht trim







OuickFix® design



One or two step triaaers

Pushbuttor 1 note or 2 note

4-wav

Analogic transducer



Cyclic grip



CUSTOMISED CONFIGURATION

requirements.

- Crouzet defined the modular concept for helicopter grips. This heritage enables Crouzet to meet 100% of a customer's needs relative to ergonomy. Modifications to pushbutton configurations can be performed quickly thanks to our exclusively-incorporated removable front face, with optional backlighting.
- This unique design approach not only gives Crouzet customers increased flexibility, but it greatly reduces the customisation lead-time. Production can continue and minor changes are easily accommodated at final assembly.





3D design



Back liahted panel

SOLUTIONS FOR DESIGN, **INNOVATION AND** INDUSTRIALISATION

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PROJECT TEAM

Crouzet puts in place a project team that provides you with a partnership of experts throughout all your program phases: drawing up the specification, feasibility, development, performance testing, control of pre-production, optimisation of logistical parameters, long-term support for the design and product tracking.

3. INNOVATION

best technologies concepts

4. TEST LABORATORY

Crouzet laboratories are equipped with facilities for testing all our products from design to production. Either with simulation or real-life tests (electrical, mechanical life and environmental withstand), Crouzet products are validated, tested and tracked throughout the project development process

Crouzet's factories in Valence. France

1. PROJECT START-UP

After first contact, Crouzet business engineers will work with you to identify your goals and constraints in order to draw up a product performance specification and to take in account the key factors of success for your projects







2. DESIGN OFFICE

With more than 50 years of experience, Crouzet has mastered the necessary technologies for developing and industrialising complete sensor offer as well as to customise products: Mechanical (CAD-3D)

- Magnetic
- › Electromechanical
- » Electronic (EMC, EMI)



6. LOGISTICS

In order to meet the demands of the aerospace industry, Crouzet logistics are based on industry approved practices: Just-in-time processes

- Partnerships with our suppliers
- Capacity to deliver within 24 hours

The Crouzet delivery platform also optimizes logistics through output and guarantees your lead times

Based on their experience in a wide range of sectors,

- Crouzet's design offices share common objectives:
- Taking an innovative approach to market standards and the
- Combining a number of technologies to create innovative





5. PRODUCTION

Aerospace products require highly-tailored solutions for demanding applications. Our state-of-the-art production facilities certified to the highest quality standards, ensure that Crouzet products meet the level of performance that is needed in this critical environment







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