

# JAUQUET products for Turbine applications

## Introduction

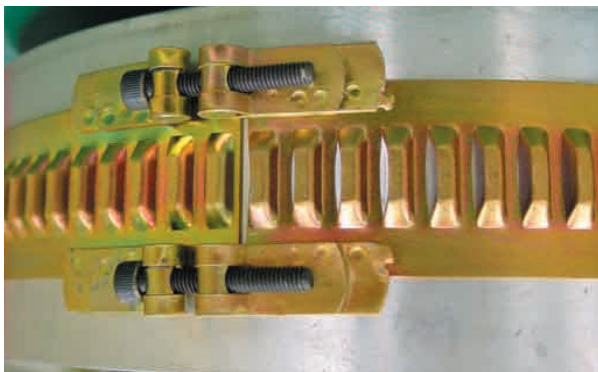
Large prime movers such as gas- steam- or hydraulic turbines needs to be protected against overspeed conditions. Traditionally this has been done with a mechanical device, but as a result of this a lot of disadvantages had to be accepted. Today an independent electronic overspeed protection system is a must in a most of installations when the new IEC 61508 regulations are applicable. But not only the safety of the installations profit from this but namely the availability and the efficiency of this prime movers can be brought to a higher level.

The speed of the machine is measured by a target and speed sensors. The target normally is a pole wheel or in some cases also a pole band. To detect the frequency of the rotating target different technologies of speed sensors can be used depending on the required signals and speed conditions.

Multi-channel digital speed measurement systems and frequency to current converters are used to deliver the speed information to the governor systems and also to provide reliable over speed protection.



**Typical Speed sensor used on turbines or compressors**



**Polewheels and polebands used in rotating machines to detect speed information**

## Speed Sensors

Different technologies such as electromagnetic systems, single or differential hall-effect based speed sensors as well as HF sensors or magneto-resistive units can be provided depending on the application. All of them configured to match the dimensional and installation requirements of the specific case with integral cable or connector. For temperatures up to  $-40 \dots +150 \text{ }^{\circ}\text{C}$ .

ATEX certified sensors for hazardous areas are available together with the necessary zener barriers and signal treating elements.

### Technical Data DSE 2210.00 SHZ

Type	Electromagnetic Sensor
Coil resistance	850 Ohm
Inductivity	350 mH
Temperature range	$-40 \dots +150 \text{ }^{\circ}\text{C}$
Frequency	$\sim 10 \dots 25'000 \text{ Hz}$

### Technical Data DSF 2210.87 STV

Type	Hall effect with line amplifier
Output signal	Square wave from push-pull stage
Supply	10 .. 30 VDC
Frequency	0.05 .. 20'000 Hz
Temperature range	$-25 \dots +85^{\circ}\text{C}$

### Technical Data DSD 2210.01 SHV

Type	Differential Hall effect, amplified
Output signal	Square wave from push pull stage
Supply	8 .. 30 VDC
Frequency	0 .. 20'000 Hz (static behaviour)
Temperature range	$-40 \dots +125^{\circ}\text{C}$

## Over Speed Protection Systems

To safely protect large prime movers from overspeed conditions a constant monitoring of the measured speed values is required. To not compromise the availability multichannel systems provides 2oo3 voting and intensive test functions. The introduced IEC61508 standard demands a SIL 3 level for the over speed protection. JAQUET has a wide range of products from single channel ready to be used units up to fully adaptable multi channel systems.

### Single channel system: FT 1400



#### Technical Data FT1400

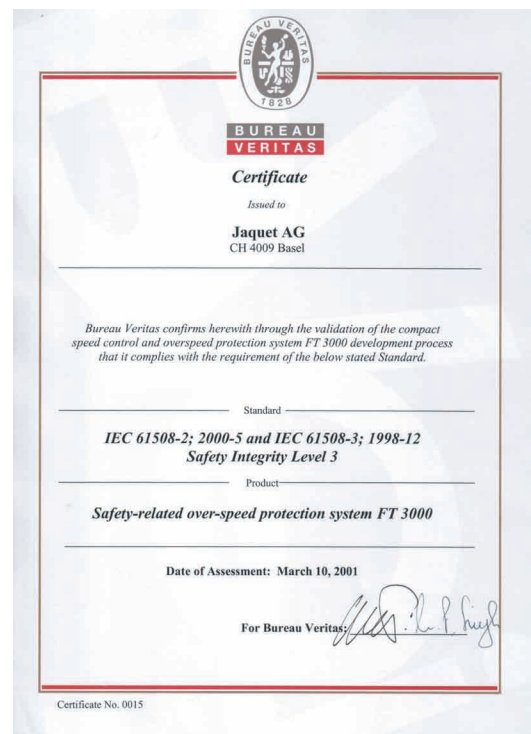
- Frequency to current converter
- 4 setpoints can be assigned to 4 relays
- Supply voltage UC2: 93 .. 264 VAC or 93 .. 375 VDC  
UC3: 18 .. 58 VAC or 18 .. 60 VDC
- 0 .. 50 kHz = 0/4 .. 20 mA resolution 12 bit
- 50 mV .. 80 V sensor input voltage
- Integrated sensor supply with monitoring
- Fast response time of ~10 ms
- 2 Binary inputs
- Programmable through local touch or with PC-program

### Multi channel system: FT3000



The FT3000 has been developed as a true 3 (or multi) channel system that permits machine protection with 2oo3 voting. Maximum availability and high system integrity is achieved through complete redundancy of all functions, along with continuous self checking and test possibilities at each stage in the channel. The clear open architecture, using a bus interface, enables the FT3000 to be used with a master control system so that it provides independent monitoring and machine protection, whilst being part of an integrated system.

The FT3000 conforms therefore to both the API670 as well as to the IEC61508 SIL 3.



#### Certificat IEC61508

Technical Date FT3000

- 19" Rack based design
- Up to 6 channels to monitor 2 shafts in 1 rack
- Supply voltage 18 .. 33 VDC direct or any with redundant supply units
- Fast reaction time for limit values (~10 ms)
- 4 independent setable limit values
- Analogue outputs available
- RS232 bus for programming
- RS485 bus for communication
- Modulare layout with channel modules, relay cards, trip chain control cards, supply and communication cards
- Fully programmable with PC Windows based program
- Wide range of arithmetical and logic functions, such as acceleration, max. speed value and voted values available
- Integrated test functions controllable through binary inputs

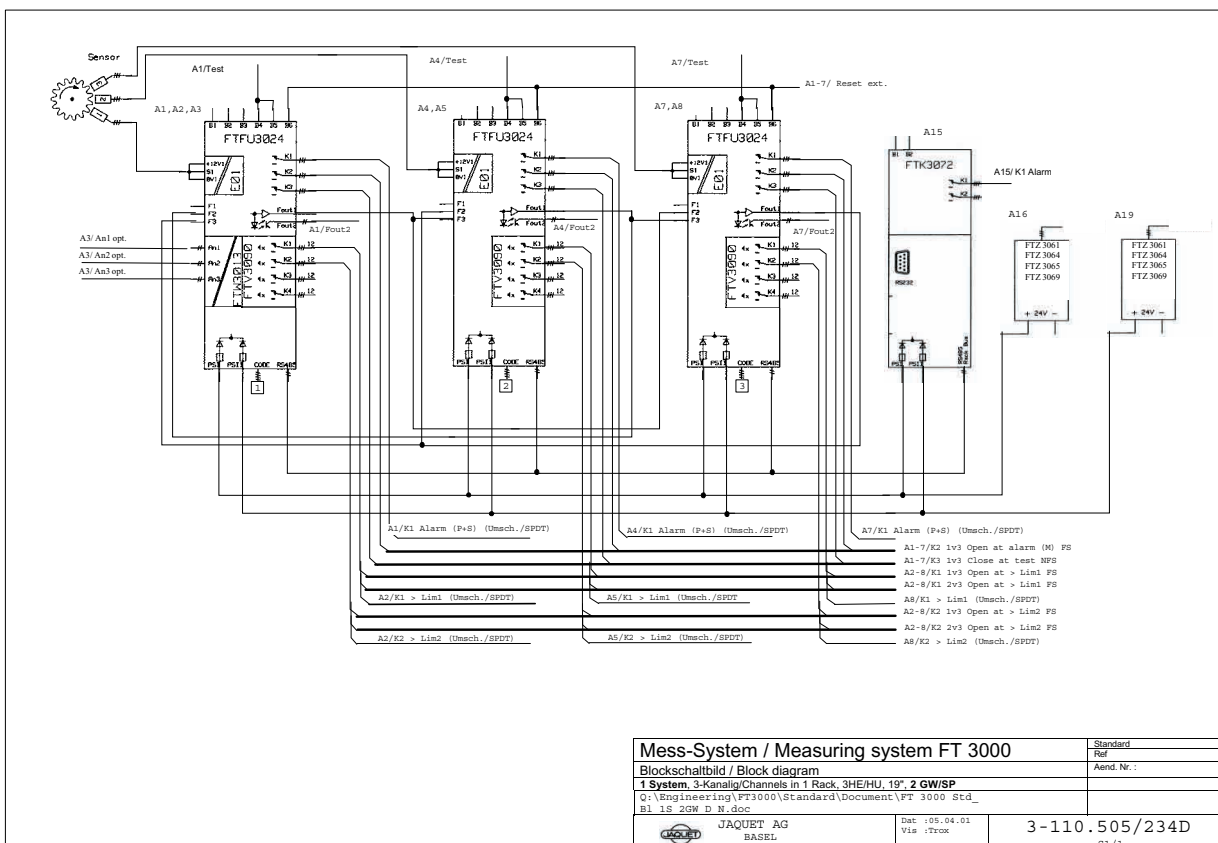


Channel module of an FT3000 system with attached relay card



FT3000 system programmed by PC

Drawing of a 3 Channel system with voted limit and 3 analogue outputs



31 0004 5203

## Reference List

Project	Customer	Description	Product
Various Powerplants	ABB Baden	Overspeed protection and monitoring of 30 MW water pumps	FT2000 Systems
Kraftwerk Amsteg	SBB Swiss Railways	Monitoring of hydraulic turbines	FT2000 System
Various Powerstations	ABB Baden	Overspeed protection and monitoring of steam turbines	FT2000 Systems
Various Powerstations	NOK Switzerland	Monitoring of hydraulic turbines	FT2000 Systems
Various Powerproduction Units	Voigt Turbo Crailsheim	Overspeed protection of HD and ND side of steam turbines	FT3000 System
KKW Phillipsburg	SIEMENS Germany	Protection of ventilation system in Nuclear Powerplants	FT1400
Various Nuclear Powerplants	EdF (Electricité de France)	Overspeed protection and monitoring of steam turbines in Nuclear Powerplants	FT2000 Systems
Various Nuclear Powerplants	SIEMENS Germany	Overspeed protection and monitoring of cleanwater pumps 30 MW for Nuclear Plants	FT2000 Systems
Various Fertilizer applications	Barath India	Overspeed protection and monitoring of steam turbines	FT2000 Systems
Various Power Plants	Nuovo Pignone Italy	Overspeed protection and monitoring of steam turbines	FT2000 / FT3000 Systems
Various Hubs of Natural Gasdistribution	RuhrGas AG Germany	Overspeed protection and monitoring of gas turbines used as hub for distributions systems	FT2000 Systems
Kryotechnical applications	Linde Germany	Overspeed protection of steam and expansion turbines	FT2000 Systems
AGRO-NEX Plant	DSM Holland	Overspeed protection and monitoring of steam turbines	FT2000 Systems
AGRO-NEX Plant	DSM Holland	Overspeed protection of tail gas expander	FT2000 System
Hydrocarbons NAK IV	DSM Holland	Overspeed protection of a steam turbine	FT2000 System
Hydrocarbons NAK IV	DSM Holland	Overspeed protection of water pumps in thermal power plants	FT2000 Systems
Various in house power production installations	Dow Chemical Holland	Overspeed protection of steam turbines. HD and ND side.	FT2000 2v3 Systems
Various in house power production installations	Shell Chemical Holland	Overspeed protection of steam turbines.	FT2000 Systems

## Reference List

Project	Customer	Description	Product
Various in house power production installations	DSM Hydrocarbons Holland	Overspeed protection and monitoring of steam turbines	FT2000 Systems
Several in house power production installations	Papierfabrik Abbruck Germany	Overspeed monitoring and protection of steam turbines	FT3000 Systems Monitoring double Shaft turbines
Gas turbines in a Petrol refinery	PCK Schwedt Germany	Overspeed monitoring and protection of gas-turbines and compressor lines	FT3000 System 2 x 2v3 protection
Various retrofitted combi powerplants Gas-/Steam Turbines	ABB Kraftwerke Mannheim	Overspeed protection of Gas- and steam turbines in combination with ABB monitoring	FT3000 Systems
Various Hydraulic Plants	Sulzer Switzerland	Monitoring of hydraulic turbines in high pressure plants	FT1400
Hydraulic Plants of NOK	NOK Switzerland	Monitoring of hydraulic turbines and water pumps in power plants	FT3000
Steam turbine plants in Germany, Austrich, Sweeden and Spain	Blohm & Voss Germany	Overspeed measuring and protection of Steam turbines	FT3000
Burst test of turbo chargers	ABB Turbosystems	Triggering the shot at burst tests of large Turbo chargers	FT3000
Several Gaz Turbines in a in house power plant	Fiat AVIO Italy	Overspeed protection	FT3000
Several Powerplants in Trinidad	CCC / Hydro Agri	Overspeed protection and delivering of main speed signal for the governer system	FT3000
In house power production	Hooghovens Steelworks NL	Overspeed measuring and protection of Steam turbines	FT3000
Komrpressor and Steamturbine	DOW Chemical NL	Overspeed measuring and protection of Steam turbine and Compressor	FT3000
Standard for all new Steam Turbines	ALSTOM Power France	Overspeed protection of new installed Steam turbines. Certified IEC 61508 SIL 3	FT3100
Powerplant Montreal	Rolls Royce GB	TRENT SRS 3 shaft aero derivative Turbine Overspeed protection	FT3200
Powerplant Ansty	Rolls Royce GB	TRENT SRS 3 shaft aero derivative Turbine Overspeed protection	FT3200
Standard for all new Gas-Turbines	ALSTOM Power France	Overspeed protection and monitoring of other critical parameters of new installed Gas turbines. Certified IEC 61508 SIL 3	FT3300