JAQUET
TECHNOLOGY GROUP

Ex – Sensors ATEX

Prüf- und Zertifizierungsstelle

ZELM Ex

·Z·E·R·T·I·F·I·K·A·T·

(1) **Mitteilung**

über die Anerkennung der Qualitätssicherung Produktion

(2) Geräte oder Schutzsysteme oder Komponenten zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen - **Richtlinie 94/9/EG**

(3) Mitteilungsnummer: **ZELM 99 ATEX 1020: 2002**

(4) Produktgruppe: Herstellung und Vertrieb von Drehzahlmessinstrumenten in der bestimmenden Zündschutzart Eigensicherheit "i"

Die benannte Stelle führt eine Liste der EG-Baumusterprüfbescheinigungen, für die diese Mitteilung gilt.

(5) Antragsteller: **JAQUET AG**
Thannerstrasse 15
CH-4009 Basel

(6) Hersteller: **JAQUET AG**
Thannerstrasse 15
CH-4009 Basel

(7) Die Prüf- und Zertifizierungsstelle ZELM Ex, benannte Stelle Nr. 0820 für Anhang IV nach Artikel 9 der Richtlinie des Rates der Europäischen Gemeinschaft 94/9/EG vom 23. März 1994, teilt dem Antragsteller mit, daß der Hersteller ein Qualitätssicherungssystem für die Produktion unterhält, das dem Anhang IV dieser Richtlinie genügt.

(8) Diese Mitteilung basiert auf dem vertraulichen Auditbericht Nr. AB 0211001, ausgestellt am 12.11.2002. Die Mitteilung ist gültig bis 13.11.2005 und kann zurückgezogen werden, wenn der Hersteller die Anforderungen des Anhangs IV nicht mehr erfüllt.

Die Ergebnisse der regelmäßigen Begutachtung des Qualitätssicherungssystems Produktion während der Gültigkeitsperiode sind Bestandteil dieser Mitteilung.

(9) Gemäß Artikel 10 (1) der Richtlinie 94/9/EG ist hinter der CE-Kennzeichnung die Kennummer 0820 der Prüf- und Zertifizierungsstelle ZELM Ex als der benannten Stelle anzugeben, die in der Produktionsüberwachungsphase tätig wird.

Zertifizierungsstelle **ZELM Ex**

Dipl.-Ing. Harald Zelm

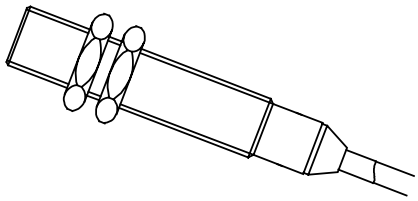
Zertifizierungs- und Prüfstelle ZELM Ex

Braunschweig, 17.12.2002

Deutscher Akkreditierungs Rat
DAR
ZLS-ZQ-117/99

Electromagnetic Sensor
Series DSE
Explosion proof versions EEx

DSE _ _ _ _.21 Ex
DSE _ _ _ _.22 Ex
DSE _ _ _ _.23 Ex
ATEX



Operating Instructions
347E-64449
valid beginning with serial no. 0103

General

Function	Sensors DSE xxxx.21/22/23 are used to convert rotational and linear movement into electronic signals and consist of an iron core and induction coil mounted in front of a permanent magnet, with an electronic limiting circuit for output voltage and output current. The pole wheel rotating close to the sensor head affects the magnetic field and, according to the laws of induction, generates a voltage in the coil which is proportional to the rate of change of magnetic flux in the iron core. The magnitude of the sensor voltage depends on the distance between pole wheel/sensor and the dimensions of the poles. It is also more or less proportional to the rotational speed of the pole wheel. The electromagnetic sensor requires no auxiliary power supply for signal generation.
Usage in an Eex explosion risk environment	**Please note the terms of the "EC-Type Examination Certificate".** Sensors of type **DSE xxxx.21/ 22/ 23 xHZ Ex atex** are certified as **intrinsically safe** II 2 G EEx ia IIC T6-T1 to be used in **plant locations with Ex-Zone 1 (Group II)** with **EC-Type Examination Certificate** no. ZELM 03 ATEX 0138X. A copy of the **EC-Type Examination Certificate** is an integral part of these Operating Instructions.

Technical Data

Signal output *	Using the sensor together with a toothed wheel having involute gear form will generate a sinusoidal signal. Analysing the frequency will determine the speed. The signal amplitude is proportional to the rate of change of flux generated by the pole wheel. It principally depends on the following parameters: • Linear velocity at the circumference of the toothed wheel • Module of the toothed wheel • Air gap between toothed wheel and sensor's front surface • Load impedance applied to the sensor Images 1, 2, and 3 show the maximum Peak-Peak voltage, which can be achieved with the different sensor models. Please note that the min/max signal amplitudes should be dimensioned in such a way as to be compatible with the instrumentation (trigger level and max I/P voltage). A trigger level of 50mVrms is used as standard with Jaquet tachometers. The minimum measurable speed is then derived from the frequency which generates a minimum amplitude of 50mVrms. **Note: For use in Ex zones the lower air gap limits shown in table 1 must not be reduced.**
Frequency range	0,05 Hz...20 kHz
Noise immunity	According to 89/336/EG / EN 50081-2 / EN 50082-2
Insulation	Housing, cable shield and coils galvanically isolated (500 V/50 Hz/ 1 min)
Operating temperature *	See tables on page 2. **Please note "EC-Type Examination Certificate".**
Housing *	Stainless machining steel X12CrNiS188, material no. 1.4305, front side hermetically sealed. Electronic components potted in chemical and age proof synthetic resin. Dimensions according to drawing and table. Maximum allowed **fixing torque:** **35 Nm** for M16x1 and 5/8"-18 UNF **50 Nm** for M18x1 **75 Nm** for M22x1
Protection class	IP68 (head), IP67 (cable entrance), IP 54 (connector – where used)
Vibration immunity	5 g_n in the range of 5...2000 Hz.

Shock immunity	50 g_n during 20 ms, semi-sinusoidal shock.
Weight	see type list
Pole wheel	Ferromagnetic toothed wheel, e.g. USt37-2, involute gear wheel preferred, minimum tooth width 6 mm, eccentricity at min. tooth width < 0,2 mm, side offset < 0,2 mm Combination pole wheel Module – Measuring system: DSE xxxx.21 is suitable for Module 1, 2 and 4 DSE xxxx.22 is suitable for Module 1,2 DSE xxxx.23 is suitable for Module 2, 4 and higher
Version AH	Connector according to table.
Version SH	**Teflon cable**, article no. 824L-31841, 2-pole, 2 x 0,75 mm² , shielded (metal net insulated from the housing), black shell, outer Ø max. 5.3 mm, bending radius min. 80 mm, weight 45 g/m.
Version S2H	**Silicone cable,** article no.. 824L-36622, 6-pole, 6*0.6mm² (AWG 20), shielded (metal net insulated from the housing), black shell, outer Ø max. 13,0 mm, bending radius min. 30 mm, weight 200 g/m. **Brown, blue and orange leads are not connected.**

***** Max. operating temperature is dependent on the following parameters:

- Size of sensor housing
- Maximum available electrical power from the intrinsically safe input circuit of the attached Ex speed measuring device or from the Zener barriers
- Ex temperature class (T1-T6)
- Sensor model

Table Operating Temperature, Output and Housing for: II 2 G EEx ia IIC T6-T1

Sensor Type resp. Housing size	Max. available electrical output [mW]	Max. allowed operating-temperature [°C] Ex-endangered plant locations: temperature class						Examples for STAHL Zener-barriers (PTB 01 ATEX 2053 + 2088) or Ex speed measuring devices from JAQUET AG	System Resistance nominal Ohm	
		T1	T2	T3	T4	T5	T6	Signal path	Coil	System compl.
DSE16xx.21 DSE 18xx.21 DSE 20xx.21 DSE 22xx.21	0	150	150	150	124	89	74	-	250	2950
	100	150	150	150	119	84	69	-	250	2950
	200	125	125	125	111	76	61	-	250	2950
	300	100	100	100	100	69	54	-	250	2950
	400	80	80	80	80	61	46	9002/77-280-094-001	250	2950
DSE 16xx.22 DSE 18xx.22 DSE 20xx.22 DSE 22xx.22	0	185	185	185	128	93	78	-	840	1660
	10	185	185	185	128	93	78	9001/02-093-003-101	840	1660
	50	175	175	175	127	92	77	9001/02-093-030-101	840	1660
	100	150	150	150	125	90	75	-	840	1660
DSE 16xx.23 DSE 18xx.23 DSE 20xx.23 DSE 22xx.23	0	185	185	185	128	93	78	-	650	1470
	10	185	185	185	128	93	78	9001/02-093-003-101	650	1470
	50	175	175	175	127	92	77	9001/02-093-030-101	650	1470
	100	150	150	150	125	90	75	-	650	1470

Type-Table for Ex-Sensors for plant location as per EEx ia IIC T6-T1

Type	Art. no.	Housing	Connection			Operating Temperature
		Thread **(1)**	Connector	Mating connector (provided) **(2)**	Length of cable **(5)**	[°C] **(1)**
DSE 2210.22 AHZ Ex atex	**347Z-05103**	**M22x1**			**-**	**Class T6-T1**
DSE 2210.22 SHZ Ex atex	**347Z-05098**	**M22x1**			**5m**	**Class T6-T1**
DSE 2210.22 S2HZ Ex atex	**347Z-05101**	**M22x1**			**5m**	**Class T6-T1**
DSE 2220.23 AHZ Ex atex	**347Z-05104**	**M22x1**			**-**	**Class T6-T1**
DSE 2220.23 SHZ Ex atex	**347Z-05099**	**M22x1**			**5m**	**Class T6-T1**
DSE 2220.23 S2HZ Ex atex	**347Z-05102**	**M22x1**			**5m**	**Class T6-T1**
DSE EH10.22 AHZ Ex atex	**347Z-05105**	**5/8“ UNF**			**-**	**Class T6-T1**
DSE EH10.22 SHZ Ex atex	**347Z-05100**	**5/8“ UNF**			**5m**	**Class T6-T1**
DSE EH10.21 SHZ Ex atex	**347Z-05096**	**5/8“ UNF**			**5m**	**Class T6-T1**
DSE EH20.23 SHZ Ex atex	**347Z-05097**	**5/8“ UNF**			**5m**	**Class T6-T1**

Connection

The sensor wires are sensitive to electrical interference.
The following two points should therefore be noted:

- A screened two-core cable must always be used for the sensor connections. The screen must be taken all the way to the terminal provided on the instrument and not earthed.
- The sensor cables should be laid as far away as possible from large electrical machines, and on no account be laid parallel to high-voltage/current power lines.

The maximum permissible cable length is a function of the sensor voltage, cable routing, the capacitance and inductance characteristics of the cable and the max. signal frequency. In general however, it is advisable to keep the distance between the sensor and the associated instruments as short as possible. The sensor cables may be extended by interposing junction boxes having type IP20 terminals (conforming to DIN 40050). We recommend JAQUET cables as extension cables (JAQUET art. no. 824L-31841).

Installation

The sensor is mounted with the centre of its face over the pole centre. With gear wheels or slots and radial sensor mounting, the sensor is usually mounted over the middle of the wheel. Dependent on the wheel width a certain axial displacement of the pole wheel is then permissible. The centre of the sensor should however, be positioned at least 3 mm away from the edge of the wheel end under all operating conditions.

Rigid vibration-free mounting of the sensor is vital.

Vibration of the sensor with respect to the pole wheel induces additional impulses. The sensors are insensitive to oil, lubricants, etc. and may be used in harsh operating conditions. When fitting the sensor, the minimum permissible pole wheel-sensor distance should be selected. This distance must be such that the transmitter on no account brushes against the pole wheel. The pole wheel-sensor distance has no influence on the calibration of the overall system.

Maintenance

Sensors are maintenance-free.

The sensors are fully potted and sealed and cannot be repaired.

Ex

Please note “EC-Type Examination Certificate” and appropriate standards (e. g. IEC 79-14 or DIN VDE 0165)!

Image 1 :

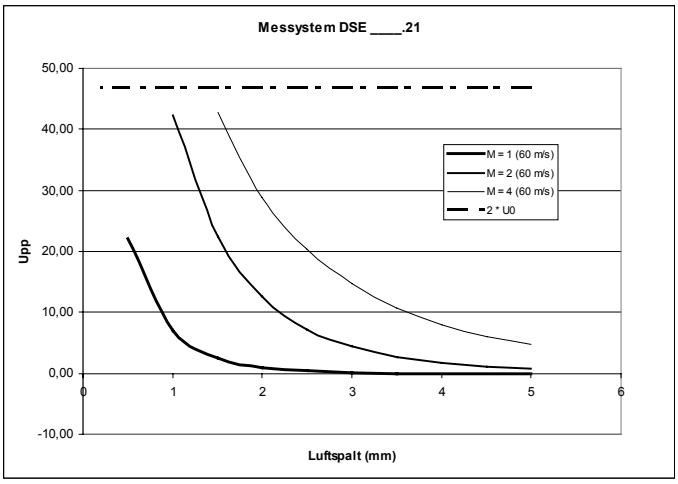
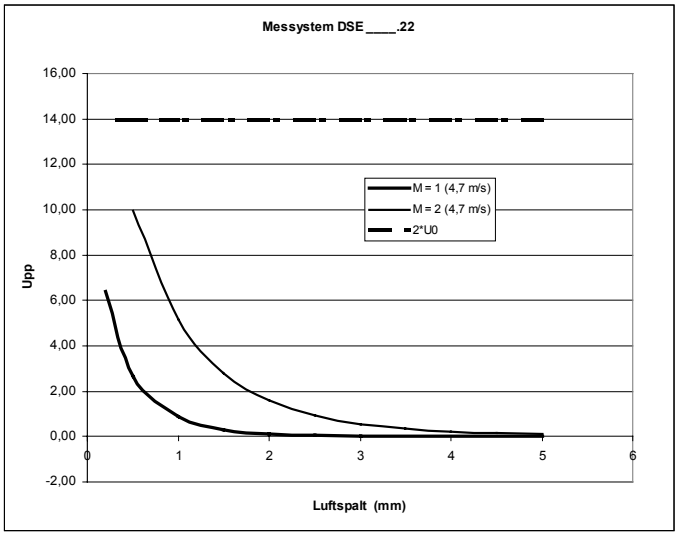


Image 2 :



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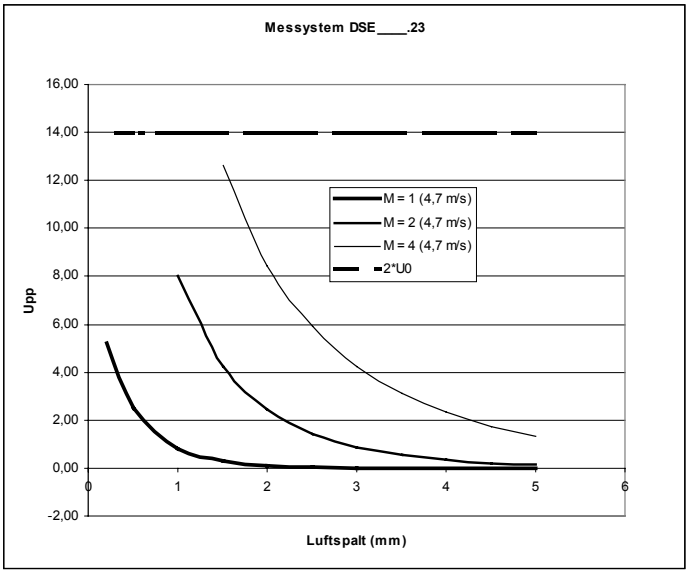
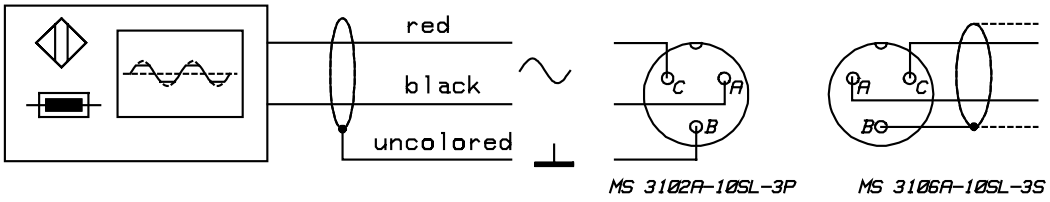


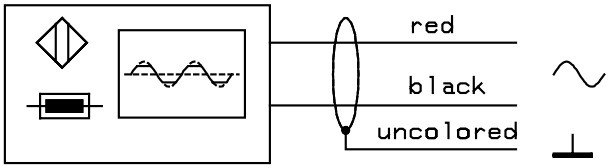
Table 1 : min. air gap limits for Ex use

Measuring system	***Module 1***	***Module 2***	***Module 4***
DSE ____.21 Reference circumferential velocity 60 m/s	***0.4 mm***	***1.2 mm***	***1.8 mm***
DSE ____.22 Reference circumferential velocity 4.7 m/s	***0.3 mm***	***0.5 mm***	***-***
DSE ____.23 Reference circumferential velocity 4.7 m/s	***0.3 mm***	***0.8 mm***	***1.6 mm***

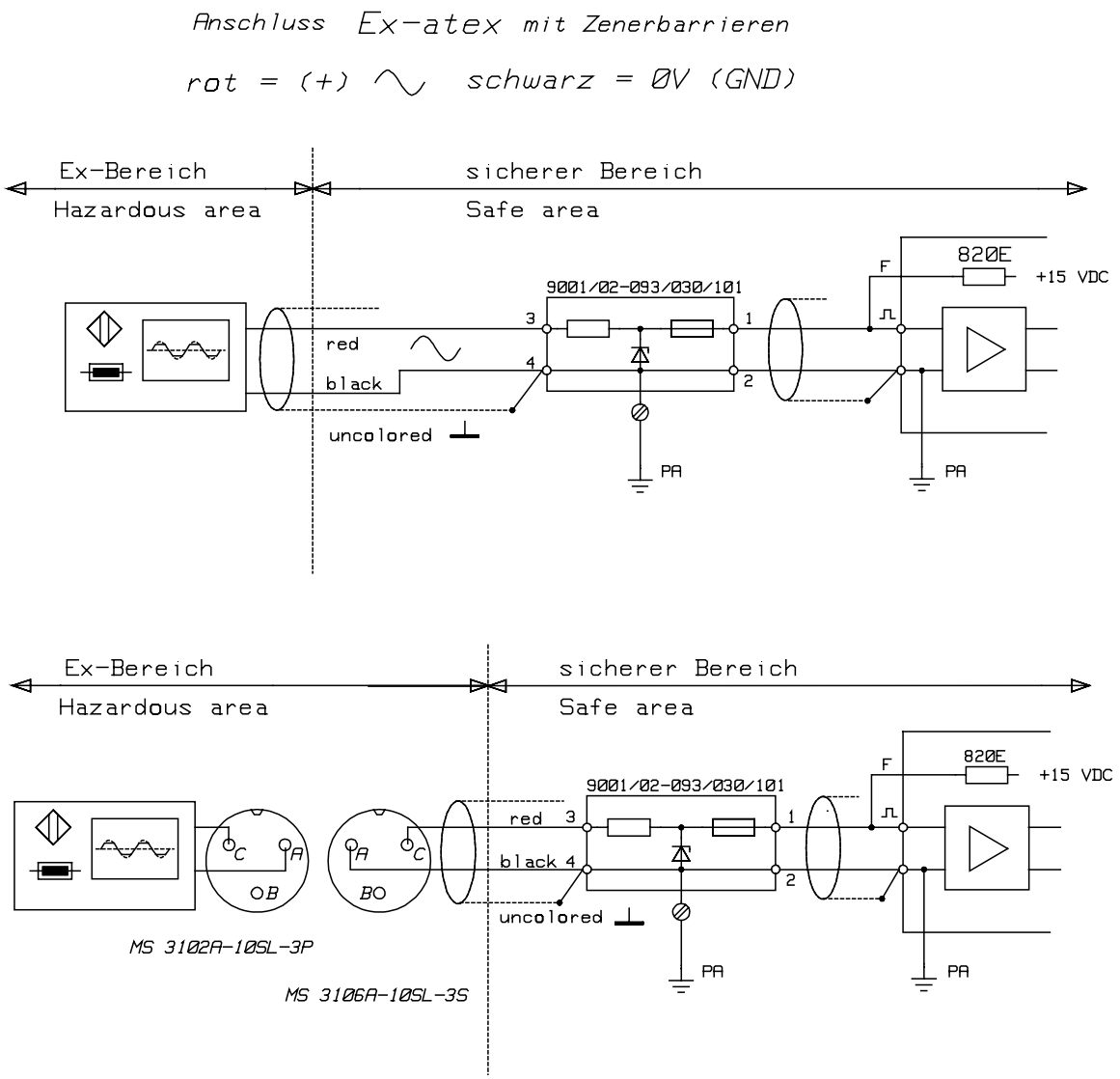
Connection diagram for sensor types DSE xxxx.xx AHZ Ex-atex:



Connection diagram for sensor types DSE xxxx.xx SHZ Ex-atex and DSE xxxx.xx S2HZ:



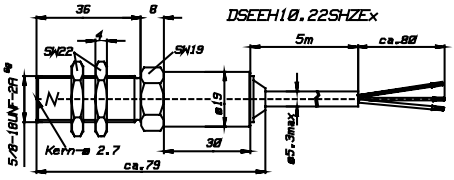
Connection using Zener barriers:

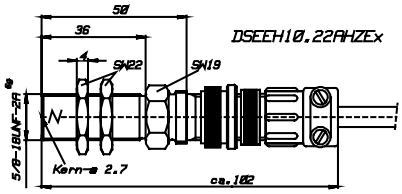


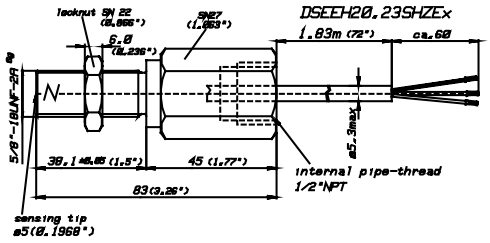
10.2.04 Pi

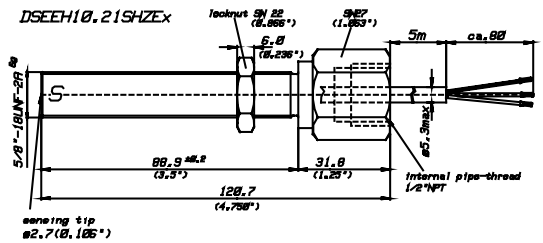
ba_z1_dse_ex

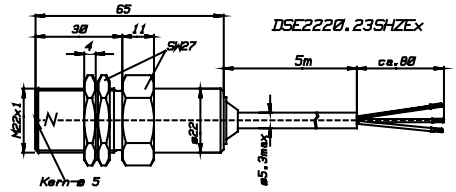
Dimensions:


DSEEH10.22SHZEx
36
8
SW22
SW19
5m
ca.80
5/8-18UNF-2A
Kern-ø 2.7
ø19
30
ø5.3max
ca.79


50
DSEEH10.22AHZEx
36
SW22
SW19
5/8-18UNF-2A
Kern-ø 2.7
ca.102


DSEEH20.23SHZEx
locknut SW 22
SW27
6.0
1.83m (72")
ca.60
5/8"-18UNF-2A
ø5.3max
45 (1.77")
internal pipe-thread
1/2"NPT
83(3.26")
sensing tip
ø5(0.1968")


DSEEH10.21SHZEx
locknut SW 22
SW27
6.0
5m
ca.80
5/8"-18UNF-2A
ø5.3max
88.9
(3.5")
31.8
(1.25")
internal pipe-thread
1/2"NPT
120.7
(4.75")
sensing tip
ø2.7(0.105")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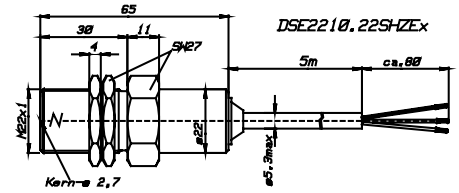
DSE2220.23SHZEx
30
11
SW27
5m
ca.80
M22x1
ø22
ø5.3max
Kern-ø 5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DSE2210.22SHZEx
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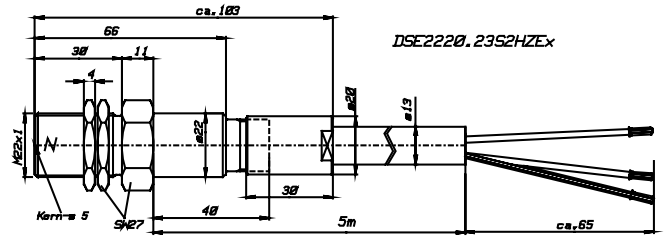
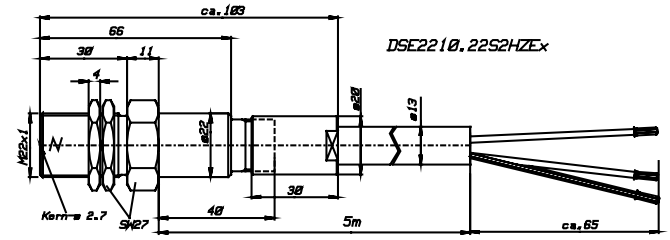
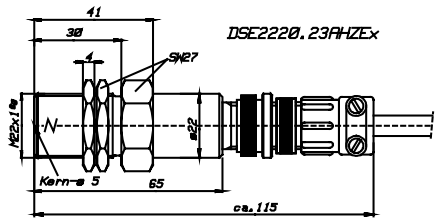
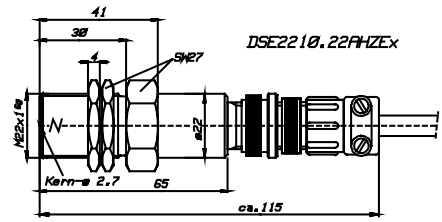
SW27
5m
ca.80
M22x1
ø22
ø5.3max
Kern-ø 2,7


ca.103
66
DSE2220.23S2HZEx
30
11
ø20
ø13
M22x1
ø22
Kern-ø 5
SW27
40
30
5m
ca.65


ca.103
66
DSE2210.22S2HZEx
30
11
ø20
ø13
M22x1
ø22
Kern-ø 2.7
SW27
40
30
5m
ca.65


41
DSE2220.23AHZEx
30
SW27
M22x1
ø22
Kern-ø 5
65
ca.115


41
DSE2210.22AHZEx
30
SW27
M22x1
ø22
Kern-ø 2,7
65
ca.115

CE-Declaration of Conformity

According to the CE guidelines

- Electromagnetic compatibility 89/336/EWG
- Apparatus used in explosive environment 94/4/EG

The apparatus

Type name : DSE xxxx.21 .HZ, DSE xxxx.22 .HZ, DSE xxxx.23 .HZ

Have been developed, and are constructed and produced in accordance with the guidelines 89/336/EG and 94/4/EG solely by :

Company : JAQUET AG, Thannerstrasse 15, CH-4009 Schweiz.

The following harmonised standards are applicable :

- EN 50081-2, EN 50011, CISPR 16
- EN 50082-2, EN 61000-4-2/3/4/5/6/8/11

- EN 50014
- EN 50020
- EN 50284
- EN 1127

- EN ISO 9001:2000

The following national standards are applicable :

- IEC 60068-2-1/2/30/6
- VDE 0165

Full technical documentation is available.
The associated instruction manuals are available under following numbers :

- 374D-64449 for DSE xxxx Ex Atex in original language.
- 343E-64449 for DSE xxxx Ex Atex in english.

Basel, the 25.08.2003 Signature Head of engineering

Prüf- und Zertifizierungsstelle

ZELM Ex

(1) # EC-TYPE-EXAMINATION CERTIFICATE

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-TYPE-EXAMINATION CERTIFICATE Number:

ZELM 03 ATEX 0138X

(4) Equipment: **Rotation speed sensor type DSE xxyy.zz *HZ Ex**

(5) Manufacturer: **JAQUET AG**

(6) Address: **Thannerstrasse 15, CH-4009 Basel**

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Prüf- und Zertifizierungsstelle ZELM Ex, notified body No. 0820 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report ZELM Ex 0360215180.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50 014: 1997+A1+A2 **EN 50020: 1994**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this Certificate.

(12) The marking of the equipment shall include the following:

Ex **II 2 G EEx ia IIC T6**

Zertifizierungsstelle **ZELM Ex**

Adolf Gruber

Zertifizierungsstelle ZELM Ex Prüf- und

Braunschweig, July 1st, 2003

(13) **SCHEDULE**

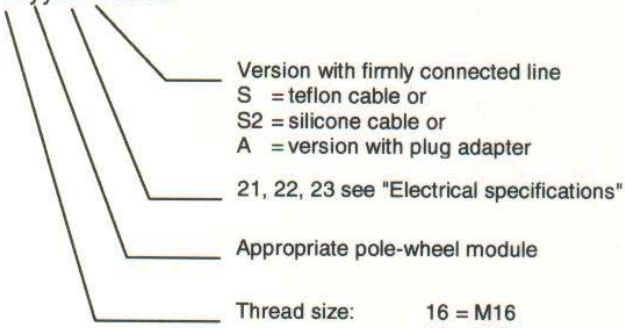
(14) **EC-TYPE-EXAMINATION CERTIFICATE ZELM 03 ATEX 0138X**

(15) Description of equipment

The rotation speed sensors are used for the recording of the rotation speed for the touchless scanning of rotating ferromagnetic rotating magnetic poles, gears, camshafts and the like.

Model key:

Rotation speed sensor type DSE xxyy.zz .HZ Ex



Electrical data

Supply- and signal circuit

type of protection Intrinsic Safety EEx ia IIC
type DSE xxyy.21 .HZ Ex

maximum values: U_o = 23,5 V
I_o = 10 mA
P_o = 58 mW
(linear output characteristic)

maximum permissible external inductance L_o = 300 mH
maximum permissible external capacity C_o = 132 nF

resp.

types DSE xxyy.22 .HZ Ex und DSE xxyy.23 .HZ Ex

maximum values: U_o = 7 V
I_o = 10 mA
P_o = 17 mW
(linear output characteristic)

maximum permissible external inductance L_o = 300 mH
maximum permissible external capacity C_o = 15,7 µF

resp.

Schedule to EC-TYPE-EXAMINATION CERTIFICATE ZELM 03 ATEX 0138X

only for connection to certified intrinsically safe circuits

maximum values: U_i = 30 V
I_i = 100 mA
P_i = 400 mW (in accordance with table 1)
(linear output characteristic)

The maximum effective inner inductance and capacitance are negligibly small

The lower temperature boundary conducts for all versions and applications - 20 °C.

The temperature class, the maximum permissible ambient temperature and the maximum permissible power of the connected, certified, intrinsically safe circuit (P_i) for the different versions are to be determined with the following table.

Table 1

type	P_i	maximum ambient temperature for the temperature classes					
		T1	T2	T3	T4	T5	T6
	[mW]						
DSE 16xx.21	0	150	150	150	124	89	74
DSE 18xx.21	100	150	150	150	119	84	69
DSE 20xx.21	200	125	125	125	111	76	61
DSE 22xx.21	300	100	100	100	100	69	54
DSE EH10.21	400	80	80	80	80	61	46
DSE 16xx.22	0	185	185	185	128	93	78
DSE 18xx.22	10	185	185	185	128	93	78
DSE 20xx.22	50	175	175	175	127	92	77
DSE 22xx.22	100	150	150	150	125	90	75
DSE EH10.22	0	185	185	185	128	93	78
DSE 16xx.23	10	185	185	185	128	93	78
DSE 18xx.23	50	175	175	175	127	92	77
DSE 20xx.23	100	150	150	150	125	90	75
DSE 22xx.23							
DSE EH10.23							

(16) Report No.

ZELM Ex 0360215180

(17) Special conditions for safe use

1. The Rotation Speed Sensors may be used only in intrinsically safe circuits in accordance with the information in this EC-Type-Examination Certificate.
2. The permissible ambient temperature range is to be determined according to the determination of this EC-Type-Examination Certificate.
3. The compliance of the limiting values for the maximum circumferential speed of 60 m/s with model DSE .....21 resp. 4,7 m/s for the further versions is to be guaranteed.

Schedule to EC-TYPE-EXAMINATION CERTIFICATE ZELM 03 ATEX 0138X

4. The compliance of the minimum air gaps in accordance with the information in the operating instruction is to be guaranteed
5. The instruction manual has to be considered.

(18) Essential Health and Safety Requirements

met by standards

Zertifizierungsstelle **ZELM Ex**

Zertifizierungs- und Prüf- stelle ZELM Ex

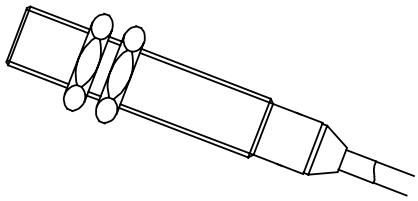
Braunschweig, July 1st, 2003

Adolf Gruber

Ferrostat Speed Sensor
Series DSF
Explosion Proof Versions EEx

DSF ..10.** .HV
Ex

ATEX



Operating Instructions
374E-64368
Valid from lot nr. 0103

General

Function	The **DSF** series Ferrostat speed sensors are suitable for use with a **pole wheel** to generate speed proportional frequency signals. They exhibit dynamic behaviour, whereby pulse generation down to 0.05 Hz is guaranteed. The sensing element is a magnetically biased Hall device, followed by an amplifier having a trigger characteristic and short circuit proof output stage.
Use in potentially explosive environment EEx	**For operation in hazardous areas the restrictions given in the EC Type Examination Certificate must be adhered to.** **DSF xx10.00 xHV Ex** series sensors are certified **intrinsically safe II 2 G EEx ia IIC T6-T1** for use in flammable gas atmospheres, and as **II 2 D T147°C IP65** for use in flammable dust atmospheres. EC Type Examination Certificate no. ZELM 03 ATEX 0124X. A copy of the EC Type Examination Certificate forms a constituent part of these operating instructions.

Technical Data

Supply voltage *	8 ... 28 VDC, max. superimposed AC ripple of 25mVpp. The voltage drop as a result of the cable impedance and Zener barrier series resistance must be allowed for! **Protected against reverse polarity.**
Current consumption	max. 15mA **(without load)**
Signal output *	Square wave from push-pull output stage, DC coupled to the supply (0V = reference voltage), Load current max. 25mA, Output voltage HI: > Supply voltage - 4 Volt at Isource = 25mA Output voltage LO: < 2 Volt at Isink = 25mA The voltage drop as a result of the cable impedance and Zener barrier series resistance must be allowed for! **Short circuit proof and protected against reverse polarity.**
Frequency range	0,05Hz...20 kHz
Noise immunity	In accordance with 89/336/EG / EN 50081-2 / EN 50082-2
Isolation	Housing, cable screen and electronics galvanically separated (500 V/50 Hz/ 1 Min.)
Operating temperature *	See tables on following pages. **The restrictions given in the EC Type Examination Certificate must be adhered to.**
Housing *	Stainless steel X12CrNiS188, material number 1.4305, front side hermetically sealed, electronic components potted in a chemical and age proof ceramic. Dimensions according to table and drawings. Maximum permissible tightening torque: **12 Nm** for M12x1 **25 Nm** for M14x1 **35 Nm** for M16x1 **50 Nm** for M18x1 **75 Nm** for M22x1
Protection class	IP68 (Head), IP67 (cable connection), IP 54 (where connector used)
Ex protection *	II 2 G EEx ia IIC T6-T1 (explosive gas) II 2 D 147°C IP 65 (explosive dust) **The restrictions given in the EC Type Examination Certificate must be adhered to.**
Vibration immunity	5 g_n in the range 5...2000Hz.

Shock immunity	50 g_n during 20 ms, half sine wave impact.
Weight	According to table
Pole wheel	Ferromagnetic toothed wheel, material e.g.. USt37-2, involute gear wheels preferred, Module ≥1, tooth width min. 6 mm, sidewise movement at min. tooth width < 0,2 mm, eccentricity < 0,2 mm. • Pole wheel – sensor gap with Module 1: 0,2...1,0 mm Module 2: 0,2...2,5 mm ≥Module 4: 0,2...4,5 mm
Version AH	Connector per table.
Version SH	**Teflon cable**, Art.-Nr. 824L-35053, 4-pole, 4 x 0,24 mm² (AWG 24), screened wires (mesh screen, isolated from housing), white outer shell Ø max. 4,0 mm, bending radius min. 60 mm, weight 32 g/m. **The brown wire is not used.**
Version S2H	**Silicone cable,** Art-Nr. 824L-36622, 6-pole, 6*0.6mm² (AWG 20), screened wires (mesh screen, isolated from housing), black outer shell Ø max. 13,0 mm, bending radius min. 30 mm, weight 200 g/m. **The brown, blue and orange wires are not used.**

***** The maximum permissible operating temperature depends upon the following parameters, as shown in the table below:

- Sensor housing size
- Maximum available electrical power from the intrinsically safe sensor power supply and from the intrinsically safe input circuit of the attached instrumentation and any Zener barriers.
- Ex Temperature class (T1-T6)

Operating temperature for II 2 D T 147°C IP65 : -20 / + 100°C
Where dust clouds are present, the surface temperature of the sensor must not exceed 2/3 of the ignition temperature of the corresponding dust / air mixture.
In the event of dust coatings being present, the surface temperature of the sensor must not exceed the limits defined in EN 50281-1-2.

Operating temperature for II 2 G EEx ia T6-T1 : *per table :*

Sensor Type or Housing size	maximum available electrical power [mW]	maximum permissible operating Temperature [°C] Ex hazardous areas: Temperature class						Example Zener Barriers from STAHL (PTB 01 ATEX 2053) (Connection diagrams page 4)
		T1	T2	T3	T4	T5	T6	Power supply & Signal path
DSF 1210.**	900	125	125	125	83	48	33	1 x 9001/011-280-075-10 & 1 x 9001/01-280-050-101
	630	125	125	125	96	61	46	2 x 9001/01-168-075-101
	525	125	125	125	102	67	52	1 x 9001/01-168-075-101 & 1 x 9001/01-168-050-101
	490	125	125	125	104	69	54	1 x 9001/01-280-050-101 & 1 x 9001/01-280-020-101
	399	125	125	125	108	73	58	1 x 9001/01-168-075-101 & 1 x 9001/01-168-020-101
	300	125	125	125	113	78	63	-
	200	125	125	125	117	82	67	-
	100	125	125	125	120	89	74	-
	50	125	125	125	120	91	76	-
DSF 1810.**	900	125	125	125	90	55	40	1 x 9001/01-280-075-101 & 1 x 9001/01-280-050-101
	630	125	125	125	102	67	52	2 x 9001/01-168-075-101
	525	125	125	125	106	71	56	1 x 9001/01-168-075-101& 1 x 9001/01-168-050-101
	490	125	125	125	107	72	57	1 x 9001/01-280-050-101 & 1 x 9001/01-280-020-101
	399	125	125	125	111	76	61	1 x 9001/01-168-075-101 & 1 x 9001/01-168-020-101
	300	125	125	125	115	80	65	-
	200	125	125	125	120	85	70	-
	100	125	125	125	120	89	74	-
	50	125	125	125	120	91	76	-
DSF 2210.**	900	125	125	125	98	63	48	1 x 9001/01-280-075-101 & 1 x 9001/01-280-050-101
	630	125	125	125	107	72	57	2 x 9001/01-168-075-101
	525	125	125	125	110	75	60	1 x 9001/01-168-075-101 & 1 x 9001/01-168-050-101
	490	125	125	125	111	76	61	1 x 9001/01-280-050-101 & 1 x 9001/01-280-020-101
	399	125	125	125	114	79	64	1 x 9001/01-168-075-101 & 1 x 9001/01-168-020-101
	300	125	125	125	118	83	68	-
	200	125	125	125	120	86	71	-
	100	125	125	125	120	90	75	-
	50	125	125	125	120	91	76	-

Ex-Sensor type table:

Type	Art.-Nr.	Housing	Connection			Weight complete	Operating temperature
		Thread **(1)**	„LEMO“ Connector	Mating connector supplied **(2)**	Cable length **(4)**	[g]	[°C] **(1)**
DSF 1210.00 SHV Ex atex	**374Z-05066**	**M12x1**			**2m**		**Class T6-T1**
DSF 1810.00 SHV Ex atex	**374Z-05067**	**M18x1**			**2m**		**Class T6-T1**
DSF 1810.00 S2HV atex	**374Z-05068**	**M18x1**			**5m**		**Class T6-T1**
DSF 2210.00 SHV Ex atex	**374Z-05069**	**M22x1**			**2 m**		**Class T6-T1**
DSF 2210.00 S2HV Ex atex	**374Z-05071**	**M22x1**			**5m**		**Class T6-T1**
DSF 2210.00 AHV Ex atex	**374Z-05072**	**M22x1**	**ERA 2S-304 CLL**	**(3)**	**-**		**Class T6-T1**
DSF 2210.87 SHV Ex atex	**374Z-05070**	**M22x1**			**2 m**		**Class T6-T1**

(1) The temperature and atmosphere limitations for each sensor housing size, as shown in the table, must be observed and the restrictions given in the EC Type Examination Certificate must be adhered to.

(2) Mating connector for cable diameter 3.1...4.1mm, other diameters on request.

(3) Type FFA 2S 304 CLA C42 : Art.-Nr. 820A-35732

(4) The limitations relating to permissible cable capacitance and inductance detailed in the EC Type Examination Certificate under Ex power supply and instrumentation Ex input must be adhered to!

Connection

The sensor wires are sensitive to electrical interference.
The following 2 points should therefore be noted:

- A screened 3 core cable must always be used for sensor connections. The screen must be taken all the way to the terminal provided on the instrumentation and not earthed.
- The sensor cables should be laid as far as possible from large electrical machines and on no account laid parallel to high voltage/current power lines.

The maximum permissible cable length is a function of the sensor voltage, cable routing, the capacitance and inductance characteristics of the cable and the max. signal frequency. In general however, it is advisable to keep the distance between sensor and instrumentation as short as possible. The sensor cables can be extended using junction boxes having IP20 rated terminals. (corresponding to DIN 40050 or IEC 529) We recommend the use of JAQUET extension cable Art.-Nr. 824L-31081.

Installation

The sensor should be mounted with the middle of the front face over the middle of the tooth. With radial sensor mounting around gear or slotted wheels, the sensor is normally mounted over the centre of the wheel. Dependent upon gear width, a degree of axial movement is then permissible. The middle of the sensor must however be a minimum of 3 mm from either edge of the pole wheel under all operating conditions.

Solid and vibration free mounting of the sensor is important.

The sensors are insensitive to oil, grease etc and can be installed in arduous conditions. Should the cable be subjected to aggressive materials, then Teflon cable should be specified. During installation the smallest allowable pole wheel to sensor air gap should be set. The gap should however be set so as to prevent the face of the sensor ever touching the pole wheel. The overall system calibration is not influenced by the air gap.

Maintenance

Sensors are maintenance free.

The sensors are fully potted and sealed and cannot be repaired.

Ex

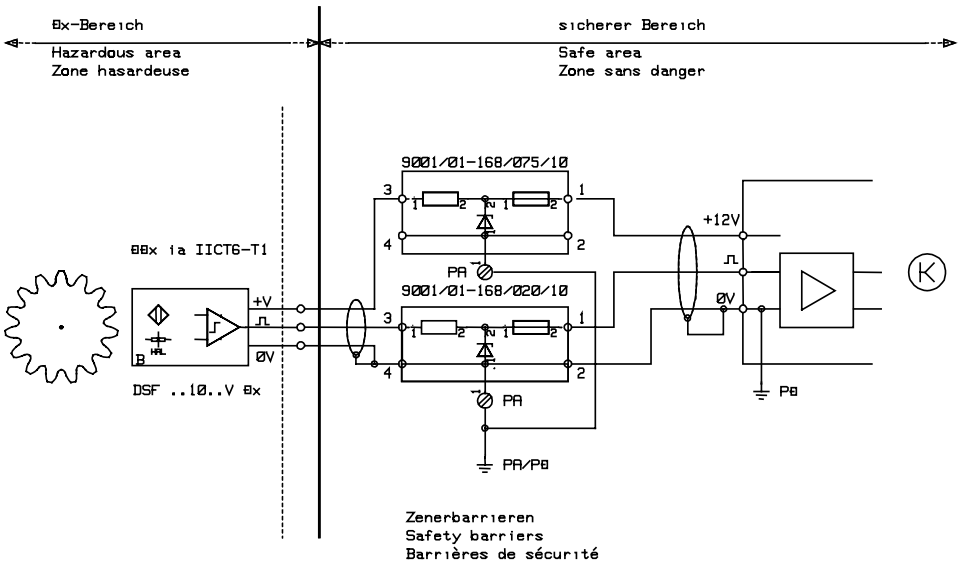
A connection diagram for use with Zener barriers is provided on page 4.

Protection class : II 2 G EEx ia IIC T6-T1

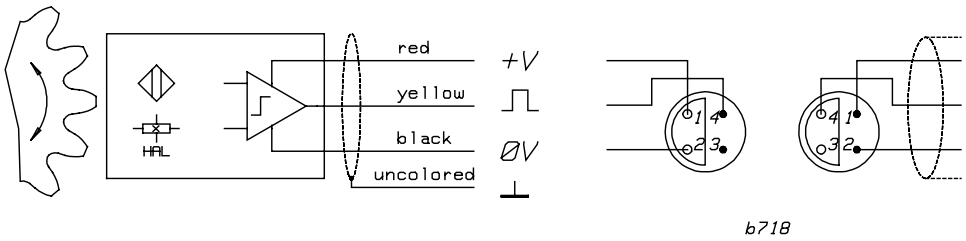
II 2 D 147°C IP 65 (Power level of 900mW, at Ta =100°C)

The restrictions given in the EC Type Examination Certificate and appropriate standards (e.g. IEC 79-14 or DIN VDE 0165) must be adhered to.

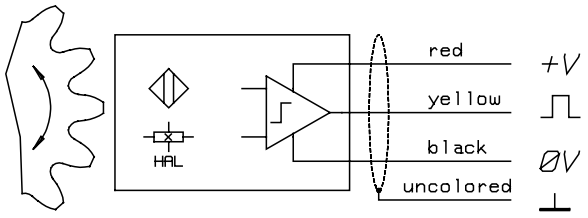
Connection using Zener barriers:



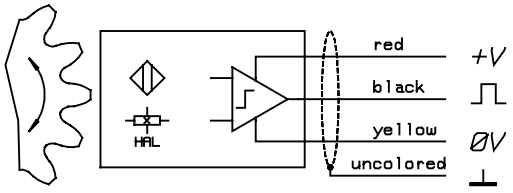
Connection diagram sensor type DSF xx10.00 AHV Ex-atex:



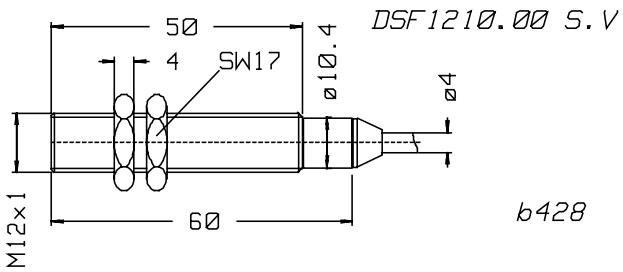
Connection diagram sensor types DSF xx10.00 SHV Ex-atex und DSF xx10.00 S2HV Ex-atex :

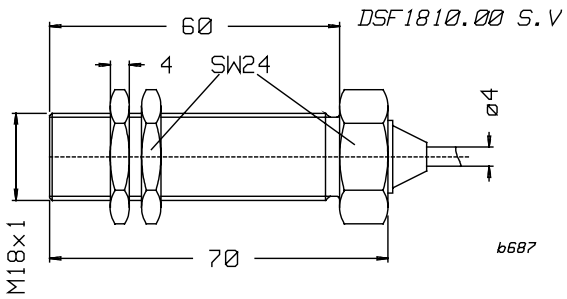


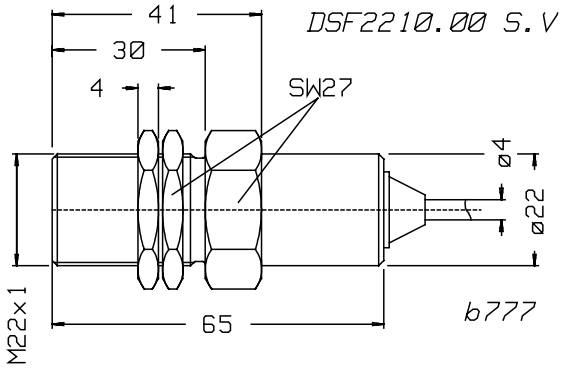
Connection diagram sensor type DSF 2210.87 SHV Ex-atex:

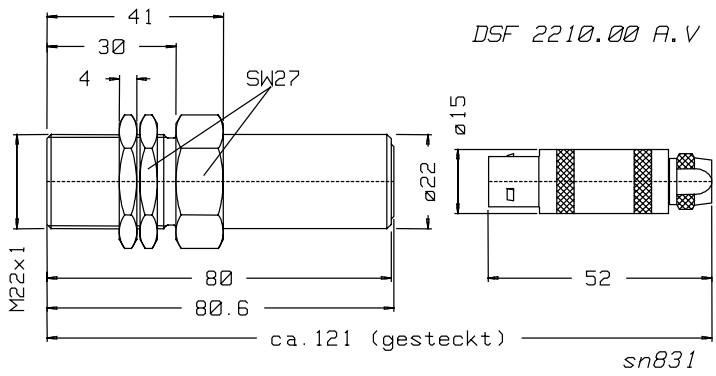


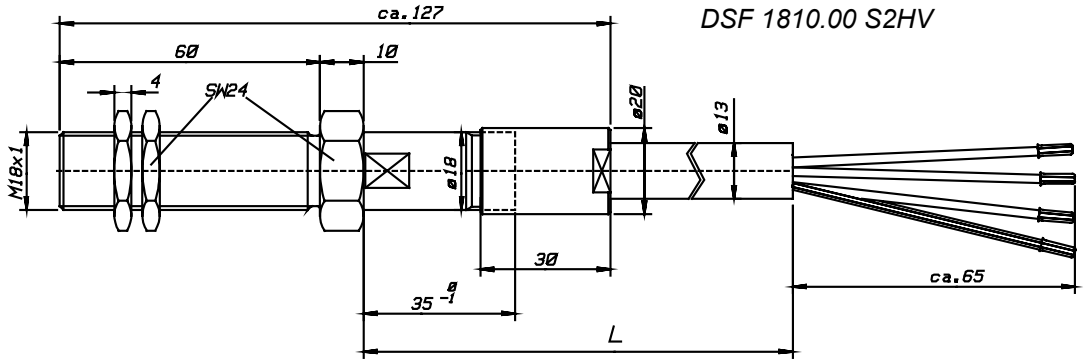
Dimensional drawings for sensor types DSF xx10.xx xHV Ex-atex :

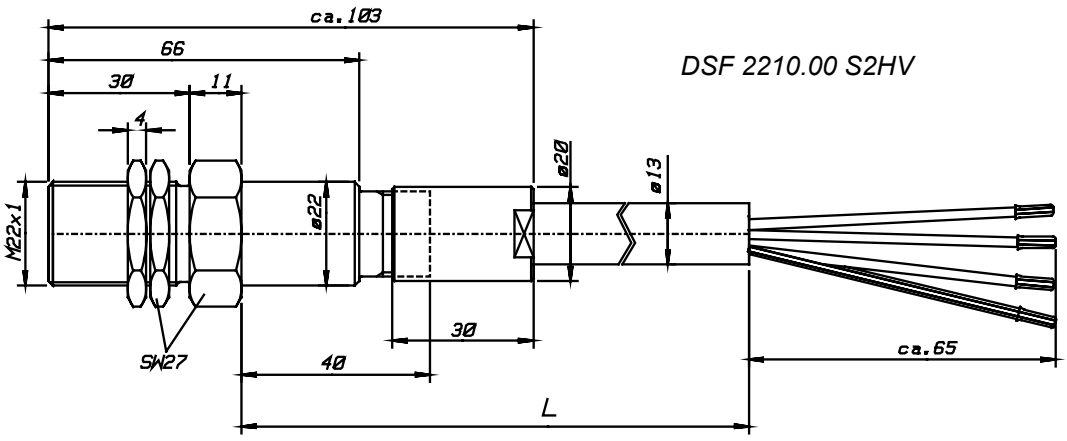












CE-Declaration of Conformity

According to the CE guidelines

- Electromagnetic compatibility 89/336/EWG
- Apparatus used in explosive environment 94/4/EG

The apparatus

Type name : DSF xx10.xx xHV atex

Have been developed, and are constructed and produced in accordance with the guidelines 89/336/EG and 94/4/EG solely by :

Company : JAQUET AG, Thannerstrasse 15, CH-4009 Schweiz.

The following harmonised standards are applicable :

- EN 50081-2, EN 50011, CISPR 16
- EN 50082-2, EN 61000-4-2/3/4/5/6/8/11

- EN 50014
- EN 50020
- EN 50284
- EN 1127

- EN ISO 9001:2000

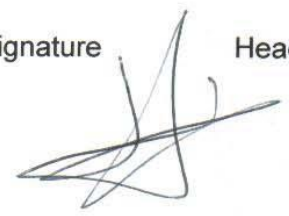
The following national standards are applicable :

- IEC 60068-2-1/2/30/6
- VDE 0165

Full technical documentation is available.
The associated instruction manuals are available under following numbers :

- 374D-64368 for DSF xx10.xx Ex Atex in original language.
- 343E-64368 for DSF xx10.xx Ex Atex in english.

Basel, the 01.09.03 Signature Head of engineering



Prüf- und Zertifizierungsstelle

ZELM Ex

(1) # EC-TYPE-EXAMINATION CERTIFICATE

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-TYPE-EXAMINATION CERTIFICATE Number:

ZELM 03 ATEX 0124X

(4) Equipment: **Rotation speed sensor type DSF ..10.**.HV Ex**

(5) Manufacturer: **JAQUET AG**

(6) Address: **Thannerstrasse 15, CH-4009 Basel**

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Prüf- und Zertifizierungsstelle ZELM Ex, notified body No. 0820 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report ZELM Ex 0370215173.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50 014: 1997+A1+A2 **EN 50020: 1994** **EN 50 281-1-1: 1998**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this Certificate.

(12) The marking of the equipment shall include the following:

Ex **II 2 G EEx ia IIC T6 and II 2 D T 147°C IP 65**

Zertifizierungsstelle **ZELM Ex**

Zertifizierungsstelle und Prüf- ZELM Ex

Braunschweig, June 18, 2003

Adolf Gruber

Sheet 1/4

Prüf- und Zertifizierungsstelle ZELM Ex • Siekgraben 56 • D-38124 Braunschweig

(13) **SCHEDULE**

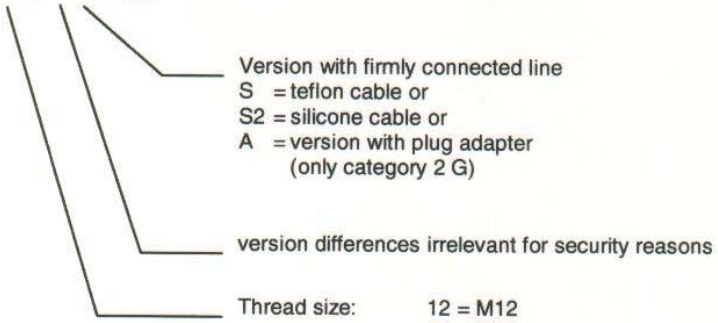
(14) **EC-TYPE-EXAMINATION CERTIFICATE ZELM 03 ATEX 0124X**

(15) Description of equipment

The rotation speed sensors are used for the recording of the rotation speed for the touchless scanning of rotating ferromagnetic rotating magnetic poles, gears, camshafts and the like.

Model key:

Rotation speed sensor type DSF ..10.** .HV Ex



Electrical data

Supply- and signal circuit: type of protection Intrinsic Safety EEx ia IIC resp. IIB or iaD for use according to category 2D

only for the connection to certified intrinsically safe circuits

maximum values: U_i = 28 V
I_i = 150 mA
P_i = 900 mW (at category 2D) and/or
$P_i \leq$ 900 mW (in accordance with table 1 at category 2 G)

Maximum effective inner capacity C_i = 36 nF

The maximum effective inner inductance is negligibly small

For use according to category 2D the maximum permissible ambient temperature conducts to 100°C.

The lower temperature boundary is for all versions and applications - 20 °C.

The temperature class, the maximum permissible ambient temperature and the maximum permissible power of the connected, certified, intrinsically safe circuit (P_i) for the different versions are for the usage according to category 2G are to be determined with the following table.

Schedule to EC-TYPE-EXAMINATION CERTIFICATE ZELM 03 ATEX 0124X

Table 1

type	P_i [mW]	maximum ambient temperature for the temperature classes					
		T1	T2	T3	T4	T5	T6
DSF 1210... DSF 1410... DSF 1610... DSF EH10..	900	125	125	125	83	48	33
	630	125	125	125	96	61	46
	525	125	125	125	102	67	52
	490	125	125	125	104	69	54
	399	125	125	125	108	73	56
	300	125	125	125	113	78	63
	200	125	125	125	117	82	67
	100	125	125	125	120	89	74
	50	125	125	125	120	91	76
DSF 1810... DSF 2010...	900	125	125	125	90	55	40
	630	125	125	125	102	67	52
	525	125	125	125	106	71	56
	490	125	125	125	107	72	57
	399	125	125	125	111	76	61
	300	125	125	125	115	80	65
	200	125	125	125	120	85	70
	100	125	125	125	120	89	74
	50	125	125	125	120	91	76
DSF 2210...	900	125	125	125	98	63	48
	630	125	125	125	107	72	57
	525	125	125	125	110	75	60
	490	125	125	125	111	76	61
	399	125	125	125	114	79	64
	300	125	125	125	118	83	68
	200	125	125	125	120	86	71
	100	125	125	125	120	90	75
	50	125	125	125	120	91	76

(16) Report No.

ZELM Ex 0370215173

(17) Special conditions for safe use

1. The Rotation Speed Sensors may be used only in intrinsically safe circuits in accordance with the information in this EC-Type-Examination Certificate.
2. The permissible ambient temperature range is to be determined according to the determination of this EC-Type-Examination Certificate.
3. The versions with plug adapter are only intended for use in areas, in which explosive atmospheres caused by gases or vapours in accordance with the category 2 G might occur.
4. The instruction manual has to be considered.

Schedule to EC-TYPE-EXAMINATION CERTIFICATE ZELM 03 ATEX 0124X

(18) Essential Health and Safety Requirements
met by standards

Zertifizierungsstelle **ZELM Ex**

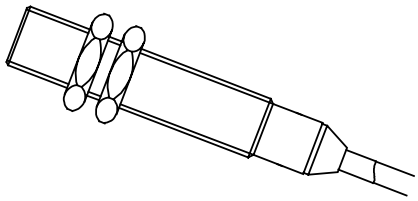
Braunschweig, June 18, 2003

Adolf Gruber

Ferrostat Speed Sensor
Series DSF ..15.01
Explosion Proof Versions EEx

DSF ..15.01 .HV
Ex

ATEX



Operating Instructions
304E-64471
valid from lot no. 3003

General

Function	The **DSF** series Ferrostat speed sensors are suitable for use with a **pole wheel** to generate speed proportional frequency signals. They exhibit static behaviour, whereby pulse generation down to 0 Hz is guaranteed. The sensing element is a magnetically biased Hall device, followed by a 2 wire amplifier (version **V**).
Use in potentially explosive environment EEx	**For operation in hazardous areas the restrictions given in the EC Type Examination Certificate must be adhered to.** **DSF xx15.01 xHV Ex** series sensors are certified **intrinsically safe II 2 G EEx ia IIC T6-T1** for use in flammable gas atmospheres. EC Type Examination Certificate no. ZELM 03 ATEX 0170 X. A copy of the EC Type Examination Certificate forms a constituent part of these operating instructions.

Technical Data

Supply voltage *	For Ex types : 9 ... 18 VDC For non Ex types : 9 ... 28 VDC **Protected against reverse polarity**
Current consumption	max. 10 mA
Signal output *	The supply is provided from the non Ex environment via a 820 Ohm resistor. The current impulses generated are analysed on this resistor. Pulse levels of 2.2 V peak-peak are generated across the 820 Ohm resistor, with a d.c. component of ¾ supply voltage (see drawing). **Short circuit proof and protected against reverse polarity.**
Frequency range	0 Hz...15 kHz
Noise immunity	In accordance to 89/336/EG / EN 50081-2 / EN 50082-2
Isolation	Housing, cable screen and electronics galvanically separated (500 V/50 Hz/ 1 Min.)
Operating temperature *	See tables on following pages. **The restrictions given in the EC Type Examination Certificate must be adhered to.**
Housing *	Stainless steel X12CrNiS188, material number 1.4305, front side hermetically sealed, electronic components potted in a chemical and age proof ceramic. Dimensions according to table and drawings. Maximum permissible tightening torque: **12 Nm** for M12x1 **25 Nm** for M14x1 **35 Nm** for M16x1 **50 Nm** for M18x1 **75 Nm** for M22x1
Protection class	IP68 (Head), IP67 (cable connection), IP 54 (where connector used)
Ex protection *	II 2 G EEx ia IIC T6-T1 (explosive gas) **The restrictions given in the EC Type Examination Certificate must be adhered to.**
Vibration immunity	5 g_n in the range 5...2000Hz.
Shock immunity	50 g_n during 20 ms, half sine wave impact.
Weight	According to table

Pole wheel	Ferromagnetic toothed wheel, material e.g. USt37-2, involute gear wheels preferred, Module ≥1, tooth width min. 6 mm, sideways movement at min. tooth width < 0,2 mm, eccentricity < 0,2 mm. • Pole wheel – sensor gap with Module 1: 0,2...1,0 mm Module 2: 0,2...2,5 mm ≥Module 4: 0,2...4,5 mm
Version AH	connector **Type MS 310 2A-10SL-3P MIL-C-5015**
Version SH	**Teflon cable**, Art.-no. 824L-35053, 4-pole, 4 x 0,24 mm² (AWG 24), screened wires (mesh screen, isolated from housing), white outer shell Ø max. 4,0 mm, bending radius min. 60 mm, weight 32 g/m. **The brown and yellow wires are not used.**
Version S2H	**Silicone cable,** Art-no. 824L-36622, 6-pole, 6*0.6mm² (AWG 20), screened wires (mesh screen, isolated from housing), black outer shell Ø max. 13,0 mm, bending radius min. 30 mm, weight 200 g/m. **The brown, blue and orange wires are not used.**

***** The maximum permissible operating temperature depends upon the following parameters, as shown in the table below:

- Sensor housing size
- Maximum available electrical power from the intrinsically safe sensor power supply and from the intrinsically safe input circuit of the attached instrumentation and any Zener barriers.
- Ex Temperature class (T1-T6)

Operating temperature for II 2 G EEx ia T6-T1 : see table ***:***

Sensor Type or housing size	maximum available electrical power [mW]	maximum permissible operating temperature [°C] Ex hazardous areas: Temperature class						Example Zener Barriers from STAHL (PTB 01 ATEX 2088) or JAQUET speed measuring devices (Connection diagrams page 4)
		T1	T2	T3	T4	T5	T6	Power supply & signal path
DSF 1215.**	450	104	104	104	99	71	56	9001/01-168-050-101 or 9001/01-168-075-101 or 9001/01-168 -100-101 or 9001/01-126-075-101
	200	125	125	125	119	84	69	9001/01-168-020-101 or 9001/01-126-020-101
DSF EH15.**	450	104	104	104	99	71	56	9001/01-168-050-101 or 9001/01-168-075-101 or 9001/01-168 -100-101 or 9001/01-126-075-101
	200	125	125	125	119	84	69	9001/01-168-020-101 or 9001/01-126-020-101
DSF 1615.**	450	104	104	104	99	71	56	9001/01-168-050-101 or 9001/01-168-075-101 or 9001/01-168 -100-101 or 9001/01-126-075-101
	200	125	125	125	119	84	69	9001/01-168-020-101 or 9001/01-126-020-101
DSF 1815.**	450	104	104	104	99	74	59	9001/01-168-050-101 or 9001/01-168-075-101 or 9001/01-168 -100-101 or 9001/01-126-075-101
	200	125	125	125	120	86	71	9001/01-168-020-101 or 9001/01-126-020-101
DSF 2215.**	450	104	104	104	99	77	62	9001/01-168-050-101 or 9001/01-168-075-101 or 9001/01-168 -100-101 or 9001/01-126-075-101
	200	125	125	125	120	87	72	9001/01-168-020-101 or 9001/01-126-020-101

Ex-Sensor type table:

Type	Art.-no.	Housing	Connection			Weight complete	Operating temperature
		Thread **(1)**	connector MIL-C-5015	Mating connector MIL-C-5015	Cable length	[g]	[°C] **(1)**
DSF 2215.01 AHV Ex atex	**304Z-05163**	**M22x1**	**MS3102A-10SL-3P**	**MS3106A-10SL-3S**	**-**		**Class T6-T1**
DSF 2215.01 SHV Ex atex	**304Z-05164**	**M22x1**			**5 m**		**Class T6-T1**
DSF 2215.01 S2HV Ex atex	**304Z-05165**	**M22x1**			**5 m**		**Class T6-T1**
DSF EH15.01 AHV Ex atex	**304Z-05166**	**5/8“ UNF**	**MS3102A-10SL-3P**	**MS3106A 10SL-3S**	**-**		**Class T6-T1**
DSF EH15.01 SHV Ex atex	**304Z-05167**	**5/8“ UNF**			**5 m**		**Class T6-T1**
DSF EH15.01 S2HV Ex atex	**304Z-05168**	**5/8“ UNF**			**5 m**		**Class T6-T1**
DSF 1615.01 SHV Ex atex	**304Z-05196**	**M16 * 1**			**5 m**		**Class T6-T1**
DSF 1215.01 SHV Ex atex	**304Z-05197**	**M12 * 1**			**5m**		**Class T6-T1**

(1) The temperature and atmosphere limitations for each sensor housing size, as shown in the table, must be observed and the restrictions given in the EC Type Examination Certificate must be adhered to.

(2) Mating connector for cable diameter 3,5...7 mm, other diameters on request.

(3) Type MS 3106A-10SL-3S : Art.-no. 820E-31141/820E-30691

(4) The **limitations** relating to permissible cable capacitance and inductance detailed in the EC Type Examination Certificate under Ex power supply and instrumentation Ex input must be adhered to!

Connection

The sensor wires are sensitive to electrical interference.
The following 2 points should therefore be noted:

- A screened 2 core cable must always be used for sensor connections. The screen must be taken all the way to the terminal provided on the instrumentation and not earthed.
- The sensor cables should be laid as far as possible from large electrical machines and on no account laid parallel to high voltage/current power lines.

The maximum permissible cable length is a function of the sensor voltage, cable routing, the capacitance and inductance characteristics of the cable and the max. signal frequency. In general however, it is advisable to keep the distance between sensor and instrumentation as short as possible. The sensor cables can be extended using junction boxes having IP20 rated terminals. (corresponding to DIN 40050 or IEC 529) We recommend the use of JAQUET extension cable art. no. 824L-31081.

The screen must be connected to **0 Volts at the analysing device.**

Installation

The sensor should be mounted with the middle of the front face over the middle of the tooth. With radial sensor mounting around gear or slotted wheels, the sensor is normally mounted over the centre of the wheel. Dependent upon gear width, a degree of axial movement is then permissible. The middle of the sensor must however be a minimum of 3 mm from either edge of the pole wheel under all operating conditions.

Solid and vibration free mounting of the sensor is important.

The sensors are insensitive to oil, grease etc and can be installed in arduous conditions. Should the cable be subjected to aggressive materials, then Teflon cable should be specified. During installation the smallest allowable pole wheel to sensor air gap should be set. The gap should however be set so as to prevent the face of the sensor ever touching the pole wheel. The overall system calibration is not influenced by the air gap.

Maintenance

Sensors are maintenance free.

The sensors are fully potted and sealed and cannot be repaired.

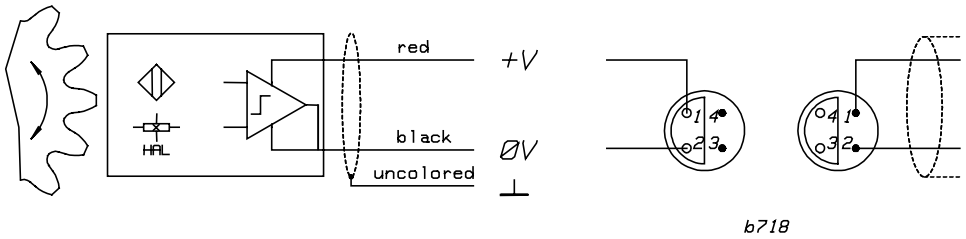
Ex

A connection diagram for use with Zener barriers is provided on page 5.

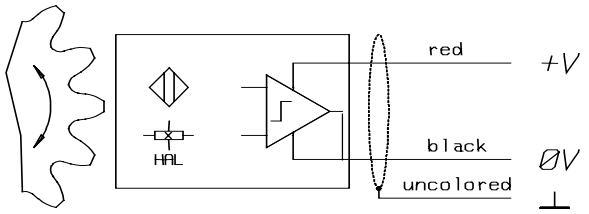
Protection class : II 2 G EEx ia IIC T6-T1

The restrictions given in the EC Type Examination Certificate and appropriate standards (e.g. IEC 79-14 or DIN VDE 0165) must be adhered to.

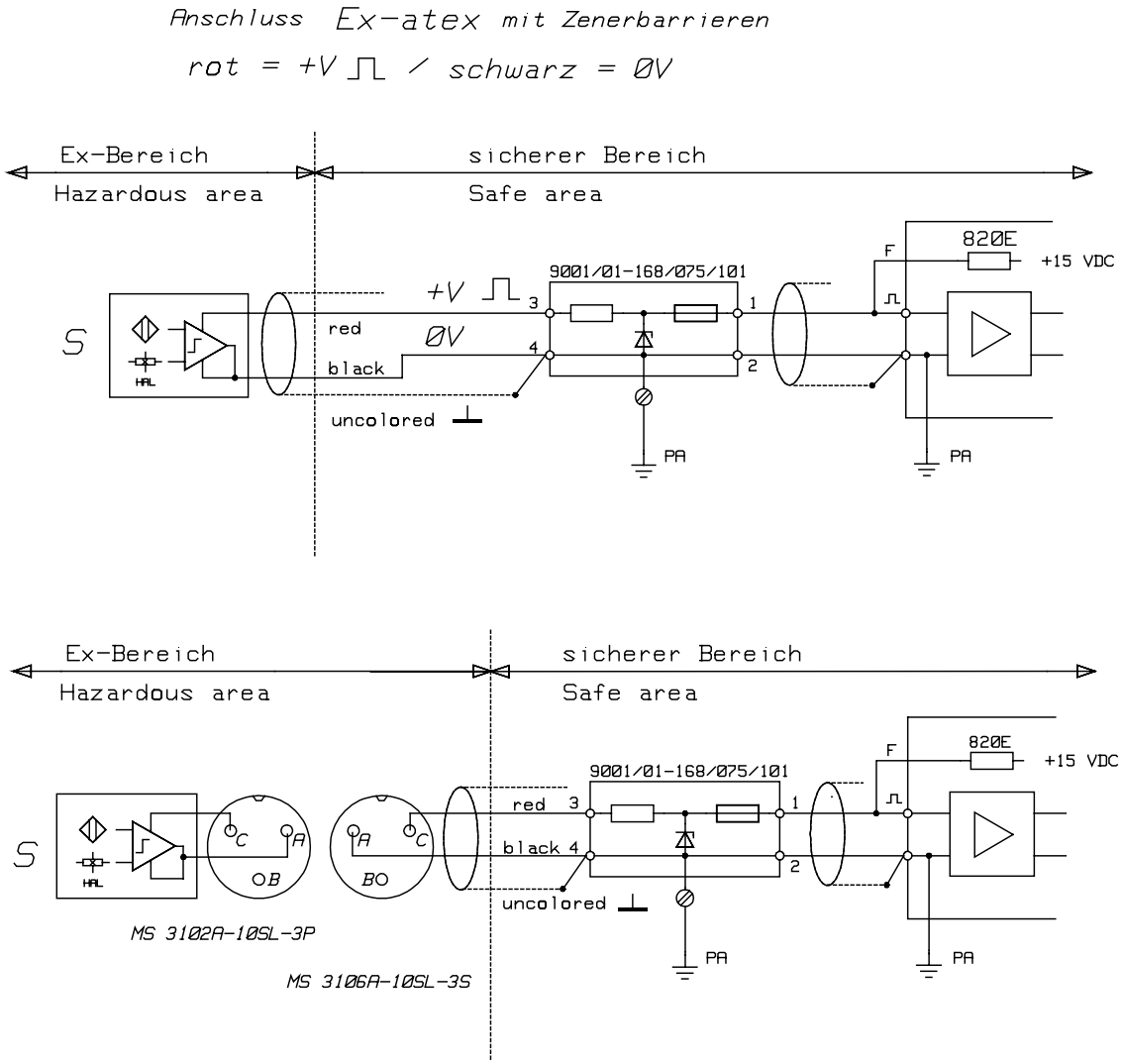
Connection diagram sensor type DSF xx15.01 AHV Ex-atex:



Connection diagram sensor type DSF xx15.01 SHV Ex-atex and DSF xx15.01 S2HV Ex-atex :



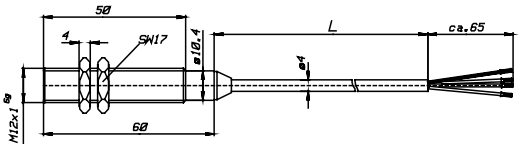
Connection using Zener barriers:



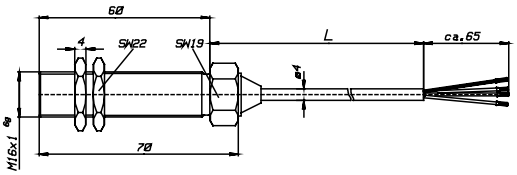
ÄNDERUNG: 5942 14.1.04 Pi

ba_z1_dsf.15ex

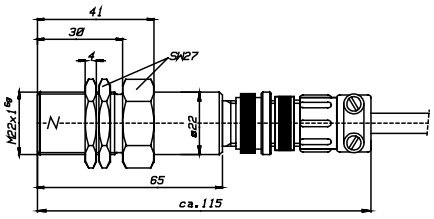
Dimensional drawings for sensor types DSF ..15.xx xHV Ex-atex :



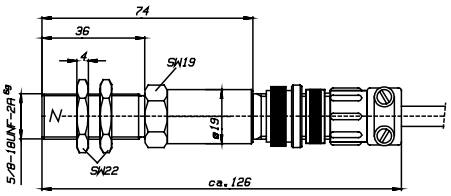
DSF1215.01SHV Ex-atex



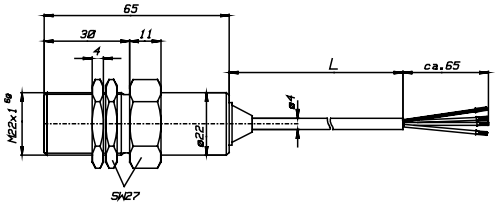
DSF1615.01SHV Ex-atex



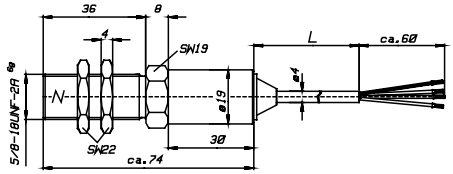
DSF2215.01AHV Ex-atex



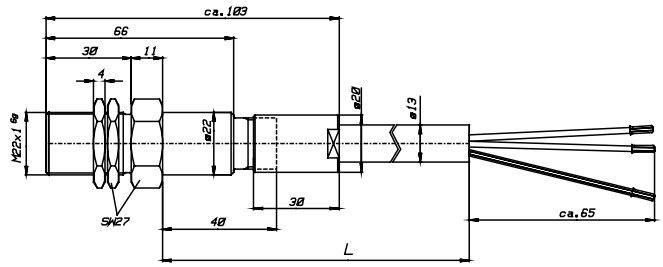
DSFEH15.01AHV Ex-atex



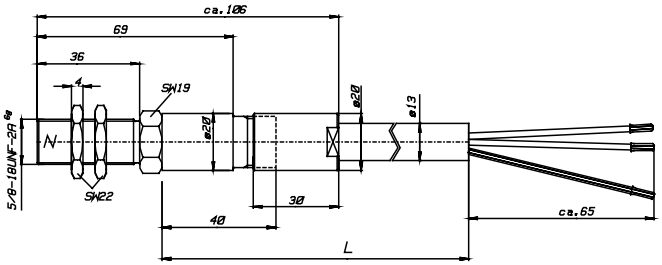
DSF2215.01SHV Ex-atex



DSFEH15.01SHV Ex-atex



DSF2215.01S2HV Ex-atex



DSFEH15.01S2HV Ex-atex

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CE-Declaration of Conformity

According to the CE guidelines

- Electromagnetic compatibility 89/336/EWG
- Apparatus used in explosive environment 94/4/EG

The apparatus

Type name : DSE ..15.xx .HV

Have been developed, and are constructed and produced in accordance with the guidelines 89/336/EG and 94/4/EG solely by :

Company : JAQUET AG, Thannerstrasse 15, CH-4009 Schweiz.

The following harmonised standards are applicable :

- EN 50081-2, EN 50011, CISPR 16
- EN 50082-2, EN 61000-4-2/3/4/5/6/8/11

- EN 50014
- EN 50020
- EN 50284
- EN 1127

- EN ISO 9001:2000

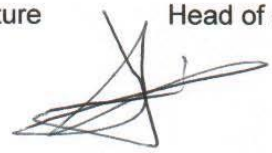
The following national standards are applicable :

- IEC 60068-2-1/2/30/6
- VDE 0165

Full technical documentation is available.
The associated instruction manuals are available under following numbers :

- 304D-64471 for DSE xxxx Ex Atex in original language.
- 304E-64471 for DSE xxxx Ex Atex in english.

Basel, the 25.08.2003 Signature Head of engineering



Prüf- und Zertifizierungsstelle
ZELM Ex

(1) **EC-TYPE-EXAMINATION CERTIFICATE**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-TYPE-EXAMINATION CERTIFICATE Number:

ZELM 03 ATEX 0170 X

(4) Equipment: **Rotation speed sensor type DSF .. 15.xx ..V Ex Atex**

(5) Manufacturer: **JAQUET AG**

(6) Address: **CH-4009 Basel**

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Prüf- und Zertifizierungsstelle ZELM Ex, notified body No. 0820 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report ZELM Ex 0900319224.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50 014: 1997+A1+A2 **EN 50020: 2002**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this Certificate.

(12) The marking of the equipment shall include the following:

Ex **II 2 G EEx ia IIC T6**

Zertifizierungsstelle **ZELM Ex**

Zertifizierungs- und stelle Prüf- ZELM Ex ZELM Ex

Braunschweig, November 26, 2003

Dipl.-Ing. Harald Zelm

Sheet 1/3

EC-type-examination Certificates without signature and stamp are not valid. The certificates may only be circulated without alteration. Extracts or alterations are subject to approval by the Prüf- und Zertifizierungsstelle ZELM Ex. This English version is based on the German text. In the case of dispute, the German text shall prevail.

Prüf- und Zertifizierungsstelle ZELM Ex • Siekgraben 56 • D-38124 Braunschweig

(13) **SCHEDULE**

(14) **EC-TYPE-EXAMINATION CERTIFICATE ZELM 03 ATEX 0170 X**

(15) Description of equipment

The rotation speed sensors are used for the recording of the rotation speed for the touchless scanning of rotating ferromagnetic rotating magnetic poles, gears, camshafts and the like.

Model key:

Rotation speed sensor type DSF .. 15.xx .. V Ex Atex

Version with firmly connected line
SH = teflon cable or
S2H = silicone cable or
AH = version with plug adapter

version differences irrelevant for security reasons

Thread size: 12 = M12
16 = M16
22 = M22
EH = 5/8" –18 UNF

Electrical data

Supply- and signal circuit — type of protection Intrinsic Safety EEx ia IIC

only for the connection to certified intrinsically safe circuits

maximum values: U_i = 18 V
I_i = 100mA
P_i = 450mW resp. 200 mW

Maximum effective inner capacity C_i = 16 nF

Maximum effective inner inductance L_i = 7,5 µH

The reactances of the 5m long connection cable are already considered within this data.

The lower temperature boundary is for all versions and applications - 20 °C.

The temperature class, the maximum permissible ambient temperature and the maximum permissible power of the connected, certified, intrinsically safe circuit (P_i) for the different versions are to be determined with the following table.

Schedule to EC-TYPE-EXAMINATION CERTIFICATE ZELM 03 ATEX 0170 X

Table 1

Type	P_i [mW]	max. ambient temperature for the temperature classes [°C]					
		T1	T2	T3	T4	T5	T6
DSF 12...	450	104	104	104	99	71	56
	200	125	125	125	119	84	69
DSF 16...	450	104	104	104	99	71	56
	200	125	125	125	119	84	69
DSF 22...	450	104	104	104	99	77	62
	200	125	125	125	120	87	72
DSF EH...	450	104	104	104	99	71	56
	200	125	125	125	119	84	69

(16) Report No.

ZELM Ex 0900319224

(17) Special conditions for safe use

1. The permissible ambient temperature range is to be determined according to the determination of this EC-Type-Examination Certificate.
2. The complete electrical data have to be taken from this EC-Type-Examination Certificate.
3. The instruction manual has to be considered.

(18) Essential Health and Safety Requirements

met by standards

Zertifizierungsstelle **ZELM** Ex

Dipl.-Ing. Harald Zelm

Zertifizierungsstelle ZELM Ex

Braunschweig, November 26, 2003

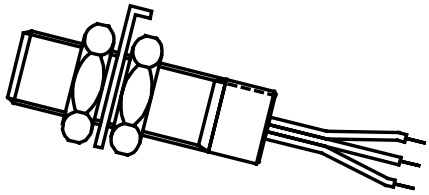
JAQUET TECHNOLOGY GROUP

Ferrostat Differential Speed Probe Series FTG 1088.XX and EEx-approved Types (atex)

FTG 1088.XX

343E-63725

Operating instructions



General

Function	The ferrostat differential sensors **FTG 1088.XX** are suitable, in conjunction with a **pole wheel**, for generating square wave signals proportional to rotary speeds. They have a dynamic behaviour, so that pulse generation is guaranteed down to a speed corresponding to a frequency of 5 Hz. The sensing element consists of a magnetically biased hall effect semiconductor in a bridge-circuit, followed by a Schmitt-trigger. This latter has an open collector output connected with the positive pole of the power supply through a 1.8k resistor.
Safety Notice	Sensor types FTG 1088.XX **Ex** are certified for applications in areas with explosive atmospheres. These types are to be duly used, undamaged and clean. No modifications are allowed on the sensors if not expressly listed in these operating instructions.
Conformity to Standards	Sensor types FTG 1088.XX **Ex** comply with the requirements of EN 50014:1997, EN 50020:1994 and EN 1127-1:1997. They have been designed, manufactured and tested according to the state of the art. **For their application the restrictions listed in the European Certificate of Conformity** ZELM 00 ATEX 0147X **must be observed!**

Technical Data

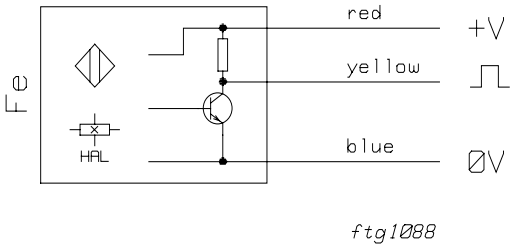
Power supply	5V ±10%, max. allowed 12V, **protected against false polarity**
Current consumption	max. 16mA
Signal output	square wave voltage, mark-space approx. 1:1, DC-coupled with power source, signal-amplitude corresponding to power supply (max. allowed sink current = 25mA at a saturation voltage of <0.4V). The output is connected through a pull-up resistor of 1.8kOhm to the plus pole of the power supply
Frequency range	5Hz...20 kHz
Electromagnetic compatibility (EMC)	• Electrostatic discharge onto housing, cable shield and wires: up to ±4 kV peak according to IEC 61000-4-2, severity level 2 • Radiated electromagnetic field: up to 30 V/m, 50% AM, 1kHz in the range of 1 MHz to 1000 MHz according to IEC 61000-4-3, severity level 3 • Electrical fast transients/bursts, coupled to sensor cable with a capacitive coupling clamp: up to ±4 kV peak according to IEC 6100-4-4, severity level 4
Insulation	Housing and electronics galvanically separated (500 V/50 Hz/ 1 Min.)
Operating temperature	-40/+125°C for non Ex version, for Ex version see Ex related information.
Housing	Argentan (German silver) CuNi10Zn42Pb DIN 2.0770, front side hermetically sealed, sensor components potted in chemical and age proof synthetic resin. Dimensions according to drawing.

Protection	IP68 (head) IP67 (connection)
Vibration immunity	3 g in the range 4...100 Hz
Shock immunity	20 g during 11 ms, half-sine wave
Weight	see type list
Pole wheel	Ferromagnetic toothed wheel (eg. USt 37-2), involute gear wheel preferred, module ≥0.5, minimum tooth width 3mm, side offset < 0.2mm, eccentricity < 0.2mm Pole wheel - sensor gap with Module 0.5: 0.1...1.4 mm Module 1.0: 0.1...1.0 mm ≥ Module 2.0: 0.1...1.3 mm
Connection	Type A: Teflon insulated wires, length 40 cm, 0.22 mm² (AWG 24) Type B: Molex-plug, Type 03-06-2031, Part-No. 343C-72577
Mounting	These sensors contain a differential hall sensor. Therefore it is necessary that the housing is positioned according to the dimensional drawing below. **If this condition is not complied with it is possible that the sensor will not work correctly.**
Ex-Safety	**For explosion proof versions II 1G and II1D a copy of the European Certificate of Conformity** ZELM 00 ATEX 0147X **is attached.** **See also below, the Ex related information in this documentation .**
Installation	For installation, the CE directives for the installation of apparatus in explosive environments must be taken into consideration.
Marking Acc. to Directive 94/9/EC	CE 0820 Ex II 1 G II 1 D
Electrical Data	Uo=10V, Is=204mA, P=510mW
Maintenance	No maintenance. The sensors cannot be repaired.

Type-list:

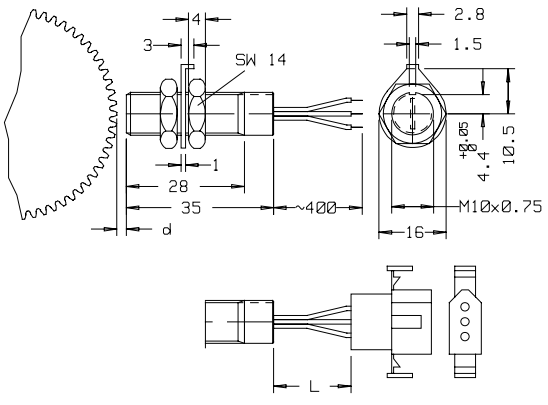
Type	Part.No.	Connection	Cable type	Cable length L	Weight
FTG 1088.00	343Z-03828	Type A	lace open	400 mm	20 gr
FTG 1088.01	343Z-03835	Type B	lace twisted	(with plug) 105 mm	23 gr
FTG 1088.00 Ex	343Z-03772	Type A	lace open	400 mm	20 gr
FTG 1088.01 Ex	343Z-03770	Type B	lace twisted	(with plug) 105 mm	23 gr
FTG 1088.01 S4 Ex	343Z-03834	Type A	Lace open	5m cable	100 gr

Schema:



ftg1088

Dimensional drawing:



CE-Declaration of Conformity

According to the CE guidelines

- Electromagnetic compatibility 89/336/EWG
- Apparatus used in explosive environment 94/4/EG

The apparatus

Type name : FTG 1088.xx and FTG 1089.xx

Have been developed, and are constructed and produced in accordance with the guidelines 89/336/EG and 94/4/EG solely by :

Company : JAQUET AG, Thannerstrasse 15, CH-4009 Schweiz.

The following harmonised standards are applicable :

- EN 50081-2, EN 50011, CISPR 16
- EN 50082-2, EN 61000-4-2/3/4/5/6/8/11

- EN 50014
- EN 50020
- EN 50284
- EN 1127

- EN ISO 9001:2000

The following national standards are applicable :

- IEC 60068-2-1/2/30/6
- VDE 0165

Full technical documentation is available.
The associated instruction manuals are available under following numbers :

- 343D-63725 for FTG 1088.xx in original language.
- 343D-63726 for FTG 1089.xx in original language.

Basel, the 28.11.2002 Signature Head of engineering

Prüf- und Zertifizierungsstelle

ZELM Ex

(1) EC-TYPE-EXAMINATION CERTIFICATE

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-TYPE-EXAMINATION CERTIFICATE Number:

ZELM 03 ATEX 0147X

(4) Equipment: **Rotation speed sensor type FTG 1088... Ex und Typ FTG 1089... Ex**

(5) Manufacturer: **JAQUET AG**

(6) Address: **Thannerstrasse 15, CH-4009 Basel**

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Prüf- und Zertifizierungsstelle ZELM Ex, notified body No. 0820 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report ZELM Ex 0040315194.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50 014: 1997+A1+A2 **EN 50020: 1994**
prEN 61241-0: 2002 **31H/143/CD (IEC 61241-11): 2002**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this Certificate.

(12) The marking of the equipment shall include the following:

Ex **II 1 G EEx ia IIC T6 und II 1 D Ex iaD 20 T ...°C**

Zertifizierungsstelle **ZELM** Ex

Adolf Gruber

Zertifizierungsstelle ZELM Ex und Prüf- ZELM Ex

Braunschweig, June 19, 2003

(13) **SCHEDULE**

(14) **EC-TYPE-EXAMINATION CERTIFICATE ZELM 03 ATEX 0147X**

(15) Description of equipment

The rotation speed sensors are used for the recording of the rotation speed for the touchless scanning of rotating ferromagnetic rotating magnetic poles, gears, camshafts and the like.

Model key:

type	Cable type	Cable length	Remarks
FTG 1088.00 Ex FTG 1089.00 Ex	Single laces	400 mm	
FTG 1088.01 Ex FTG 1089.01 Ex	Single laces - twisted	105 mm	with connection plug
FTG 1088.01 S4 Ex FTG 1089.01 S4 Ex	3-wire shielded teflon cord	max. 5 m	

The types FTG 1088... and FTG 1089... distinguish through the inner construction and the functional behavior. These differences are however for security reasons without importance.

Electrical data

Supply- and signal circuit

type of protection intrinsic safety EEx ia IIC resp. ia IIB or iaD for use according to category 1D

only for the connection to certified intrinsically safe circuits

maximum values: U_i= 10 V
I_i = 204 mA
P_i= 510 mW resp. 200 mW

Maximum effective inner capacity C_i = 9 nF

The maximum effective inner inductance is negligibly small

The lower temperature boundary is for all versions and applications - 20 °C.

The temperature class resp. the maximum surface temperature, the maximum permissible ambient temperature and the maximal permissible power of the connected, certified, intrinsically safe circuit (P_i) for the different versions are to take from the tables 1 resp. 2.

Table 1

		maximum ambient temperature for the temperature classes in °C					
Category	P_i [mW]	T1	T2	T3	T4	T5	T6
2G	510	100	100	100	100	70	55
	200	100	100	100	100	85	70
1G	510	100	100	100	80	50	40
	200	100	100	100	95	65	55

Schedule to EC-TYPE-EXAMINATION CERTIFICATE ZELM 03 ATEX 0147X

Table 2

Category	P_i [mW]	maximum ambient temperature	maximum surface temperature
1D	510	100 °C	155 °C
	200	100 °C	125 °C

(16) Report No.

ZELM Ex 0040315194

(17) Special conditions for safe use

1. The Rotation Speed Sensors may be used only in intrinsically safe electric circuits in accordance with the information in this EC-type-examination certificate. Because of possible ignition hazards, which can arise due to mistakes and/or transient currents in the potential equalization system galvanic separation is to be favored in the supply- and signal circuit. Associated apparatus without galvanic separation may be used only if the corresponding requirements are kept according to IEC 60079-14.
2. The permissible ambient temperature range is to be determined according to the determination of this EC-type-examination certificate.
3. The versions with plug adapter resp. with single laces are only intended for mounting in an appropriate enclosure, which assure an adequate protection corresponding the environmental conditions and allowed the proper electric connection. The supply cable of the corresponding version is to protect against mechanical hazards and against electrostatic charge where appropriate by correct installation.
4. The metal case of the rotation speed sensors is to be included in the local potential equalization as far as dangerous electrostatic charge for example through flowing media or mechanical friction must be reckoned on.
5. The tightness for the purposes of zone separating measures for the mounting across the boundary between different zones is not subject of this certification and must be ensured by appropriate measures of installation.
6. The instruction manual has to be considered.

(18) Essential Health and Safety Requirements

Met by standards. The rotation speed sensors correspond with the norms EN 50014 and EN 50020. For the commitment 1 D the performed draft standards were used besides since no harmonized European standards that are to be applied in connection with the type of protection "Intrinsic safety" are available in the moment.

Zertifizierungsstelle **ZELM** Ex

Adolf Gruber

Zertifizierungs- und Prüf- stelle ZELM Ex

Braunschweig, June 19, 2003

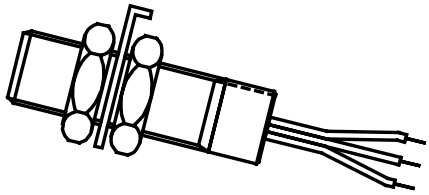
JAQUET TECHNOLOGY GROUP

Ferrostat Differential Speed Probe Series FTG 1089.XX and EEx-approved Types (atex)

FTG 1089.XX

Operating instructions

343E-63726



General

Function	The ferrostat differential sensors **FTG 1089.XX** are suitable, in conjunction with a **pole wheel**, for generating square wave signals proportional to rotary speeds. They have a static behaviour, so that pulse generation is guaranteed down to a speed corresponding to a frequency of 0Hz. The monitoring element consists of a magnetically biased hall effect semiconductor in a bridge-circuit followed by a Schmitt trigger. This latter has an open collector output connected with the positive pole of the power supply through a 1.8k resistor.
Safety Notice	Sensor types FTG 1089.XX **Ex** are certified for applications in areas with explosive atmospheres. These types are to be duly used, undamaged and clean. No modifications are allowed on the sensors if not expressly listed in these operating instructions
Conformity to Standards	Sensor types FTG 1089.XX **Ex** comply with the requirements of EN 50014:1997, EN 50020:1994 and EN 1127-1:1997. They have been designed, manufactured and tested according to the state of the art. **For their application the restrictions listed in the European Certificate of Conformity** ZELM 00 ATEX 0147X **must be observed!**

Technical Data

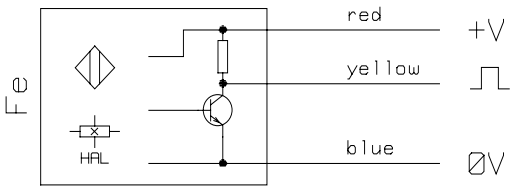
Power supply	5V ±10%, max. allowed 12V, **protected against false polarity**
Current consumption	max. 16mA
Signal output	square wave voltage, mark-space approx. 1:1, DC-coupled with power source, signal-amplitude corresponding to power supply (max. allowed sink current = 25mA at a saturation voltage of <0.4V). The output is connected through a pull-up resistor of 1.8kOhm to the plus pole of the power supply
Frequency range	0 Hz...20 kHz
Electromagnetic compatibility (EMC)	• Electrostatic discharge onto housing, cable shield and wires: up to ±4 kV peak according to IEC 61000-4-2, severity level 2 • Radiated electromagnetic field: up to 30 V/m, 50% AM, 1kHz in the range of 1 MHz to 1000 MHz according to IEC 61000-4-3, severity level 3 • Electrical fast transients/bursts, coupled to sensor cable with a capacitive coupling clamp: up to ±4 kV peak according to IEC 6100-4-4, severity level 4
Insulation	Housing and electronics galvanically separated (500 V/50 Hz/ 1 Min.)
Operating temperature	-40/+125°C for not Ex version, for Ex version see Ex related information.
Housing	Argentan (German silver) CuNi10Zn42Pb DIN 2.0770, front side hermetically sealed, sensor components potted in chemical and age proof synthetic resin. Dimensions according to drawing.

Protection	IP68 (head)/IP67 (connection)
Vibration immunity	3 g in the range 4...100 Hz
Shock immunity	20 g during 11 ms, half-sine wave
Weight	see type list
Pole wheel	Ferromagnetic toothed wheel (eg. USt 37-2), involute gear wheel preferred, module ≥1, minimum tooth width 3mm, side offset < 0.2mm, eccentricity < 0.2mm, Pole wheel - sensor gap with Module 1: 0.1...0.5 mm Module 2: 0.1...1.3 mm ≥ Module 4: 0.1...1.5 mm
Connection	Type A: Teflon insulated wires, length 40 cm, 0.22 mm² (AWG 24) Type B: Molex-plug, Type 03-06-2031, Part-No. 343C-72577
Mounting	These sensors contain a differential hall sensor. Therefore it is necessary that the housing is positioned according to the dimensional drawing below. **If this condition is not being complied with it is possible that the sensor will not work correctly.**
Ex-Safety	**For explosion proof versions II 1G and II1D a copy of the European Certificate of Conformity** ZELM 00 ATEX 0147X **is attached.** **See also below, the Ex related information in this documentation .**
Installation	For installation, the CE directives for the installation of apparatus in explosive environment must be taken into consideration.
Marking Acc. to Directive 94/9/EC	CE 0820 Ex II 1 G II 1 D
Electrical Data	Uo=10V, Is=204mA, P=510mW
Maintenance	No maintenance. The sensors can not be repaired.

Type-list:

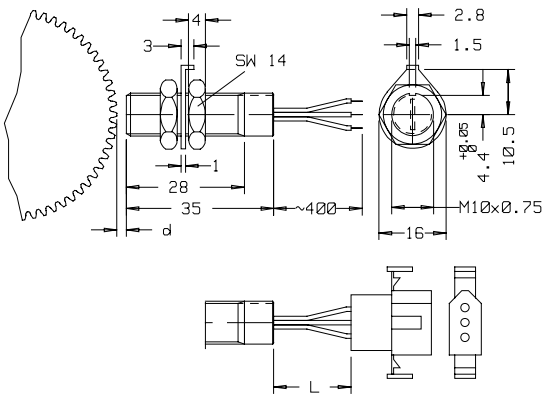
Type	Part.No.	Connection	Cable type	Cable length L	Weight
FTG 1089.00	343Z-03831	Type A	lace open	400 mm	20 gr
FTG 1089.01	343Z-03990	Type B	lace twisted	(with plug) 105 mm	23 gr
FTG 1089.00 Ex	343Z-03832	Type A	lace open	400 mm	20 gr
FTG 1089.01 Ex	343Z-03837	Type B	lace twisted	(with plug) 105 mm	23 gr
FTG 1089.01 S4 Ex	343Z-03829	Type A	Lace open	5m cable	100 g

Schema:



ftg1088

Dimensional drawing:



CE-Declaration of Conformity

According to the CE guidelines

- Electromagnetic compatibility 89/336/EWG
- Apparatus used in explosive environment 94/4/EG

The apparatus

Type name : FTG 1088.xx and FTG 1089.xx

Have been developed, and are constructed and produced in accordance with the guidelines 89/336/EG and 94/4/EG solely by :

Company : JAQUET AG, Thannerstrasse 15, CH-4009 Schweiz.

The following harmonised standards are applicable :

- EN 50081-2, EN 50011, CISPR 16
- EN 50082-2, EN 61000-4-2/3/4/5/6/8/11

- EN 50014
- EN 50020
- EN 50284
- EN 1127

- EN ISO 9001:2000

The following national standards are applicable :

- IEC 60068-2-1/2/30/6
- VDE 0165

Full technical documentation is available.
The associated instruction manuals are available under following numbers :

- 343D-63725 for FTG 1088.xx in original language.
- 343D-63726 for FTG 1089.xx in original language.

Basel, the 28.11.2002 Signature Head of engineering

Prüf- und Zertifizierungsstelle

ZELM Ex

(1) EC-TYPE-EXAMINATION CERTIFICATE

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-TYPE-EXAMINATION CERTIFICATE Number:

ZELM 03 ATEX 0147X

(4) Equipment: **Rotation speed sensor type FTG 1088... Ex und Typ FTG 1089... Ex**

(5) Manufacturer: **JAQUET AG**

(6) Address: **Thannerstrasse 15, CH-4009 Basel**

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Prüf- und Zertifizierungsstelle ZELM Ex, notified body No. 0820 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report ZELM Ex 0040315194.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50 014: 1997+A1+A2 **EN 50020: 1994**
prEN 61241-0: 2002 **31H/143/CD (IEC 61241-11): 2002**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this Certificate.

(12) The marking of the equipment shall include the following:

Ex **II 1 G EEx ia IIC T6 und II 1 D Ex iaD 20 T ...°C**

Zertifizierungsstelle **ZELM** Ex

Adolf Gruber

Zertifizierungsstelle und Prüf- ZELM Ex

Braunschweig, June 19, 2003

Sheet 1/3

Prüf- und Zertifizierungsstelle ZELM Ex • Siekgraben 56 • D-38124 Braunschweig

(13) **SCHEDULE**

(14) **EC-TYPE-EXAMINATION CERTIFICATE ZELM 03 ATEX 0147X**

(15) Description of equipment

The rotation speed sensors are used for the recording of the rotation speed for the touchless scanning of rotating ferromagnetic rotating magnetic poles, gears, camshafts and the like.

Model key:

type	Cable type	Cable length	Remarks
FTG 1088.00 Ex FTG 1089.00 Ex	Single laces	400 mm	
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FTG 1088.01 S4 Ex FTG 1089.01 S4 Ex	3-wire shielded teflon cord	max. 5 m	

The types FTG 1088... and FTG 1089... distinguish through the inner construction and the functional behavior. These differences are however for security reasons without importance.

Electrical data

Supply- and signal circuit

type of protection intrinsic safety EEx ia IIC resp. ia IIB or iaD for use according to category 1D

only for the connection to certified intrinsically safe circuits

maximum values: U_i= 10 V
I_i = 204 mA
P_i= 510 mW resp. 200 mW

Maximum effective inner capacity C_i = 9 nF

The maximum effective inner inductance is negligibly small

The lower temperature boundary is for all versions and applications - 20 °C.

The temperature class resp. the maximum surface temperature, the maximum permissible ambient temperature and the maximal permissible power of the connected, certified, intrinsically safe circuit (P_i) for the different versions are to take from the tables 1 resp. 2.

Table 1

		maximum ambient temperature for the temperature classes in °C					
Category	P_i [mW]	T1	T2	T3	T4	T5	T6
2G	510	100	100	100	100	70	55
	200	100	100	100	100	85	70
1G	510	100	100	100	80	50	40
	200	100	100	100	95	65	55

Schedule to EC-TYPE-EXAMINATION CERTIFICATE ZELM 03 ATEX 0147X

Table 2

Category	P_i [mW]	maximum ambient temperature	maximum surface temperature
1D	510	100 °C	155 °C
	200	100 °C	125 °C

(16) Report No.

ZELM Ex 0040315194

(17) Special conditions for safe use

1. The Rotation Speed Sensors may be used only in intrinsically safe electric circuits in accordance with the information in this EC-type-examination certificate. Because of possible ignition hazards, which can arise due to mistakes and/or transient currents in the potential equalization system galvanic separation is to be favored in the supply- and signal circuit. Associated apparatus without galvanic separation may be used only if the corresponding requirements are kept according to IEC 60079-14.
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5. The tightness for the purposes of zone separating measures for the mounting across the boundary between different zones is not subject of this certification and must be ensured by appropriate measures of installation.
6. The instruction manual has to be considered.

(18) Essential Health and Safety Requirements

Met by standards. The rotation speed sensors correspond with the norms EN 50014 and EN 50020. For the commitment 1 D the performed draft standards were used besides since no harmonized European standards that are to be applied in connection with the type of protection "Intrinsic safety" are available in the moment.

Zertifizierungsstelle **ZELM** Ex

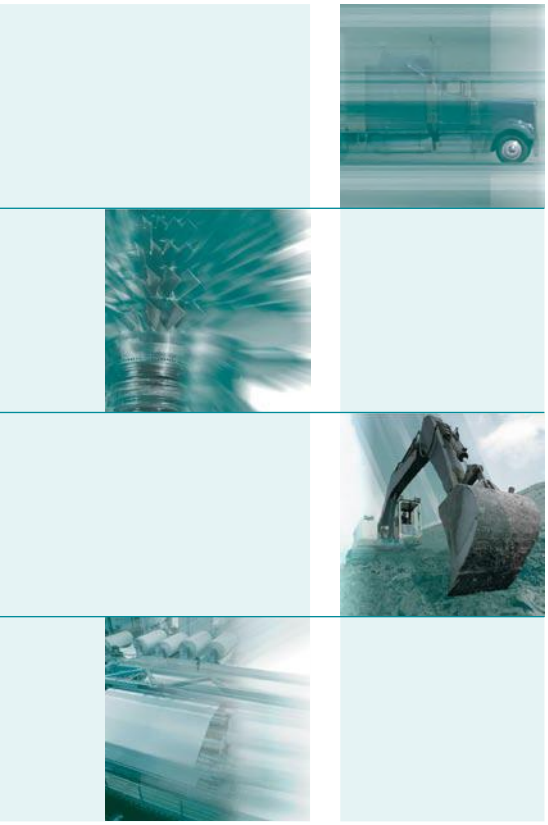
Adolf Gruber

Zertifizierungs- und Prüf- stelle ZELM Ex

Braunschweig, June 19, 2003

Prüf- und Zertifizierungsstelle ZELM Ex • Siekgraben 56 • D-38124 Braunschweig

JAQUET
TECHNOLOGY GROUP



Sayısal • Analog • Dönüştürücüler • Anahtarlar Algılama • Ölçme • Kontrol • Koruma

- TEK KANALLI TAKOMETRELER
- İKİ KANALLI ÇOK FONKSİYONLU TAKOMETRELER
- ÇOK KANALLI AŞIRI HIZ KORUMA SİSTEMLERİ
- EL TAKOMETRELERİ

Pirene'nin yüksekliklerindeki hidroelektrik istasyonlardan okyanusun derinliklerindeki nükleer denizaltılara ölçüm, kontrol ve tüm önemli makine koruma fonksiyonu için optimum çözümler sağlayan JAQUET takometre ürünleri kullanılmaktadır.

Zorlu uygulamalar için tip testi yapılan ve yeterliliği tescillenen JAQUET ürünleri emniyetli hazır bulunabilirlik sağlar çünkü değerli yatırımların korunması söz konusu olduğunda, ödün verme düşünülemez.

Tek veya çok kanallı olsun, basit veya karmaşık oylama mantıklı olsun; biz size en hızlı reaksiyon zamanı, maksimum güvenlik ve optimum hazır bulunabilirlik sözü veriyoruz.

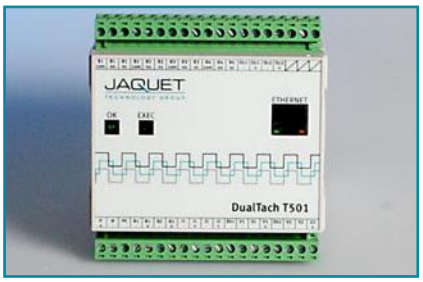
Optimal ürün seçiminde veya JAQUET'in komple ölçüm zincirini kullanarak bir anahtar teslim çözüm oluşturmada lütfen size nasıl yardım edebileceğimizi sorun. Denenmiş ve test edilmiş tecrübemizden yararlanarak, bireysel ihtiyaçlarınızı karşılayan bir öneriyi süratle ve güvenle verebiliriz. Size, toplam maliyetlerinizi de azaltmanıza yardım edecek etkin bir çözüm sağlamanın gururunu yaşarız. JAQUET'in uzman uygulama bilgisinin, uzun tecrübesinin ve üst seviye ürün kalitesinin yatırımlarınızı korumasına izin verin.

Tümünü yaparız – hemen yaparız. Bir işaretinizi bekliyoruz.

JAQUET SYSTEMS

ÜRÜN TANITIMI

1-2 KANAL TAKOMETRELER

	JAQUET T400 serisi	JAQUET Dualtach T500
		
Ürün Açıklaması	Ekranlı veya ekransız tek kanallı takometreler; bir cihazda 0/4…20 mA dönüştürücü ve hız anahtarı; Röle ve açık toplayıcı frekans çıkışı.	2 frekanslı ve iki ikili (binary) giriş; 2 analog, 4 röle ve 2 açık toplayıcı çıkış; karmaşık ölçüm, kontrol ve koruma için.
Tipik uygulamalar	Motor çalıştırma kontrolü ve aşırı hız koruma Mikro türbin EOST Turbo hız ölçümü, Evrensel hız gösterimi	Motor + turbo hız V motorlarda çifte turbo hız 2 kanal türbin izleme ve koruma
JAQUET avantajı	2 set noktası. Uyarlanır tetik. Hızlı yanıt. 2 / 3 tel sensör (wire sensor) izleme. Takılabilir terminaller. Set noktaları için % 0.05 hassasiyet. Analog sinyaller için % 0.5. Kişisel bilgisayar üzerinden konfigürasyon ve durum görüntüleme. Lloyds ve EN50155 onayı. JAQUET DSY sensörleri ile kullanıldığında hız ve yön	Her biri 6'lı 4 parametre seti Sistem Limitleri, giriş/ parametrelerin mantıksal bir kombinasyonu örn. hız > sıcaklık ile limit < ikili (binary) giriş ile gösterildiği şekilde limit Matematiksel fonksiyon örn. A/B, ivme Uyarlanır tetik. Hızlı yanıt. Limitler için % 0.002 hassasiyet. Analog sinyaller için % 0.025. Yerleşik yazılım ve Ethernet ara yüzü yoluyla konfigürasyon ve durum görüntüleme. Lloyds onayı. 2/3 tel sensör (wire sensor) izleme

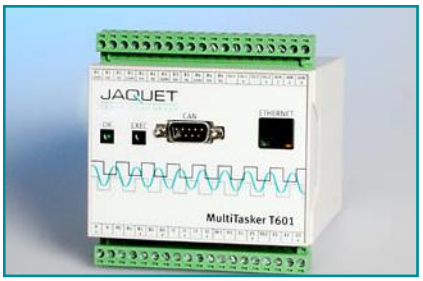
Fonksiyonalite

Frekans girişleri	1; 0.01 Hz...35 kHz	2; 0.025 Hz...50 kHz
İkili (Binary) girişler	parametre seçimi ve röle kontrol için 1	parametre seçimi, komutlar veya röle kontrol için 2
Parametre setleri	2	4
Limitler	2	4 x 6 Sistem Limitleri
Analog çıkışlar	1	2
Röleler	1 değişim	4 değişim
Açık toplayıcı çıkışları	1; frekans çıkışı için izoleli	2; frekans x1, x2, x4 veya durumlar için izoleli
Sensör kaynağı	14 VDC, 35 mA	14 VDC, 35 mA'de 2
Ekran / durum görüntüleme	T411/ T412 ile 5 basamaklı LCD	-
Konfigürasyon	RS232 üzerinden	Ethernet ve yerleşik yazılım üzerinden
Gerilim	10…36 VDC kaynak	90…264 VAC veya 18…36 VDC
Özel fonksiyonlar	-	Matematik fonksiyon

JAQUET TECHNOLOGY GROUP

2 KANAL ÇOK FONKSİ-YONLU TAKOMETRELER

JAQUET MultiTasker T600



JAQUET Display D211

Ürün Açıklaması

2 frekans, 1 analog ve 2 ikili (binary) girişli MultiTasker; 2 analog, 4 röle ve 2 açık toplayıcı çıkışı; CAN veri yolu ve Ethernet ara yüzleri; olay kaydedici ve trip veri loglayıcı; karmaşık ölçüm, kontrol, koruma ve iletişim için.

T600 için 5 basamaklı ekran opsiyonu. 1 ekranın direk kablo bağlantısı veya 1…7 ekranın Bluetooth ana modülü veya Bluetooth kabiliyetli ekranlar üzerinden bağlantısı.

Tipik uygulamalar

Motor + turbo hız + sıcaklık.

V motorlarda çifte turbo hız.

2 kanal türbin izleme ve koruma.

Emniyetin kritik olduğu uygulamalar.

CAN veri yolu iletişimi

Bir veya 7'ye kadar T600 parametresinin gösterimi

JAQUET avantajı

Her biri 6'lı 4 parametre seti

Sistem Limitleri, giriş/ parametrelerin mantıksal bir kombinasyonu örn. hız > sıcaklık ile limit < analog giriş ile gösterildiği şekilde limit. Direk PT100 bağlantısı.

Olay kaydedici ve trip veri loglayıcı;

Matematiksel fonksiyon örn. A/B, ivme

Uyarlanır tetik. Hızlı yanıt.

Limitler için % 0.002 hassasiyet. Analog sinyaller için % 0.025.

Yerleşik yazılım ve Ethernet ara yüzü yoluyla konfigürasyon ve durum görüntüleme.

Lloyds onayı.

2/3 tel sensör (wire sensor) izleme

Farklı parametreler için çoklu ekran kullanılabilir örn. Analog değer
Hız A/B

Fonksiyonalite

Frekans girişleri	2; 0.025 Hz…50 kHz
Analog giriş	Aktif veya pasif 0/4…20 mA veya PT100
İkili (Binary) girişler	parametre seçimi, komutlar veya röle kontrol için 2
Parametre setleri	4
Limitler	4 x 6 Sistem Limitleri
Analog çıkışlar (akım / gerilim)	2
Röleler	4 değişim
Açık toplayıcı çıkışları	2; frekans x1, x2, x4 veya durumlar için izoleli
Sensör kaynağı	14 VDC, 35 mA'de 2
Konfigürasyon / durum görüntüleme	Ethernet ve yerleşik yazılım üzerinden
Ekran	D211 – 5 basamak LCD
Gerilim	90…264 VAC veya 18…36 VDC
Özel fonksiyonlar	Matematik, sızma (creep) tespiti, yön

Sistem Limiti Hakkında

T500 ve T600 serisi, takometreleri bir üst seviyeye taşımıştır.
Her ikisi de, bir alarm veya trip komutu oluşturmak üzere giriş parametrelerinin mantıksal kombinasyonuna imkan sağlayan bir Sistem Limit kabiliyeti sunmaktadır.
T500 cihazında, bunlar aşağıdakiler olabilir:
Hız 1 > X AND
Hız 2 < Y AND
İkili (Binary) 1 aktif
Veya T600 cihazında
Hız 1 > X AND
Pt100 üzerinden sıcaklık < Y

JAQUET SYSTEMS

ÜRÜN TANITIMI

ÇOK KANALLI AŞIRI HIZ KORUMA

JAQUET standart FT3000

JAQUET müşteriye uyarlanmış FT3000

Ürün Açıklaması

Aşırı hız koruma sistemi, SIL 3 uygulamaları için tasarlanmıştır.

Standart 1 (STD01): Oylamaların 3'ünden 2'si ile 3 kanal; Analog kart; iletişim kartı.

Standart 2 (STD02): 3 x 1'de 1 ile 3 kanal; İletişim kartı.

Aşırı hız koruma sistemi, SIL 3 uygulamaları için tasarlanmıştır.

19" ve 24" raklarda çok kanallı modüler sistemler

Tipik uygulamalar

Ana türbin

Kazan besleme pompası

Türbin kompresör izleme ve koruma

Ana türbin

Kazan besleme pompası

Türbin kompresör izleme ve koruma

Özellikle güçlendirme uygulamaları için uygundur.

JAQUET avantajı

Maliyet etkin ve standardize sistemler.

İstek üzerine en hızlı kesme (trip)

Çevrim içi test, Sıcak modül değişimi

Kişisel bilgisayar yazılımı ile kolay konfigürasyon ve durum görüntüleme.

24 VDC güç kaynağı ünitesi yedek

Spesifik uygulamaya uyan sistemler.

İstek üzerine en hızlı kesme (trip)

SIL^ortamı içerisinde diğer kaynaklardan gelen tripleri birleştirmek için trip zincir kontrol kartı

Bir rakta 2 ve 3 şaft izleme ihtimali

Yön ayrımı

Çevrim içi test, Sıcak modül değişimi

Kişisel bilgisayar yazılımı ile kolay konfigürasyon ve durum görüntüleme

Nükleer uygulamalarda kullanım için onaylı

Geniş Güç Kaynağı Ünitesi yelpazesi

cCSAul sertifikasyonu

Fonksiyonalite

		STD 01 / STD 02		Sistem	Kanal başına
Frekans girişleri		3		3, 6, 9*	1
İkili (Binary) girişler		4 isolated with programmable assignment		4 izoleli / 2 izolesiz	4 izoleli / 2 izolesiz
Limitler		2		36	4
Röleler:	alarm	kanal başına 3 alarm		27*	3
	3'ten 2'si	STD 01:2	STD 02: yok	12*	4
	3'ten 1'i	STD 01:yok	STD 02: yok	12*	4
	1'den 1'i	STD 01:yok	STD 02: 2	12*	4
Analog çıkışlar / akım		STD 01:3	STD 02: yok	27*	3
Hızın yeniden iletilmesi		3		9	1
Çevrim içi test		dahili sinyal üreteçleri yoluyla		STD 01/02'de olduğu gibi	STD 01/02'de olduğu gibi
Bütünlük izleme		Güç kaynağı üniteleri, algılayıcılar, kanaldan kanala		STD 01/02'de olduğu gibi	STD 01/02'de olduğu gibi
Konfigürasyon / durum görüntüleme		Kişisel bilgisayar yazılımı ile		STD 01/02'de olduğu gibi	STD 01/02'de olduğu gibi

* depending on configuration

KOMPLE ÖLÇÜM ZİNCİRİ

JAQUET Hız Sensörleri – OEM, standart veya müşteriye uyarlanmış

JAQUET hız sensörleri en zor çevre koşullarına dayanmak üzere tasarlanmıştır ve bir kaçını saymak gerekirse turbo kompresörler, hidrolik motorlar, dizel ve benzinli motorlar, türbinler, pompalar ve kompresörler gibi bir çok uygulamada kullanılırlar. Platform yaklaşımımız bize en uygun algılama teknolojisini alma ve onu mevcut durumdaki geniş kasa yelpazesinden birine veya sizin spesifik ihtiyaçlarınıza uyan bir kasaya yerleştirme kabiliyeti sunar.

Yüksek sıcaklıkta bir helikopter türbini algılayıcısına veya ilk dişten başlayarak diş frekansı x 16 sağlayan bir demiryolu çekiş kontrolüne mi ihtiyacınız var? Yapılmış bilin! Bir sonraki işiniz için hazırız.

JAQUET Hız Sensörleri – OEM, standart veya müşteriye uyarlanmış

JAQUET TECHNOLOGY GROUP'un GreenLine ailesi, endüstriyel hız sensörleri ve kontrol modülleri standart ürün grubudur. Bu sensörler ve takometreler, hem son kullanıcılar hem de OEM'ler için hız algılama ve kontrol uygulamalarında çözümler sunar. Kablolu veya konnektör ara yüzlü VR veya Hall teknolojilerini kullanan 50'den fazla sensör mevcuttur. Boyutları 3/8-24 ve M10X1 ile 3/4-16 ve m16X1.5 arasında değişmektedir. Sensör kabiliyeti ise sıfır hız ile yüksek frekans tespiti aralığındadır ve sıvı girmesini önlemek amacıyla tüm ünitelerde sızdırmaz algılama alanları vardır. Ayrıca, yön algılama üniteleri ve hem Kuzey Amerika (NEC, CEC) hem de Avrupa (ATEX) (Q4 2007) için tehlikeli lokasyon versiyon da mevcuttur.

JAQUET pole wheels ve pole bands

JAQUET pole wheels ve pole bands hedef teknolojisinin en üst kalitesini temsil eder ve hız ölçüm zincirini tamamlar. Daha fazla bilgi için lütfen pole wheels ve pole bands broşürlerine bakınız.

JAQUET El takometreleri

Hız ölçüm portföyümüzü tamamlamak için – JAQUET el takometreleri de sunar. JAQUET HO 100 Optik Takometre, pervane ve tekerlek gibi dönen cihazların RPM'ini ölçmek için hassas optikler ve fosforlu şerit kullanır.

JAQUET HM 100 Kontak Takometre, RPM'i ölçmek için dışbükey ve içbükey eklentiler kullanır. Aynı zamanda, taşıyıcılar ve değirmenler gibi hareketli cihazların doğrusal yüzey hızını ölçmek için yerleşik bir tekere de sahiptir.

JAQUET HC 100 Kombinasyon Seti yukarıda bahsi geçen iki takometrenin bir kombinasyonudur.

COMPANY PROFILE

JAQUET TECHNOLOGY GROUP

JAQUET TECHNOLOGY GROUP, dönüsel hızın tespiti, ölçümü, teşhisi ve yönetimi için dünyanın en çok yönlü ve ileri çözüm alanını sunmaktadır.
Bizim endüstri ve uygulamaya özel uzmanlığımız sizin optimum bir çözüme ulaşacağınızın garantisidir. Kişisel ihtiyaçlarınıza tam uygunluk sağlayarak ve ana endüstriyel standartları ve sertifikasyonları karşılayarak, ürünlerimiz mülkiyet masraflarınızı azaltırken makinelerinizin performansını artırmaya yardım edecektir.

HİZMET VERİLEN TİPİK ENDÜSTRİLER

- Otomotiv ve kamyon
- Dizel / benzinli motorlar
- Hidrolik
- Raylı sistemler
- Türbinler
- Turbo kompresörler
- Endüstriyel makineler

ÜRÜNLER – HIZ ENSÖRLERİ

- Çeşitli teknolojiler
- Standart, uyarlamalı ve OEM Modeller
- Zorlu uygulamalar örn. 300.000 rpm, 320oC / 600 oF'ye kadar sıcaklık, 200 g'a kadar yüksek vibrasyon, şok vs.
- Genel uygulamalar için GreenLine hız sensörleri
- Tehlikeli alanlar için eski modeller
- Gerekli olduğu yerde pole band ve target wheel

ÜRÜNLER SİSTEMLER

- Çok kanallı aşırı hız koruma sistemleri
- 1-2 kanal ölçüm, koruma ve kontrol modülleri
- Motor teşhis sistemi
- Yedek hız ölçümü ve gösterimi

ÖZEL PROJE ÖRNEKLERİ

- Otomotiv doğrusal hareket sensörü
- Ekran ve vites kontrolü için entegre güç ve tork ölçümü
- Nükleer denizaltılar için deniz spec. türbin
- Taretli ve izlenen araçlar için hız ölçümü

KALİTE YÖNETİMİ VE STANDARTLAR

- Kalite yönetimi: TS 16949 ve ISO 9001, ZELM ATEX 1020, KWU
- Sensörler: GL, KWU, TÜV, ATEX, EN 50155, NFF 16-101, 102, ABS, EMC
- Sistemler: IEC 61508 SIL 2 ve SIL 3, API 670, GL, TÜV, KWU, EX
- Çevresel: RoHS – EU direktifi 2002/95/EC

JAQUET – PARTNERİNİZ

- Etkili ve profesyonel hizmet – JAQUET TECHNOLOGY GROUP ana merkezi Basel İsviçre'dedir ve dünya çapında distribütör ve son kullanıcı servis ağı ile Belçika, Çin, Almanya, Hollanda, Birleşik Krallık ve Birleşik Devletler'de alt kuruluşları vardır.
- Esnek üretim miktarları; proje başına 1 veya milyonlar
- Akıllı ve maliyet etkin çözümlerle toplam maliyetin düşürülmesi
- Hızlı geri dönüş (turn around) zamanı

IN CHARGE OF SPEED

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JAQUET TECHNOLOGY GROUP

FT 3000 Speed measurement system

3-channel speed control and overspeed protection

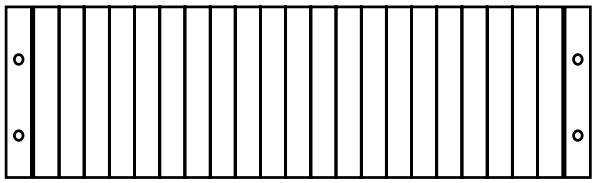
System documentation FT 3000 :

- Operating instructions FT 3000
- Operating instructions sensor
- Rack 19 ¨ description
- Bloc function description
- System configuration
- Connection diagram
- IEC 61508 certificate

JAQUET AG, Thannerstrasse 15, CH-4009 Basel
Tel. +41 61 306 88 22 Fax +41 61 306 88 18

Operating Instructions 377E-63917

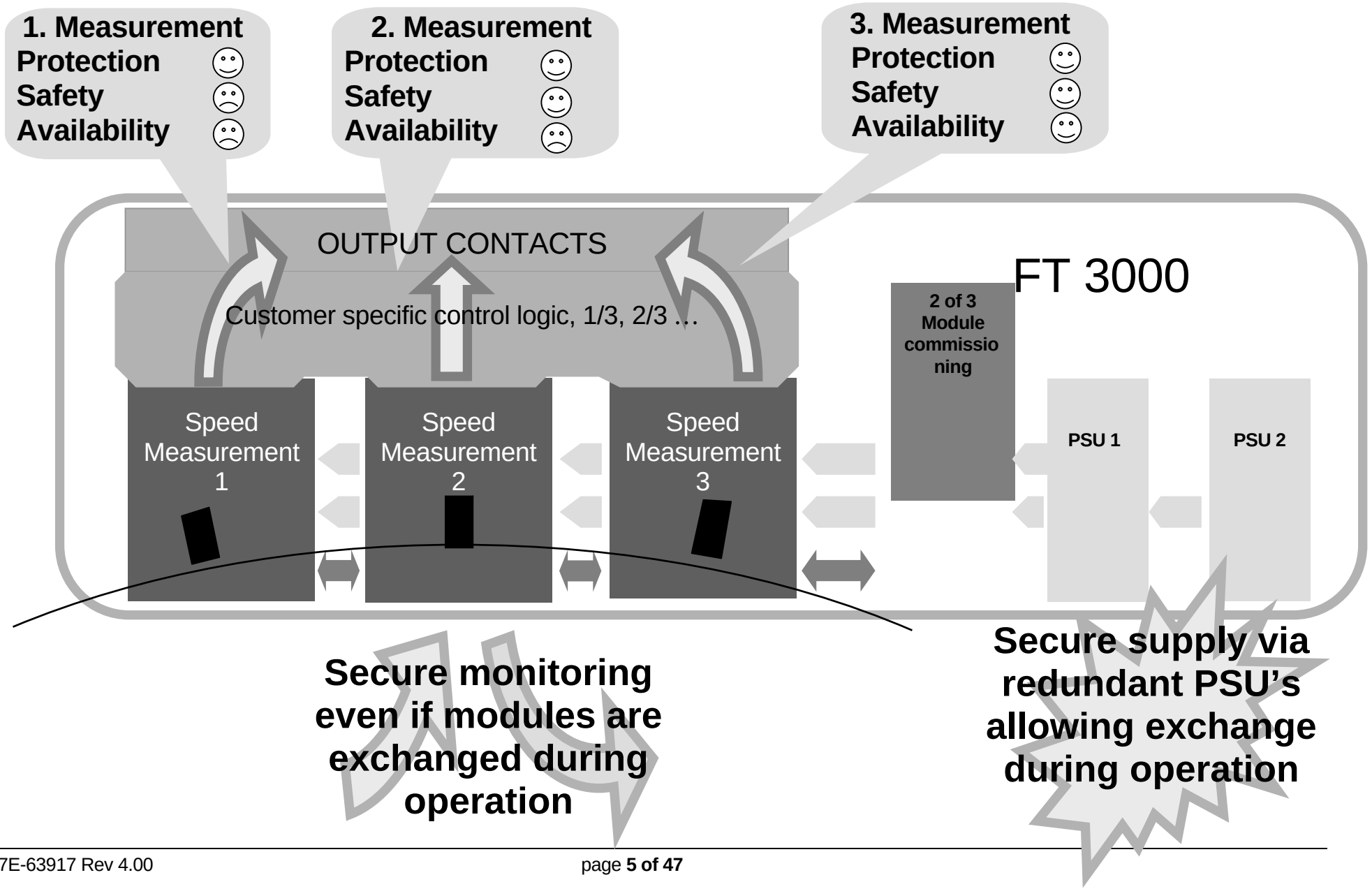
V 4.00 20.12.04



FT 3000

Table of contents

1 The Redundant Over Speed Protection Concept :



2 Safety Warning

During operation, parts of the FT 3000 are under dangerous voltages. The units conform to protection class 1 and require an earth connection on the corresponding module connector and/or terminal on the 19" rack.

The units have been designed and tested in accordance with IEC 348 and have left the factory in perfect condition.

These operating instructions include information and guidance on the safe operation of the equipment and installation. Please specially note section 6.

If in doubt about the condition of any part following electrical, environmental or mechanical damage, the unit should be returned for repair.

3 Applications

FT 3000 tachometers are used to monitor and measure frequencies in the range 0 to 30000Hz eg from frequency proportional sources such as rotational speed.

The FT 3000 family comprises of the following modules:

• Monitoring module (Motherboard)	**FTFU 3024**		
with input card -E01	**FTFU**	**3024- E01**	Art. Nr. 377Z-03981
with input card -E02	**FTFU**	**3024- E02**	Art. Nr. 377Z-03982
with input card -E03	**FTFU**	**3024- E03**	Art. Nr. 377Z-03983
• Trip Chain Control card	**FTBU**	**3034**	Art. Nr. 377Z-05030

• Frequency to current converter (Auxiliary module)	**FTW 3013**	Art.Nr.377Z-03984
• Relay card (Auxiliary module)	**FTV 3090**	Art. Nr. 377Z-03985
• Comms module	**FTK 3072**	Art. Nr. 377Z-03986
• PSU 116/230Vac	**FTZ 3061**	Art. Nr. 377Z-04065
• PSU 24/48Vac	**FTZ 3062**	Art. Nr. 377Z-04073
• PSU 14...70Vdc	**FTZ 3064**	Art. Nr. 377Z-04074
• PSU 75...372Vdc	**FTZ 3065**	Art. Nr. 377Z-04075
• Mains filter (2 wire)	**FTZ 3069**	Art. Nr. 804D-35886

FT 3000 3 channel speed monitoring and over speed protection systems comprise of 3 independent channels, from speed pick ups through to limit signalling. High integrity operation is provided for in the rack through the use of 2 redundant power supplies to each module via diode decoupling. Rack module supply requirements are matched to the incoming supply by the 2 redundant power supplies.

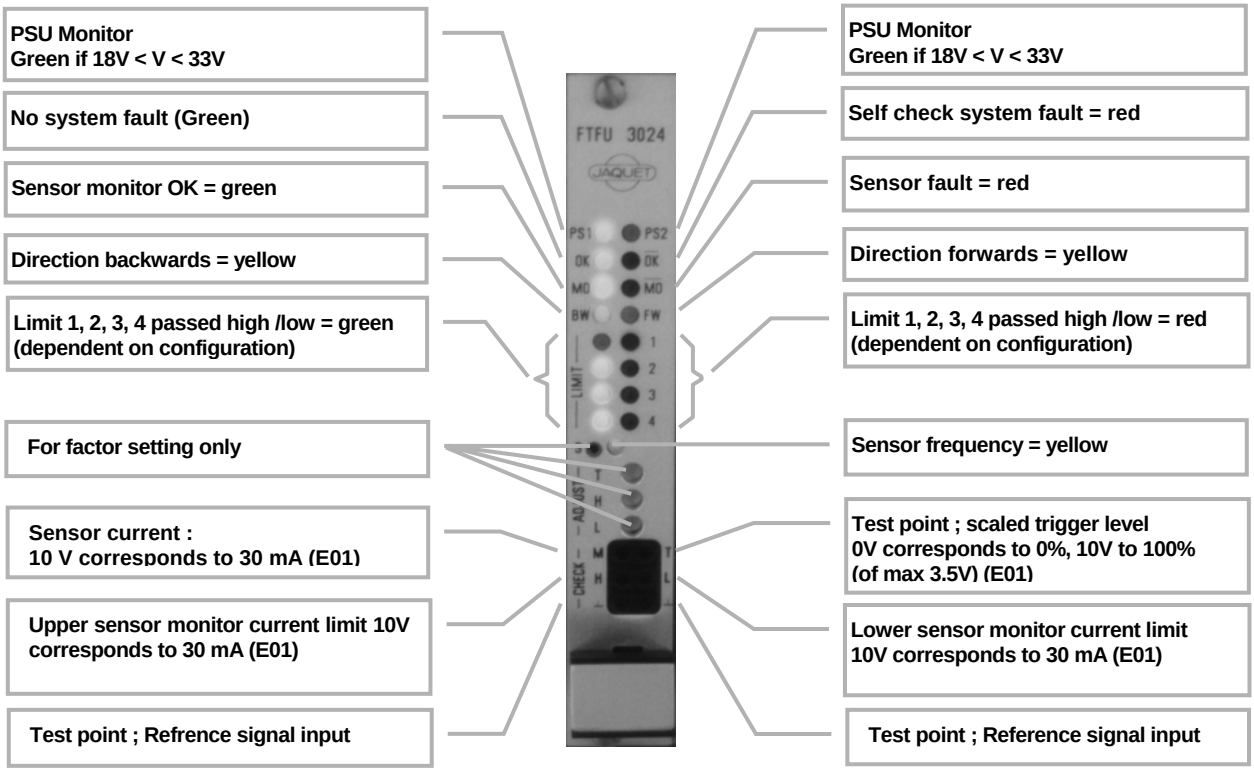
4 Construction

The modules are plug in units in a 19" rack, with height 3 HE and with 4, 12 or 20 TE in accordance with DIN 41494.

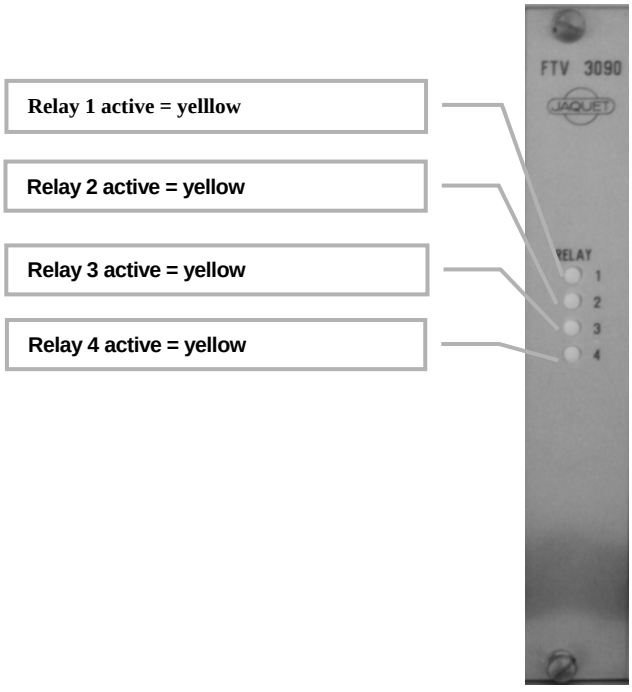
Compatible card frames with up to 21 locations at 4 TE are used for mounting and wiring the modules. The card frames are built by JAQUET to customer requirements. Connections for speed sensors, control and output signals along with power supplies are normally provided at the back via screw terminals or Termi-Point connections.The setting of measuring range, monitoring and relay parameters is via front panel RS 232 interface on the FTK 3072 comms module to a PC. This module controls the data flow between the PC and individual modules in the rack (RS 485 rack bus). The parameters are stored in EEPROM's and protected against mains failure.

5 Front Panel description

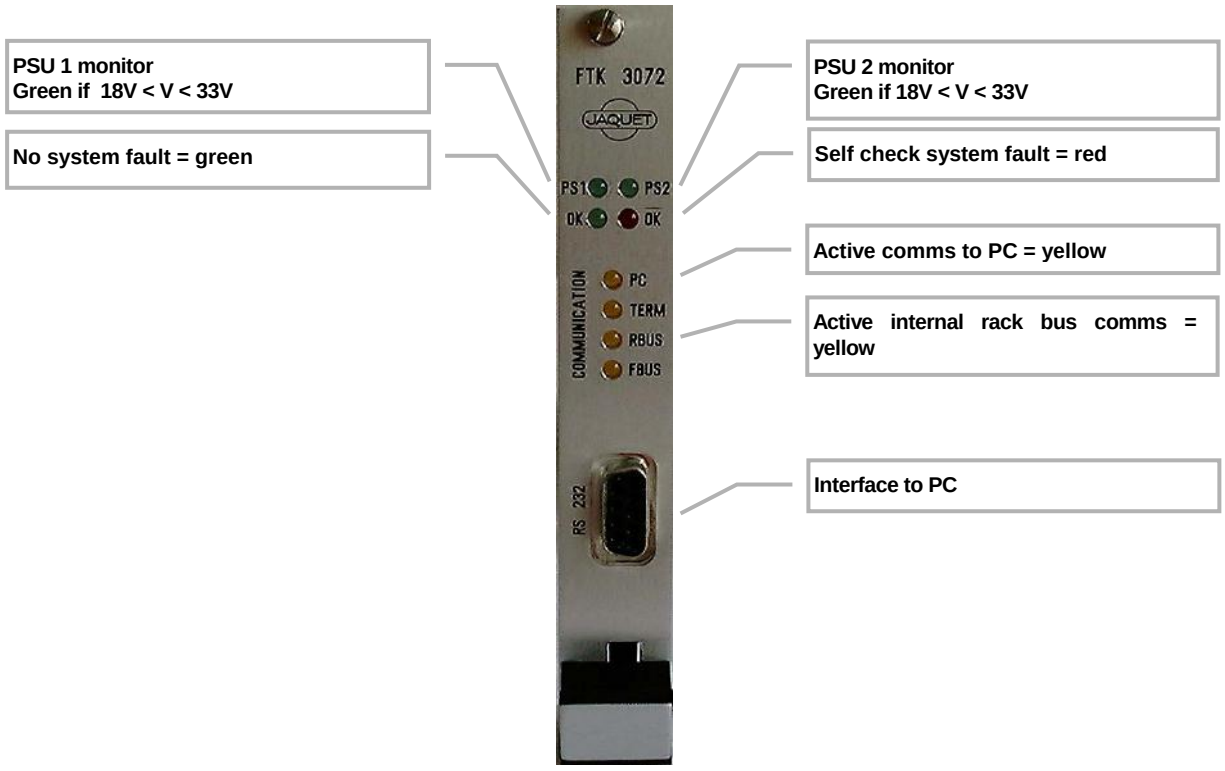
5.1 FTFU 3024



5.2 FTV 3090

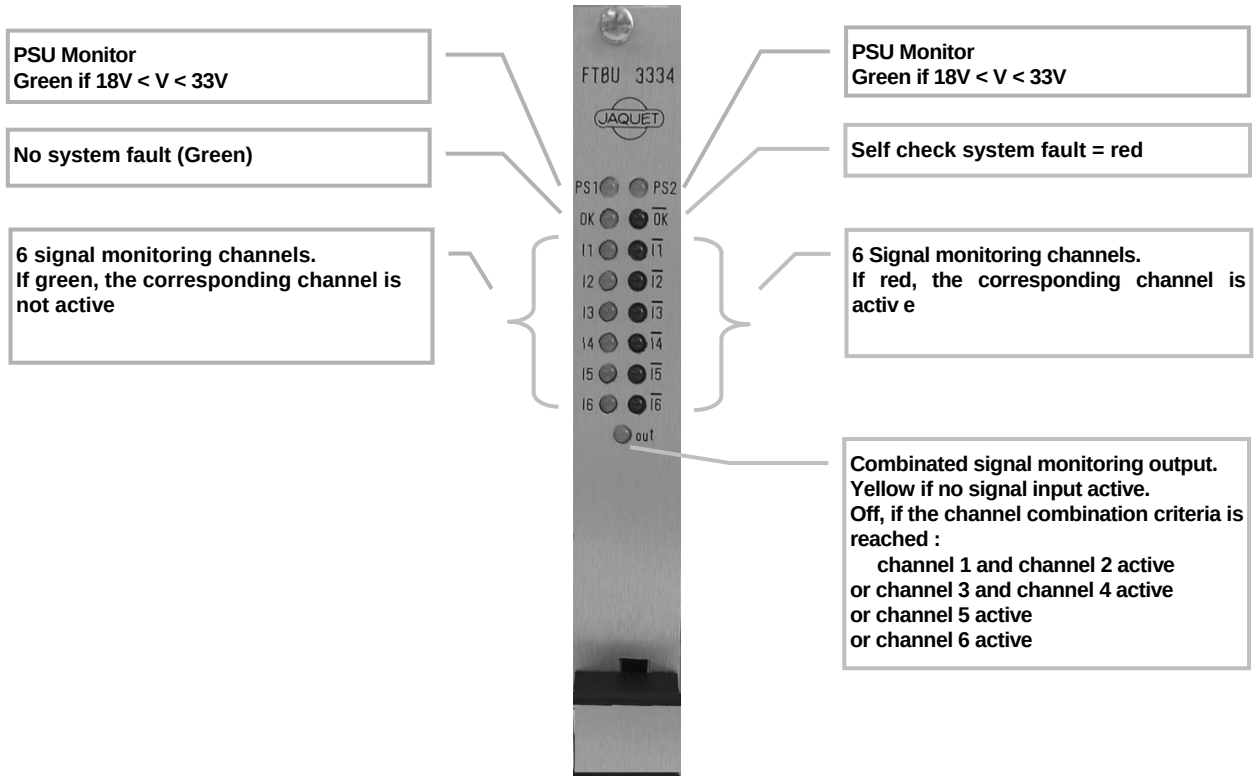


5.3 FTK 3072



5.4 FTW 3013

5.5 FTBU 3034


PSU Monitor
Green if 18V < V < 33V
No system fault (Green)
6 signal monitoring channels.
If green, the corresponding channel is not active
FTBU 3334
JAQUET
PS1
PS2
OK
OK
I1
I2
I3
I4
I5
I6
out
PSU Monitor
Green if 18V < V < 33V
Self check system fault = red
6 Signal monitoring channels.
If red, the corresponding channel is activ e
Combinated signal monitoring output.
Yellow if no signal input active.
Off, if the channel combination criteria is reached :
channel 1 and channel 2 active
or channel 3 and channel 4 active
or channel 5 active
or channel 6 active

6 Specifications

6.1 Statistics

Mean Time Between Failure for each channel (without voting) : 188683 hours # 21.5 years
Mean Time Between Failure for each OSP channel (FTFU 3024) : 230700 hours # 26,0 years
Mean Time Between Failure for each signal monitoring channel (FTBU 3x34) : 1036000 hours # 118 years

PFHg according to IEC 61508-2 : 2.69e-8 fits
DC % according to IEC 61508-2 : 94.23%

Life duration for the system is 20 years. During this period the data integrity of the programable devices are garanted, this time is equivalent to the MTBF of the channel. After this period the overspeed protection system must be replaced.

6.2 IEC 61508-2-3 specifications :

- System configuration for the Overspeed Protection System :
  The system definition must include for reaching the IEC 61508-2-3 and SIL 3 conformity an alarm signal with following activated selfcontrols for the S + M + P Alarm output :
  - System check : Watchdog, Parameter monitoring, software test
  - Sensor monitoring : Static and/or dynamic sensor monitoring activated
  - Power supply check : monitoring of the supply voltage

  In addition, for a safe system behaviour in the case of multiple faults, the system S +M + P Alarm must be combined with the overspeed signal. This means that multiple detected system faults generate a trip.
  Only 3 channel systems can fulfil the IEC 61508-2-3 requirements.

- System configuration for the optinal additional Trip Chain Control Card.
  Only a 3 channel Trip Chain Control System can fulfil the IEC 61508-2-3 requirements for SIL3. The voted or non voted TCCC signals can be combined with OSPS trip signals.

- System installation :
  The installation specification must be kept for reaching the IEC 61508-2-3 conformity. These specifications must be realised by the system integrator / end user. See chapter Installation.

- System maintenance :
  The maintenance specification must be kept for reaching the IEC 61508-2-3 conformity. These specifications must be realised by the system integrator / the end user. See chapter Maintenance.

6.3 Technical data OSPS

Reference conditions: Operating temperature +20ºC
Supply within defined limits

Smallest measuring range:	0...1.000 Hz
Largest measuring range:	0...35.00 KHz

Once the machine factor M is defined (M = Freq. In Hz/ measured value eg rpm), the input of measuring range and limit values is directly in the chosen physical units eg rpm. In place of the machine factor, the number of pulses per rev from the pole wheel may be entered. Moreover once the nominalspeed is defined (=100%), limits can be given as a percentage of nominal. The measured range may be continuously exceeded up to 55KHz without affecting functionality or causing any damage to the unit.

Sensor signal input- Frequency input 1	Input card -0X for frequency input 1, plugged onto the motherboard FTFU 3024

	potential free, isolation 500V, 50Hz,1 Min. from electronics and earth ie from front panel and card frames.
Input card E-01:	for connection of electromagnetic, ferrostat or HF sensors, proximity switches and sensors with line amplifiers. Input impedance: 100kohm Input voltage: 50mV...80V rms Bandwith (-3dB) : 0,5 Hz /3.3 kHz Frequency domain for pulsed signals : 0.02Hz / 30kHz Input level for sinus signals : 50 mv rms at min trigger Input level for pulsed signals : 10Vpp at 20% trigger level Trigger level: adjustable between 0 and +3.5V via front panel trimmer T. The voltage at test point T to ground of fixed hysteresis of 50mV rms = 141mVss Integral pull up (+12V) and pull down (0V) resistance of 820 Ohm for connecting 2 wire sensors, jumper selectable. Sensor monitoring of 2 and 3 wire sensors, jumper selectable -If the supply current is < I min or > I max a defect is signalled by the green LED 'MO' off and the red LED 'MO' on. I min is set via front panel trimmer 'L' I max is set via front panel trimmer 'H' A voltage at test points 'L' and 'H' to ground of 0...10V corresponds to supply current of 0...30mA. A voltage of 0...10V at test point 'M' corresponds to the actual supply current of ...30mA. To adjust the trimmers the module must be plugged onto an extension card to open the seal. Integral sensor supply of +11.5...12.5V, max 25mA, short circuit proof (max 40mA).
Input card E-02:	potential free, insulation 500V, 50Hz,1 Min. from electronics and earth ie from front panel and card frames. This input card is a special version and is only for specific applications available. Configuration available only by contacting the system supplier. Input impedance: 100kohm Input voltage: 0...-24V Frequency domain for pulsed signals : 0... 30kHz Input level for pulsed signals : 0.2 ...24Vpp Trigger level: Adjustable between 0 and +3.5V via front panel trimmer T. The voltage at test point T of 0...10V correspnds to 0...3.5V Trigger Voltage Fixed hysteresis of 50mV rms = 141mVss Default setting : T = 2V corresponds to 660mV Trigger level The sensor monitoring is realised by checking the sensor output signal (Card Uin). Uin (low) must be greater then the defined minimum value (absolut values). Uin(high) must be smaler then de defined maximum value (absolut values). Uin < Uin(min) or Uin > Uin(max) is signaled by the green LED 'MO' off and the red LED 'MO' on. Uin(min) is set via front panel trimmer 'L' Uin(max) is set via front panel trimmer 'H' A voltage at test points 'L' and 'H' to ground of 0...10V corresponds signal level of 0...-24V. Default setting of 'L' = 1V corresponds to a minimum signal level of -2.4V. Default setting of 'H' = 8.33 V corresponds to a maximum signal level of – 19.9V. A square wave signal of 0...10Vpp at test point 'M' corresponds to the actual sensor signal of 0...-24Vpp. To adjust the trimmers the module must be plugged onto an extension card to open the seal. Integral sensor supply of –24V +/- 4%
Frequency inputs 2 and 3	Motherboard FTFU 3024

	For average/max values and direction
2 inputs with common reference voltage - -V of supply	+24 level **U** low: 0...+3V or open U high**:** +10...+33V, I source = max 3mA.

Limit values 1 - 4	Motherboard FTFU 3024 with optional relay card FTV 3090 Up to 4 limits for speed or frequency functions
Hysteresis	Upper and lower set points are freely programmable for each limit
Relay function	Monostable function, individually definable as 'Normal' energized in when upper set point exceeded 'Inverse' energized in when speed below lower set point
Relay outputs 1, 2 and 3 on FTFU 3024 motherboard	1 potential free change over contact AC Umax 250V, Imax 5A, Pmax 1250VA DC Umax 30V, Imax 5A, Pmax 150W Initial breakdown voltage : 1000Vrms 1min. from neighbouring output, electronics and earth, ie from front panel and card frames
Relay outputs 1 - 4 on FTV 3090 relay card	1 potential free change over contact AC Umax 250V, Imax 2A, Pmax 125VA DC Umax 220V, Imax 2A, Pmax 60W Initial breakdown voltage : 1000Vrms 1min. from neighbouring output, electronics and earth, ie from front panel and card frames
Accuracy	0.1% of the set point
Temperature error	max +/- 50ppm with reference to the set point
Reaction time of speed monitor Reaction time of comporaters	Where the limit is assigned to one of the three speed monitors on the motherboard, the minimum measuring time is 1 period of the corresponding set point frequency. The reaction time of the corresponding relay output is Max 1 period of the input frequency + 9ms. Where the limit is assigned to one of the 4 comparators on the motherboard, the minimum measuring time may be set as the Fixed Time. Where the period of the input frequency is shorter than the Fixed Time the relay output reaction time is - Max twice Fixed Time + max input freq. period + 12ms Typically = Fixed Time + 1 input period + 12ms Where the input period is longer than the Fixed Time the reaction time of the relay output is - Max max input period + 12ms
Analog outputs 1, 2 and 3	Auxiliary module FTW 3013 Each of the 3 analog outputs can be used for speed or frequency functions each having independent ranges. The outputs are potential free and isolated to 500V, 50Hz, 1 Min. from each other, the main electronics and earth (neighbouring o/p, front panel and card frame).
Standard configuration	0...20mA or 4...20mA, programmable for rising or falling characteristic Max load 500 Ohm (10V)
Optional version S3	0...5mA or 1...5mA programmable for rising or falling characteristic Max load 2000 Ohm (10V)
Option U, voltage output	0...10V or 2...10V programmable for rising or falling characteristic Max load 7 KOhm (1.4mA)
Max output voltage	30 V
Resolution	12 Bit. 1: 4096
Max linearity error	0.1%

Accuracy	0.2% of the range
Temperature drift	typically +/- 150ppm/ºK, max +/- 300ppm/ºK

Reaction time (step change)	The minimum measuring time may be entered. Where the input period is shorter than the Fixed Time, the reaction time is - Max twice Fixed Time + max input period + 7.5ms Typically Fixed Time + 1 input period + 7.5ms Where the input period is longer than than the Fixed Time, the reaction times is Max input period + 7.5ms Each of the analog outputs can be allocated a software defined low pass filter, whose time constant T can be configured in the range 0.0 to 9.9 seconds. The sample rate is T/10.

Binary inputs 1 - 6	Motherboard FTFU 3024 For programmable control functions such as - failure memory reset - max memory reset - initiate lamp test - set direction of rotation - initiate test
2 binary inputs (B1 and B2) having common reference - -V of the supply 4 potential free binary inputs (B3...B6) with common floating reference voltage	+ 5 V level with pull up resistor V low = active 0...+1V, Isink = max 1mA V high + 3,5...+33V or open Isolation 500V, 50Hz, 1 Min. from electronics and earth +24V level V low 0...+5V or open V high = active +10...+33V Isource = max 4mA

Frequency outputs 1 and 2	Motherboard FTFU 3024
Frequency output 1 having common 0V with supply	Square wave, amplitude +10V, output impedance 100 Ohm Output current +/-50mA continuous +/- 100mA for 10% of operating time
Frequency output 2 potential free	Square wave, amplitude +15Vpp, output impedance 100 Ohm Output current +/-50mA continuous +/- 100mA for 10% of operating time Isolation 500V, 50Hz, 1 Min. from electronics and earth

Frequency generator	Motherboard FTFU 3024 Frequency range 0.002Hz / 30KHz. Signal only accessible internally = F4

Data I/O	Comms module FTK 3072
Having potential free floating reference	Serial RS 232 interface via front panel D9 connector

Supply	PSU in the rack for all modules excluding supply modules 18...33Vdc		
	Power consumption	Typically	Max
	Motherboard FTFU 3024/E01	4.5W	5.5W
	Converter FTW 3013	2.6W	2.8W

	Relay card	FTV 3090	4.0W	4.2W
	Comms module	FTK 3072	2.0W	2.5W
	Power on surge is limited as follows			
	Motherboard	FTFU 3024/E01	7A	
	Input cards	E01, E02, E03	3.3A	
	Converter	FTW 3013	0.1A	
	Relay card	FTV 3090	0.1A	
	Comms module	FTK 3072	7A	
Power Supply	To FTZ 306X Output 24VDC-2A (1.5A for FTZ3061/62, 4A for FTZ3066) Isolation 500V, 50Hz, 1min from earth Isolation 2000V, 50Hz, 1min from input			
Model	Voltage	max power consumption	surge	
FTZ 3061	115/230Vac, -20, +15%	63VA	10A	
FTZ 3062	24/48Vac, -20, +15%	63VA	50A	
FTZ 3064	14...70Vdc	60W	500A	
FTZ 3065	88...372Vdc	60W	55A	
FTZ 3066	14 … 70Vdc	120W	500A	
FTZ 3069	Mains filter - required if modules supplied direct with 18...33Vdc		66A	
Environment	KUE to DIN 40 040 Operating temp 0...+60ºC, +70ºC for max 2 hours Storage temp -25...+85ºC rH 75% yearly average, max 90% over 30 days, condensation to be avoided.			
Electromagnetic immunity	Conforms to current european standards			
Card frames and modules	Mounting to DIN 41494 Material anodised aluminium Rack space 84 TE - 21 slots each 4 TE Height 3 HE Depth approx 220mm Connectors 2 or 3 row type F to DIN 41612, wire wrap connections as standard to rear screw terminals. Optional Termi Point terminals for direct connection.			
Dimensional drawings	Card frames Dwg nr. 3-110.544/4 Modules Dwg nr. 3-110.544/2			
Rear screw terminals	Sprung terminals for 2.5mm sq. cable or 1.5mm sq. wire			
Protection class to DIN 40050	Card frames IP 10 Plugged modules IP 20 Terminals IP 20			
Block diagram	Dwg nr. 4-110.505			
Module layout in rack	Dwg nr. 4-110.545			
Rack terminal layout/wiring	Dwg nr. 3-110.536			
Module connections				
Motherboard FTFU 3024	Dwg nr. 4-110.531/23			
Converter FTW 3013	Dwg nr. 4-110.531/24			
Relay card FTV 3090	Dwg nr. 4-110.531/25			
Comms module FTK 3072	Dwg nr. 4-110.531/26			

6.4 Technical data TCCC

TCCC = Trip Chain Control Card, FTBU 3x34

INPUT : IN1 – IN6	6 potential free inputs.
Input voltage for IN1- IN6	20 – 50 V, active level is 0V.
IN1 – IN6 Sink current	Min 10 mA, Max 15 mA
Logical channel combination	The output OUT is active when the following logical combination occurs : IN1.IN2 + IN3.IN4 + IN5 + IN6, where Ini means channel i is active (low level).

INPUT : TEST	The TEST input simulates the logical combination which activates the OUT output. This signal is used for performing periodic FTBU testing.
Input voltage for TEST	5 – 48V, input active level is high. No test mode is at TEST = 0V
TEST Sink current	< 15 mA for the whole voltage range.

OUTPUT : K1 – K6	These relays are the output stage associated with each signal channel. The Relay Ki is energized when INi is high.
Relay K1 – K6	Potential free change over contact AC Umax 250V Imax 5A Pmax 1250 VA DC Umax 30 V Imax 5A Pmax 150 VA Initial breakdown voltage : 1000Vrms 1min. from neighbouring output, electronics and earth, ie from front panel and card frames
Reaction time INi to Ki	< 8 ms

OUTPUT : OUT	This relay is the combined output of the 6 signal channels. The Relay OUT is energized when the logical combination of IN1 – IN6 is not true.
Relay OUT	2 potential free change over contacts AC Umax 250V Imax 2A Pmax 125VA DC Umax 220V Imax 2A Pmax 60W Initial breakdown voltage : 1000Vrms 1min. from neighbouring output, electronics and earth, ie from front panel and card frames
Reaction time Ini to OUT	< 8 ms

OUTPUT : ALARM	The alarm relay is the output stage of the on board self-diagnostic function. The supply voltage and the logical correlation between input levels and output levels are monitored. The relay is energized when the current card status is **no-alarm**.
Relay ALARM	Potential free change over contact, AC Umax 250V Imax 5A Pmax 1250 VA DC Umax 30 V Imax 5A Pmax 150 VA Initial breakdown voltage : 1000Vrms 1min. from neighbouring output, electronics and earth,

	ie from front panel and card frames

Power Supply	The card FTBU 3x34 can be used with standard FT3000 redundant power supply units. Both voltages are combined on the card and the supply voltages are monitored.
Supply voltage	18 ... 33V
Supply current	Typ : 160 mA Max 250 mA at 24V
Power on surges	Limited at 1 A

7 Principle of operation

7.1 Measuring system

The measuring system on the FTU 3024 motherboard processes four frequencies, F1, F2, F3, F4.
Input F1 is derived from the amplified sensor signal from the input card EOX. Inputs F2 and F3 are derived from the outputs of additional FTFU 3024's present in a 3 channel system. Input F4 is derived from the test frequency generator.

7.2 Measuring principle

7.2.1 Standardising the measured value

Following input of the machine factor M = f/n, where f = sensor frequency in Hz for a known speed and
n = machine speed in rpm

or input of the number of pulses per rev (nr. of pole wheel teeth), the frequency relay limit values and the converter measuring ranges can be directly entered in rpm.

The relationship between the sensor signal frequency f and the speed n of a pole wheel to be sensed is

f = n * p/60 where f = sensor frequency in Hz
n = pole wheel speed in rpm
p = nr. of pole wheel teeth

For rotational speed measurements the machine factor M = p/60.
In place of speed n in the formulae above, any other frequency proportional physical unit may be used.
If the limit values and measuring ranges are to be entered in percent of nominal, the above calculations are still required.

7.2.2 Speed monitor

The max 3 speed monitors are based on hardware re-triggerable One Shot circuits that are set with every positive edge of the input frequency. The timebases are derived from 3 down counters that are set with the set point frequency and clocked down using a 2.5MHz reference signal. If the counter reaches zero before the arrival of the next positive edge, this indicates that the input frequency is lower than the set point. These functions for one limit value are performed in an ASIC (Application Specific IC). The preset values for the down counter are computed by a microprocessor for the required set point and loaded into the ASIC.

The 3 speed monitors continuously collect speed frequency data without interruption.
Each speed monitor is supplied with 1 of 5 possible input signals, defined by software configuration (None, F1, F2, F3, F4)

7.2.3 Frequency measurement (Period measurement principle)

FT 3000 tachometers work on the continuous period measurement principle. The measuring chains for 3 frequency measurements are implemented in hardware using ASIC's. Each of the 3 ASIC's contain a counter to measure the period duration of up to 3 frequencies. The mpu reads the counter's status with each positive edge of the input frequency. The difference between the status of 2 counters is a measure of the period of the input signal. The frequency

data is continuously collected from all 3 measuring chains without pause. The number of periods measured is determined by the Fixed Time and the magnitude of the input frequency.

The measured value (rotational speed) is then computed by the mpu. There are then 3 floating point values available - <AbsolutA>, <AbsolutB> and <AbsolutC>.

Each measuring chain is supplied with 1 of 5 possible input signals, defined by software configuration (None, F1, F2, F3, F4).

7.2.3.1 Measurement functions

Based on the measured values <AbsolutA>, <AbsolutB> and <AbsolutC>, the following functions can be realised: <FunctionOutput>

- Majority value of A, B and C: From the 3 values 2 are selected that display the smallest difference and used to generate an average value.
- Max value of A, B and C: The max value is selected from the 3
- Min value of A, B and C: The min value is selected from the 3
- Average of A+B+C
- Average of A+B
- Average of B+C
- Average of C+A
- Difference A-B
- Difference B-C
- Difference C-A
- Ratio A/B
- Acceleration 1 (Accel. 1) :
  $Accel_1 = (speed_2 – speed_1) / (time_2 – time_1)$ (RPM/s)
- Acceleration 2 (Accel. 2) :
  $Accel_2 = Accel_1 / speed1$ (RPM/s)
  $Accel_2$ units could also be %/s, this means that we are speaking here of a rate of change from the nominal speed.

The function is defined by software configuration.

7.2.3.2 Max value memory

The max value memory <MaxMem> registers the maximum value of a measurement (Drag pointer function)
The max value memory can only be reset via an intentional entry *ResetMaxMem* in the *CommandByte* or through total power failure. Which measured value is stored is defined by the software configuration -

- <AbsolutA>
- <AbsolutB>
- <AbsolutC>
- <FunctionOutput>

Always remember to reset the Max value memory following testing with internal generators.
Speed measurement and over speed trip monitors are separate functions within the FT 3000.

In operation, there are 2 main reasons why the recorded Max value may not correspond to the limit setting:

- the trip point is reached but the machine runs on until the shutdown valve has closed. The maximum speed the machine reached prior to shutdown is therefore recorded.

- gear machining inaccuracies, coupled with a low number of pulses configured for the trip setting may result in the over speed monitor activating the trip relay at a speed apparently lower than the limit set. The solution to this is to increase the number of pulses used to say 20% of the number of teeth on the gear

7.2.3.3 Comparators

Each of the 4 comparators can be allocated one value from the following list by software configuration -

- <AbsolutA>
- <AbsolutB>
- <AbsolutC>
- <FunctionOutput>
- <MaxMem>

A comparator compares the actual measured value with the predefined set point and establishes limit status (upper/lower limit reached)

7.2.3.4 Analog outputs

Each of the 3 analog outputs from the FTW 3013 can be allocated one measured value via software. The start and end values for each range can be independently defined. Rising and falling characteristics are permissible. Each analog output may include a low pass filter with software configurable time constant.

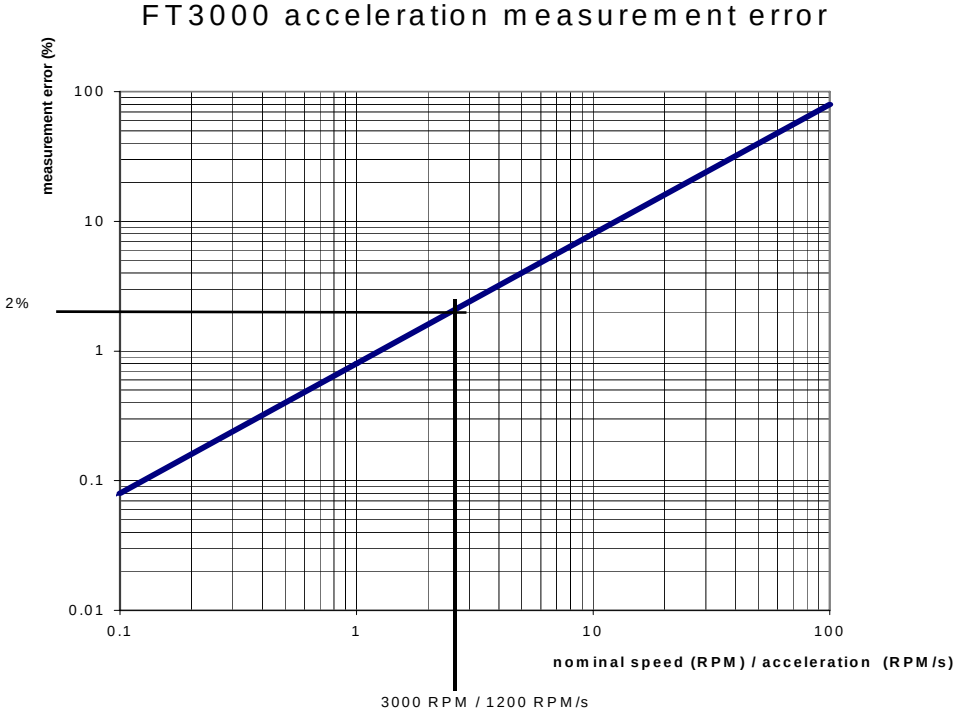
7.2.4 Acceleration measurement

The acceleration is measured with the speed measurement unit implemented in hardware (FPGA). The measurement of the speed is made every 10 ms (for speeds greater than 100 RPM). The precision of this measurement is determined by the clock of the „time counter“, which is 2.5 Mhz. Here we consider that this clock has no jitter, what is true due to the integration of the jitter during the measurement

The relative measurement accuracy of the acceleration is defined by :

$$\frac{\Delta acceleration}{acceleration}(\%) = 0.8 * \frac{speed(RPM)}{acceleration(RPM/s)}$$

For example :
Speed = 3000 RPM
Acceleration = 1200 RPM (rate of change of 40% per second)
The reachable accuracy is +/- 2% for the acceleration.


FT3000 acceleration measurement error
measurement error (%)
100
10
2%
1
0.1
0.01
0.1
1
10
100
nominal speed (RPM) / acceleration (RPM/s)
3000 RPM / 1200 RPM/s

7.2.5 Limit value control

There are 4 limit values available. There are independent upper and lower set points for each so that almost any hysteresis is possible.
Limit1, Limit2 and Limit3 may be assigned to either speed monitor 1, speed monitor 2, speed monitor 3, comparator 1, comparator 2 or comparator 3 via software configuration.

Limit4 is permanently assigned to comparator 4.
Limit status is displayed on the FTFU 3024 front panel via 4 green and 4 red LED's. The active limit colour can be defined by software configuration.
The operation of the limit can be defined by software configuration to be *normal* or *inverse*.
One relay from the FTFU 3024 and the FTV 3090 can be assigned to a limit value.
The status of the relay in failure mode (energized, deenergized) can be defined by software configuration (table)

7.2.6 Limit value time control

Time control for the first 3 limit values can be defined by software configuration.

7.3 Monitoring functions

7.3.1 Supply

The FTFU 3024 and the comms module FTK 3072 are supplied with +24Vdc from 2 redundant PSU's, PS1 and PS2. The 2 supplies are separately fused and diode decoupled.
The microprocessor's A/D converter monitors the supply tolerance after the fuse. Both front panel green LED's only light when their corresponding supplies are within tolerance of 18...33V. The internal messages *PS1OK* and *PS2OK* are set (=1) in the status byte when the supplies are within tolerance, reset (=0) when not.
PSOK is an AND function of *PS1OK* and *PS2OK* and is available for relay control. The constituents of the AND function can be masked by software configuration. When not otherwise specified, relay K1 on the FTFU 3024 signals *PSOK*.

7.3.2 Monitoring of internal voltages

The voltages before and after the +5V regulator are monitored on the FTFU 3024 and FTK 3072.
If out of tolerance a non maskable interrupt is sent to the mpu.

7.3.3 Sensor monitoring

The FTFU 3024 carries out background tests on the correct operation of the sensor.

- Static monitoring is via measurement of the sensor's current consumption. When the consumption is in the permitted range, *StaticMonitorOK* is set (=1) in the Status byte, otherwise reset (=0).
- Dynamic 2 out of 3 monitoring determines the deviation between measured values <AbsolutA>, <AbsolutB> and <AbsolutC> in comparison with a user definable max deviation. *DynAOK*, is set (=1) in the status byte when the deviation of the corresponding measured value is within defined limits, otherwise reset (=0).
- Dynamic 3 out of 3 monitoring works like Dynamic 2 out of 3 monitoring when the three measured values are above max deviation. When they are under max deviation the 3 measured values must be equal, otherwise *DynAOK*, *DynBOK* and *DynCOK* will be reset (=0).
- Combination of static and dynamic monitoring. *SensorMonitorOK* in the status byte is an AND function of *StaticMonitorOK* and *DynAOK* and is available for relay control. The constituents of *SensorMonitorOK* can be masked by software. When not otherwise defined, relay K2 on the FTFU 3024 is used to signal sensor monitoring. In the event of a fault (*SensorMonitorOK* = 0) the front panel green MO-LED goes out and the red NMO-LED lights

7.3.4 System monitoring

The FTFU 3024 and FTK 3072 run background self tests on the most important CPU and EEPROM functions. *SelftestOK* is set (=1) when no fault exists, otherwise reset (=0).

SystemOK in the status byte is an AND function of *SelftestOK*, *SensorMonitorOK* and *PSOK*. The constituents of *SystemOK* can be masked by software configuration. In the event of a fault (*SystemOK* = 0), the front panel green OK-LED goes out and NOK-LED lights.

During tests of an othwerwise fault free measuring chain, the green OK-LED blinks.

All relay and analog output behaviour in the event of a system fault is described in paragraph 7.4.4.

7.3.5 Module OK message

ModulOK in the status byte is an AND function of *SelfTestOK*, *SensorMonitorOK* ans *PSOK* and is available for relay control. The constituents can be masked by software.

7.3.6 Fault condition

CmdOnFailure in the status byte is an AND function of *SelfTestOK*, *PS1OK*, *PS2OK*, *PS1OK*-OR-*PS2OK* and SensorMonitorOK. The constituents can be masked by software configuration. In the event of a fault (*CmdFailure* = 0), the limit values assume the condition defined in the parameter table for limit value control (influence on LED's and relay control)

7.4 Direction of rotation discriminator

To establish direction of rotation, 2 or 3 suitable speed sensors can be positioned around a pole wheel such that their output signals are electrically phase shifted by 90 or 120 degrees. The sequence of signals then changes with pole wheel direction.

An analysis of the signal phase relationships allows the direction to be determined. The required logic is on the FTFU 3024 in the ASIC's. The direction is displayed on the front panel yellow LED's FW (**F**or**W**ard) and BW (**B**ack**W**ard). *BW* and *FW* in the status byte are available for relay control.

When 2 signals are present (S1 and S2 or S2 and S3 or S3 and S1), forward operation (FW on) is defined as S1 leading S2 or S2 leading S3 or S3 leading S1.

When 3 signals are present (S1, S2 and S3), forward operation (FW on) is defined as S1 leading S2 **and** S2 leading S3 and S3 leading S1.

The use of 3 sensors **instead of 2** provides greater security against sensor failure since the internal logic provides correct discrimination even if one sensor fails.

The required **direction display for a given phase relationship** can be defined in the configuration. Direction can also be signalled via a relay.

Setting forward operation is via the corresponding binary input configured. Forward operation is then assumed and the relay adopts the corresponding status.

The **direction display following power up** can be defined by software.

7.5 Relay control

Each of the 3 relays on the FTFU 3024 and 4 on the FTV 3090 can be assigned to one function from the following list. The selection is defined by software:

- Limit value
- *ModulOK*
- *PSOK*
- *SensorMonitorOK*
- *FW*
- *BW*

- *TestO*
- *PS1OK*
- *PS2OK*
- *Limit 1*
- *Limit 2*
- *CmdOnFailure*
- *FW Inverse*
- *BW Inverse)*
- *ON*
- *OFF*
- *Limit3*
- *Limit4*

7.6 Test frequency generator

ASIC 3 (measurement channel C) on the FTFTU 3024 includes a frequency generator for test purposes, having 2 selectable frequencies. The output signal from the generator is taken to input F4 and can be routed to inputs F1, F2 or F3 on the speed monitor. The 2 frequencies are automatically derived from the predetermined parameters *upper test value* and *lower test value* (eg in rpm).

7.7 Test

Each of the 3 speed monitors can be allocated 2 configurable parameters, *upper test value* and *lower test value*.2 internal commands in the *CommandByte*, *SpeedMonitorInputASelect* and *SpeedMonitorInputBSelect* enable selection of one of the 3 speed monitors as follows:

SpeedMonitorInputBSelect	*SpeedMonitorInputASelect*	Selected monitor
inactive	inactive	None - no test
inactive	active	Speed monitor 1
active	inactive	Speed monitor 2
active	active	Speed monitor 3

When *UnderOverSelect* in the *CommandByte* is set active (=1), the *upper test value* is selected, when reset inactive (=0), the lower. The command *TestOn* in the *CommandByte* then switches the test frequency to the chosen speed monitor.

With *TestOn* set active (=1) the test starts, with *TestOn* reset inactive (=0) testing is terminated.

During testing the green LED OK flashes at 1Hz and *TestOn* is set active (=1) in the StatusByte and is available for relay control.

Testing is only possible if there is no system fault, a speed monitor has been selected and *TestOn* is set active.

The status of internal commands *SpeedMonitorInputASelect*, *SpeedMonitorInputBSelect*, *UnderOverSelect* and TestOn can be changed via configured binary inputs or FT 3000 PC commands.

7.8 Frequency outputs

3 frequency outputs are available.
Frequency output 1 having common reference voltage with -V on the supply.

Frequency output 2 having potential free, floating reference.
Frequency output 3 controls the yellow front panel LED S.
Every frequency output is programmable with one of 5 possible input signals (None, F1, F2, F3, F4).

7.9 Lamp test

The lamp test switches on all FTFU 3024 and any FTV 3090 LED's present. No relay status is changed.
Relays remain under the sole control of the monitoring module.
Lamp testing is active when *LampTest* is set active (=1) in the *CommandByte*.

7.10 Message acknowledgement

Whether the internal messages *PS1OK*, *PS2OK*, *SensorMonitorOK* and *ModulOK* must be acknowledged or not can be defined by software. Acknowledgement is via setting (=1) and resetting (=0) of *ResetLatch* in the *CommandByte*.

7.11 Binary inputs

Each of the 6 binary inputs can be allocated to one of the following functions:

- without None
- Reset messages via active hold function *ResetLatch*
- Reset max value memory *ResetMaxMem*
- Lamp test *LampTest*
- Set direction *DirectionSet*
- Select speed monitor to test *SpeedMonitorASelect*
- Select speed monitor to test *SpeedMonitorBSelect*
- Select 1 of 2 test frequencies *UnderOverSelect*
- Initiate test *TestOn*

An inactive binary input resets (=0) the allocated internal command.
An active binary input sets (=1) the allocated command.

7.12 Parameter entry

The input of **process** and **configuration** parameters would normally be made by the manufacturer or OEM per the order. **Process** and c**onfiguration** parameters are configurable via PC software using the RS 232 interface and the FTK 3072 comms module (see section 7).

Where a micro terminal is installed, process parameters may be entered via this.

Service parameters are reserved for the manufacturer.

All parameters are stored in EEPROM and not lost if power fails.

7.13 Signal Monitoring

The FTBU card is designed to combine different trip commands to provide global shutdown control within the IEC 61508 SIL 3 regime. The overspeed functionality of the FT3000 is SIL 3 certified. The FTBU extends this certification to encompass trip signals from other sources such as temperature, pressure etc alarms.

6 potential free change-over relay contacts (K1-6) are created from 6 opto-coupled inputs (IN1-6). The relationship between INi and Ki is 1:1. An additional output (OUT) comprises of two relays that each provide a change-over contact. These contacts allow 2 out of 3 voting in a three FTBU 3x34 card system. The OUT output is driven by a logical combination of the six inputs : OUT is active (deenergized) when the folowing equation is true :

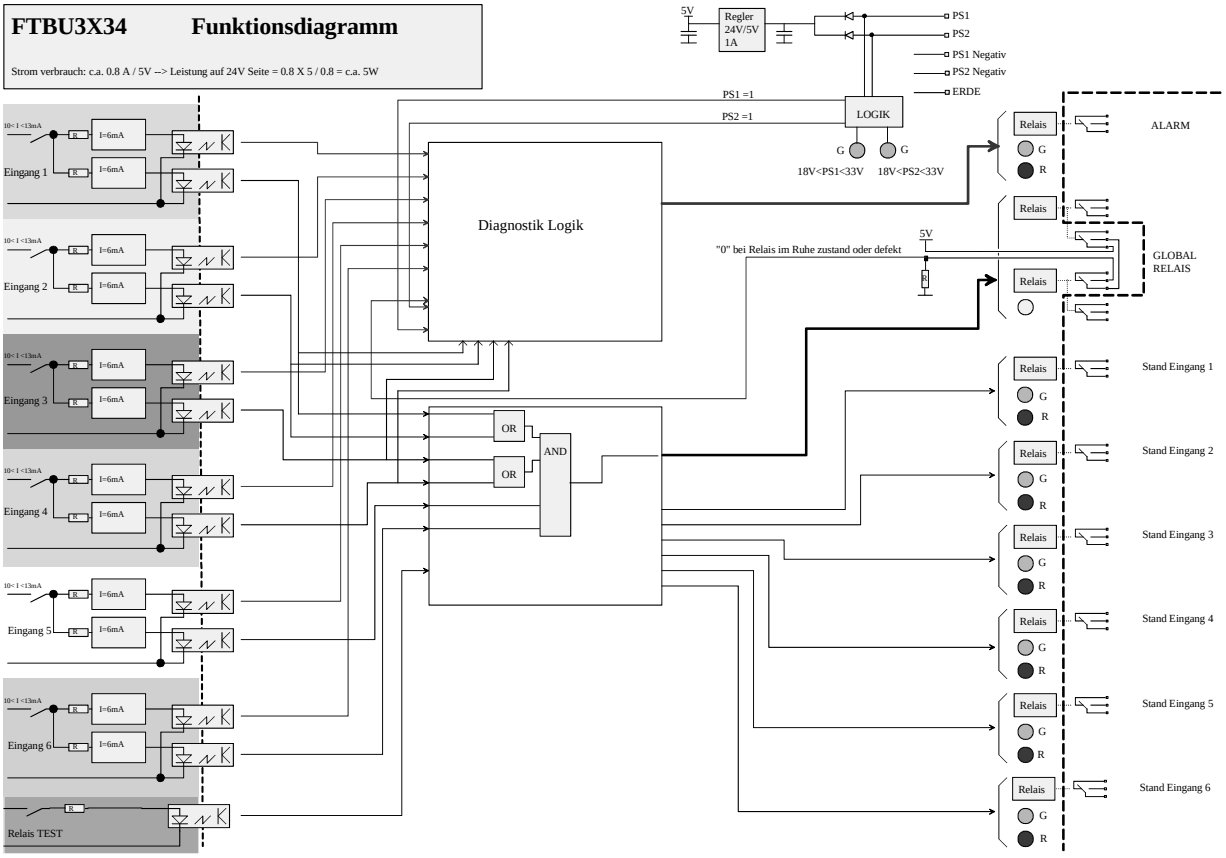
$$IN1.IN2 + IN3.IN4 + IN5 + IN6$$

where INi means an active input (low level).

This function allows the FTBU card to provide optimum combination of commands in the trip chain and simplify system wiring.

The card has an on board self-diagnostic unit, which drives the ALARM output. The power supply and the logical correlation between the 6 inputs and the relay outputs are monitored. Spare contacts from the OUT relays are used for this purpose.

To periodically check the availability of the trip chain function a test input allows simulation of the OUT relays. The relay function must then checked by the user.



8 Installation

8.1 General

The equipment conforms to protection class 1 and requires the connection of protective earth.
This must be connected to the designated terminal **before** any other connections are made. The earth wire cross section must be at least the same size as the power cables.

NB: Any interruption of the earth connection outside or inside of the equipment affects the safety and noise immunity and may endanger personnel and/or equipment. Intentional disconnection of the earth connection is forbidden.

The wired rack may only be used in a fixed installation. The mains supply must be equipped with a suitable switch.

Before switching the equipment on, verify that the PSU's match the mains supply provided.

To ensure noise immunity, the sensor screens must be connected to the terminals provided.

To avoid external interference when switching loads, suitable suppression should be used.

19" rack connection diagram: Dwg nr. 3-110.536/...

NB: There are capacitors charged to the supply voltage on the PSU's.

8.2 IEC 61508-2-3 Specific Installation rules

The Ft3000 rack system must be installed in a key closed cabinet. Only trained people (service/installation people) have allowed acces to the rack.

The signal cables and power supply cables must be installed separately on separated paths.

No ventilator required for the system.

Avoiding common mode failures : No rack displacement during the working of the rack.

The integrator must preconfigure the process parameters for each channel before running the main process. This configuration check can be done by driving the overpeed proctection system without running the main process.

The integrated overspeed protection system must be pre-tested before running the main process (See maintenance specification for this test : periodic test).

There is no specific specifications for the starting procedure of the main process. Theses procedures depends on the OSPS / Main process integration and is full dependent of the integrator philosophy.
However the OSPS system must be started and ran when the equipment under controll is started.

9 Setting parameters and operation

9.1 Software concept

The input of various parameters is covered in section 5.11 and is via a user friendly operating system. Various windows permit the selection of functions and parameters using prepared menus.

9.1.1 Process parameter list

Using the PC software (Art. No.: 377A-72710) and the RS 232 interface on the FTK 3072 the following parameters can be configured.

Parameters and their values activated upon delivery are shown bold.

- Parameter input — **Absolute** / percent
- Min measuring time — **0.01** ... 1.00s
- Number of measurements — **1** .. 4
- Machine factor input — **Machine factor** / pulses per rev
- Machine factor 1...4 — -9.9999 E+/-12 ... **1.0000** ... +9.9999 E+/-12
- Pulses per rev 1...4 — 1 ... **60** ... 65535
- Nominal speed 1...4 — -9.9999 E+/-12 ... **1000.0** ... +9.9999 E+/-12
- Units 1...4 — **None** / U/min / rpm / T/min
- Message acknowledgement — **Without** / with acknowledgement
- Process name — (8 characters)
- Lower set point 1...4 (Limit X low) — -9.9999 E+/-12 ... **1.0000** ... +9.9999 E+/-12
- Upper set point 1...4 (Limit X high) — -9.9999 E+/-12 ... **1.0000** ... +9.9999 E+/-12
- Analog output range 1...3 — 0/4...20mA
0/1...5mA
0/2...10V
- Measuring range start value — -9.9999 E+/-12 ... **1.0000** ... +9.9999 E+/-12
- Measuring range end value — -9.9999 E+/-12 ... **1000.0** ... +9.9999 E+/-12
- Sensor monitor (permissible deviation for dynamic monitoring) — -9.9999 E+/-12 ... **50.000** ... +9.9999 E+/-12
- Lower test value 1...3 — -9.9999 E+/-12 ... **550.00** ... +9.9999 E+/-12
- Upper test value 1...3 — -9.9999 E+/-12 ... **750.00** ... +9.9999 E+/-12
- Parameter enable - OEM — **H0, H1, H2, H3**, H4, H5, H6, **H7**
- Parameter enable - End user — **H0,** H1, H2, H3, H4, H5, H6, H7
- Parameter enable - micro terminal — H0, H1, H2, H3, H4, H5, H6, H7
- Password - manufacturer — ******
- Password - OEM — ******
- Password - End user — ****

9.1.2 Configuration parameter list

The following configuration parameters are configurable via PC. (If a micro terminal is installed it can not be used to configurate these parameters.).

Parameters and their values activated upon delivery are shown bold.

- Machine factor **Global**
- Input card **E01** / E02 / E03
- Optional converter **Without** / with
- Converter type FTW 3013
- Relay card **Without** / with
- Relay card type FTV 3090
- Microterminal **Without** / with
- Configuration name (8 characters)
- Permissible module addresses 0 ... 15
- System monitoring (LED's) System, PS1, PS2, PS1 OR PS2, Sensor Monitor 1 Sensor Monitor 2, Sensor Monitor 1 OR 2
- Module OK signalling (influence on relays) System, PS1, PS2, PS1 OR PS2, Sensor Monitor 1 Sensor Monitor 2, Sensor Monitor 1 OR 2
- Power supply monitoring PS1 , PS2
- Sensor monitoring Static, dynamic, majority, max value
- Analog output control 1...3 None, AbsolutA, AbsolutB, AbsolutC **FunctionABC**, MaxMem
- Analog output 1...3 **20mA/**5mA/10V
- Time constant on analog o/p **0.0** ... 9.9s
- If analog output 1 ... 3 deviation **Not off/**off
- Limit control 1 ... 3 None/**speed monitor**/comparator
- Speed monitor limit control 1 ... 3 None/**F1**/F2/F3/F4
- Comparator limit control 1 ... 4 None/**AbsolutA**/AbsolutB/AbsolutC FunctionABC/MaxMem
- Limit mode 1 ... 4 **Normal**/inverse
- Limit value table **Table0**/table1

When Table 0 and fault case, the limit state corresponds to limit set point overgone
When Table 1 and fault case, the limit state corresponds to limit set point undergone

- Limit value 1 ... 4 LED's **Normal**/inverse
- Time control - Limits 1 ... 4 Used/**not used**
- Function - limits 1 ... 4 **One shot**/flip-flop
- Time - limits 1 ... 4 **10**s
- Edge - limits 1 ... 4 **Positive**/negative
- Control - relay 1 (Motherboard) Limit1 / Limit 2 / Limit 3 / Limit 4 / Ok / PS / Mo / FW / BW / TestOn / PS1 / PS2
- Control - relay 2 (Motherboard) Limit1 / Limit 2 / Limit 3 / Limit 4 / Ok / PS / Mo / FW / BW / TestOn / PS1 / PS2
- Control - relay 3 (Motherboard) Limit1 / Limit 2 / Limit 3 / Limit 4 / Ok / PS / Mo / FW / BW / TestOn / PS1 / PS2
- Control - relay 1 (Relay card) Limit1 / Limit 2 / Limit 3 / Limit 4 / Ok / PS / Mo / FW / BW / TestOn / PS1 / PS2
- Control - relay 2 (Relay card) Limit1 / Limit 2 / Limit 3 / Limit 4 / Ok / PS / Mo / FW /

BW / TestOn / PS1 / PS2

- Control - relay 3 (Relay card) — Limit1 / Limit 2 / Limit 3 / Limit 4 / Ok / PS / Mo / FW / BW / TestOn / PS1 / PS2
- Control - relay 4 (Relay card) — Limit1 / Limit 2 / Limit 3 / Limit 4 / Ok / PS / Mo / FW / BW / TestOn / PS1 / PS2
- Control - binary inputs 1 ... 6 — **None**/ResetLatch/ResetMax/LampTest/DirectionSet/ SpeedMonitorInputA_Select/SpeedMonitorInputB_Select/ UnderOver_Select, TestOn
- Input - frequency measurement A — none/**F1**/F2/F3/F4
- Input - frequency measurement B — none/F1/**F2**/F3/F4
- Input - frequency measurement C — none/F1/F2/**F3**/F4
- Function output — None/**MajorVoteABC**/MaxABC/MinABC/SigmaABC/ SigmaAB/SigmaBC/SigmaAC/DeltaAB/DeltaBC/ DeltaCA, Accel. 1,Accel. 2
- Max value memory — None/**AbsolutA**/AbsolutB/AbsolutC/FunctionABC
- Frequency output 1 ... 3 — None/**F1**/F2/F3/F4
- Standard direction — **None**/FW/BW
- OnCmdSetDirection — **None**/FW/BW
- OnPowerSetDirection — **None**/FW/BW

9.1.3 Service parameter list

The detailed list of service parameters is available from JAQUET on request. Use of the service parameters is however reserved by the manufacturer and of no significance to end users.

9.2 PC communications

The FTK 3072 equipped with a RS 232 interface is required for communications between a PC and the various modules.

9.2.1 PC system requirements

386DX, 486DX or higher, equipped with Microsoft® WindowsÔ 3.11 or higher, with serial interface COM1 or COM2 available and not running any application programs other than the FT 3000.
The PC to FT 3000 interface cable must be a screened D9 male to D9 female, connected 1:1. (See 9.4.2)

9.2.2 PC software installation

The FT 3000 software is supplied on 3.5" disk and is to be found under FT3000.EXE.
The file FT3000.EXE must be copied to a suitable directory using File Manager, eg C:\FT3000. Using Drag and Drop it can then be installed in the Program Manager.

If another application is using the serial interface, the FT3000 program will display an error message when started. The interface would then be set as ‘none’.

Note: The first time the FT3000 program is used, the interface is set to ‘none’ and must be set up using the menu *Settings* and the command *Interface*.

Important: With operating system Windows 3.11, the Windows System File **SYSTEM.INI** under the (386Enh) section must be extended as follows:

```
COM1Buffer=8192          or    COM2Buffer=8192
COM1FIFO=ON  (*)               COM2FIFO=ON
COMBoostTime=30                COMBoostTime=30
```

(*) **With operating system Windows 95 or later**, the **FIFO** of the serial interface **has to be disabled**.

The application will then be ready **after Windows** has been **rebooted**.

9.2.3 Optimisation

Various settings can be made in the initialisation file FT3000.INI that is saved in the Windows directory for the FT3000 application the first time the program is exited.
The following settings are made from the FT3000 application menu - 'Settings' and should not be altered with a text editor:

`(Settings)`

`CommPort=1`	1 = COM1
`CommDirControl=0`	0 = DTR control line
`CommTimeOutEcho=`**`20`**	**Time out** in ms if the PC does not receive an **echo** (irrespective of data amount)
`CommTimeOutEchoCharacter=`**`5`**	Additional time out per character in ms if the PC does not receive an
`CommTimeOutResponse=`**`200`**	**Time out** in ms if the PC does not receive an **answer** from the **FT3000**
`CommTimeOut=`**`50`**	Additional **time out** per character in ms if the PC does not receive an **answer** from the **FT3000** (dependent on data amount)
`CommDelayTimeCommand=`**`10`**	Minimum **time** in ms that the **PC** allows from receipt of one response to **sending** a **new command** to the FT3000
`DisplayInterval=2500`	PC display interval for measured data

Note: By reducing the times shown in bold the data transfer may be speeded up. However, this increases the risk of a data crash, especially when using an older or slower PC, since the FT3000 requires a minimum time to respond to PC commands.

9.2.4 Setting the display interval

The display interval of measured data and additional messages on the PC can be set in the range 0.25 ... 10seconds. This cannot however be guaranteed due to the way Windows handles multi tasking.

9.2.5 Protection of configuration parameters

As standard, the configuration parameters are protected from being changed via PC password.
An OEM password level is provided for changing parameters as defined in 9.3.6 and 9.3.7.
The OEM should be aware that changing parameters can alter the whole FT3000 system that would in principle correpond to changing the wiring.

9.2.6 Protection of process parameters

As standard, the process parameters are protected from being changed via PC password.
A user password level is provided for changing parameters as defined in 9.3.6 and 9.3.7.

9.2.7 Reading and writing parameters

Reading or writing of parameters occurs after confirmation in the dialogue box <Confirm parameter read/write>. When reading parameters, the configuration and process parameters per module should always be read together.

If the configuration and process parameters are read into a new file, then the construction of the FT3000 must be defined. All FT3000 modules can then be automatically interrogated.

9.2.8 Parameter printout

FTFU 3024 configuration and process parameters are separately printed out for one module at a time.
The module selected is shown in the PC window top left. Selection is via <- and -> scroll keys.

9.2.9 Display of current measured data

The display of current measured data is for one module at a time. Module selection is via <- and -> scroll keys.

9.3 Setting parameters

Parameter configuration is via the FTK 3072 comms module, a RS 232 PC interface and the FT3000 application program.

Within the aforementioned range the parameters can be changed either ON-LINE (via comms module FTK 3072 and RS-232 PC interface) or OFF-LINE by selection of the corresponding menu and change of the desirred parameters.

OFF-LINE (without connected FT 3000-system):

1. With the FT 3000 command: < configuration: module on the unit .... > the modules installed must be identified by means of activating the corresponding bush button on the configuration dialogue <module on the unit> and confirming this with <OK>.
2. Only **after** step No.: 1 the dialogues for the configuration- and process-parameters can be called.
3. To change a parameter a password must be used (see 9.3.6 and 9.3.7)

Attention: Each parameter change only becomes effective after the PC command *FT3000 - write parameters* is given and the FT3000 has stored the new parameters.

There are 7 process parameter functions: <System settings>, <Sensor monitor>, <Analog outputs>, <Limit values>, <Test values>, <Parameter enable> and <Password>.

9.3.1 System settings

9.3.1.1 Parameter input

The parameters for <Sensor monitor>, <Analog outputs>, <Limit values> and <Test values> can be entered as **absolute** or percentage values of nominal speed.

9.3.1.2 Nominal speed

The nominal speed must be specified if parameters are inputed as percentage values.

Please note the following if the nominal speed is changed:

- If parameter input is in absolute values, a change to the nominal speed will not result in recalculation of the absolute values - Speed deviation, Analog measuring range, Limit set points, Test values.
- If parameter input is in percentage values, a change to the nominal speed will result in recalculation of the absolute values - Speed deviation, Analog measuring range, Limit set points, Test values.

Whether recalculation takes place is based on the setting Absolute or % in the application program.

9.3.1.3 Units

When entering parameters in absolute values, a unit may be specified eg rpm.

9.3.1.4 Machine factor

The machine factor M = f/n where

- f Hz = sensor signal for a given speed
- n rpm = machine speed

In place of the machine factor, the **number of pulses** per rev (= nr. of poles on the gear wheel) can be entered.
The machine factor is then automatically calculated as M = ppr/60.

9.3.1.5 Measurement (Min measuring time and number of measurements)

The **min. measuring** time determines the minimum period during which the input frequency is measured.
The effective measurement time is terminated upon completion of the min measuring time by the next positive edge of the input frequency.

A long **min measuring** time can be used to average out variances of the input frequency but it increases the output reaction time to step changes in speed.

The **min measuring** time can be set in increments of 10ms from 0.01 to 1.00 seconds.

To suppress variances showing up in the measured **data,** 1 to 4 **measurements** can be averaged without the need to increase the measuring time.

9.3.1.6 Message acknowledgement

'**With acknowledgement', messages** are stored until reset eg via configured binary inputs or PC command.
Or -
'Without acknowledgement', messages are not stored.

9.3.1.7 Process name

The process name (max 8 characters) serves to identify the application of individual plug in modules.

9.3.2 Sensor monitor

With 3 channel 2 out of 3 monitoring, the max permissible speed difference between 2 channels must be specified.

9.3.3 Analog outputs

The following parameters can be independently set for each of the 3 analog outputs.

9.3.3.1 Measuring range start value

The value entered tells the FTW 3013 what frequency corresponds to, for example 0mA.

9.3.3.2 Measuring range end value

The value entered tells the FTW 3013 what frequency corresponds to, for example 20mA.

For a falling characteristic the end frequency value must be smaller than the start value.

9.3.3.3 Output range

In standard FTW 3013 units this is set to *normal* (0...20mA or 0...5mA or 0...10V).
Output range with zero suppression corresponds to 4...20mA or 1...5mA or 2...10V.

9.3.4 Limit values

The following parameters can be independently set for each of the 4 limit values.

9.3.4.1 Set point

The limit value can be defined with an *upper* and *lower set point*.

If in the configuration <Limit value control> was defined as *normal*, exceeding the upper set point activates the limit. It then becomes inactive when the speed drops below the lower set point.

If in the configuration <Limit value control> was defined as *inverse*, then when the speed drops below the **lower** set point it is **active**. It then becomes inactive when the speed exceeds the **upper** set point.

9.3.4.2 Pulses

If during configuration <Limit value control> was specified as *SpeedMonitor*, the number of pulses to be used for the measurement must be defined.

If during configuration <Limit value control> was specified as *Comparator*, this entry is not required. Limit 4 is always defined as *Comparator*.

The FT 3000 Windows software will allow a minimum pulse value to be set, which is appropriate to the limit setting. In the event that trips occur at speeds apparently below the limits selected, then this may be the result of gear machining inaccuracies. The solution to this is to increase the number of pulses used to say 20% of the number of teeth on the gear.

9.3.5 Test values

If during configuration <Limit value control> was specified as *SpeedMonitor*, **upper** and **lower test values** are available for each limit. Internally generated square wave signals corresponding to the speed set points are fed to the respective speed monitor input during testing in place of the input signal. This is controlled by suitably configured binary inputs or via PC commands.

9.3.6 Parameter enable

The individual configuration and process parameters have the following fixed hierarchy:

H0 - Process 0	Absolute / %, ProcessName
H1 - Process 1	Limit_High, Limit_Low, SpeedMonitor_Pulses, Analog_Full, Analog_Zero,
H2 - Process 2	MachineFactor, NominalSpeed, PulsesPerRev, FixTime, NumberOfMeasurement
H3 - Config 0	LimitMode, LED-Mode, ConfigName
H4 - Config 1	All configuration parameters excl. H3 - Config 0 and H5 - Config 2
H5 - Config 2	ModuleInstallationByte
H6 - Service	ServiceParameter, Calibration
H7 - Commands	FT3000 commands (ReseMaxMem, LampTest etc)

The individual hierarchy levels can be enabled or disabled for the OEM and End User.

To change the parameter enable for the End User, the OEM's password is required.

To change the parameter enable for the OEM, the manufacturer' password is required. With the manufacturer's password, the End User parameter enable can also be changed.

The password must be entered each time a parameter is changed, whereby OEM's and End Users can only change parameters that their passwords allow.

If the password is accepted, then changes are allowed up until the configuration file is saved or the parameters are written to the FT3000 module. For any further changes the password has to be re-entered.

If the password is rejected, then no changes are possible.

9.3.7 Password

Following entry of a valid password, a new password may be defined. The OEM can change the End User's password but not vice versa.

The successful password change must be written to all installed FT3000 compact modules using *Write FT3000 Parameters* and to the FTC file in the PC. Permissible password characters are - A...Z, 0...9 and the characters - and _. Lower case letters are automatically interpreted as upper case.

Max password length is 6 characters.

Note: Within one installation, all process parameters, with the exception of the password, are module specific;ie. they may vary from one compact module to another. The passwords must however be the same.

9.4 Operating behaviour

9.4.1 Power up

Analog outputs: After connecting the supply and until the first measurement, the output corresponds to the analog start value configured.

Relay output: After connecting the supply the relays are initially inactive and then assume the state defined under <Limit value control>

The first positive edge of the signal input starts the first frequency measurement

- Upon completion of the first measurement relays assigned to limit control assume the state corresponding to the measurement.
- If Comparator is configured and no input frequency exists, relays assigned to limit control assume the state defined as - speed below lower set point after 20 s.
- If Speed Monitor is configured and no input frequency exists, relays assigned to limit control assume the state defined as - speed below lower set point after a measurement time corresponding to Limit x High.

9.4.2 Measurements

- A measurement starts with the positive edge of the input frequency. Following the Fixed Time, the next positive edge terminates the measurement and starts another.
- The total resulting measurement time has a resolution of +/- 0.4µs.
- The calculation and control of the outputs occurs during the next immediate measurement.
- The transfer to the PC and display of measurement values and status occurs within the display interval configured.
- If the analog ranges are exceeded, the output goes to the end values configured.

9.4.3 Response to sensor failure

- Should the input frequency suddenly and totally fail, the measured value and analog output follows an exponential step function towards the start value as soon as the period of the new measurement is 2, 4, 8 times larger than the period of the last measurement.
- Should the input frequency suddenly and totally fail, measured values below the lower set points register speed below lower limit.
- If the sensor's current consumption exceeds the predifined limits the message 'StaticMonitorFlag1' is set to 0.

9.4.4 Behaviour during system alarm

- If the module is in *Config Mode* (red NOK-LED on and green OK-LED flashing at 1Hz) or in *Service Mode* (red NOK-LED on and green OK-LED flashing at 0.5Hz) the analog outputs go to 0mA (0V) and the relays are de-energised. All LED's - BW, FW, LIMIT 1...4 are off.
- If the module is in *Process Mode* and Alarm Condition (red NOK-LED on and green OK-LED off), the analog outputs go to 0mA (0V) and the relays assume the status corresponding to the limit value control configuration. The LED's LIMIT 1...4 also assume the status defined under Limit value control.
- If the module enters *Process Mode* from *Config Mode* or *Service Mode* and an alarm condition occurs, the analog outputs go to 0mA and the relays de-energise. All LED's - BW, FW and LIMIT 1...4 are off.

9.4.5 Response to mains failure

- If the mains fails for longer than the permitted time, the analog outputs go to 0mA and the relays de-energise. When the supply returns the unit goes through the power up routine (see 7.4.1)
- Should the internally stabilised supply drop below the minimum specified voltage, then this is detetected as mains failure.

9.5 Frequency measurement calibration

The modules are calibrated at the factory and the data stored in EEPROM.

There are no manual adjustments on the FTW 3013 converters for output current range. Eventual faults must be corrected at the factory.

There are no manual adjustments on the FTFU 3024 monitoring modules. Eventual faults must be corrected at the factory.

9.5.1 Calibration tools

- Frequency sources:

Accurate frequency generator or generator with digital tachometer having accuracy better than 0.05% of the frequency setting. Where a lower demand on the accuracy exists, calibration can take place on the machine. The sensors then act as the frequency source and would be measured by a digital tachometer. **The machine factor M must be taken into account,** ie. the relationship between frequency and machine speed.

- Measurement of output current/voltage:

Precision instrument with an accuracy better than 0.05% or the integral meter. Errors in the integral meter are then automatically calibrated out and the accuracy of the total system depends upon the accuracy of the frequency source.

9.5.2 Factors influencing accuracy

- Quartz crystal:

Temp. Drift	+/-10ppm over the total temp. Range
Long term drift	+/- 5ppm/year
Failure rate	< 15 fit

- Reference source:

Temp. Drift	+/-50ppm/ Deg. K
Long term drift	typically +/- 1ppm/1000hrs
Failure rate	< 4.5 fit

- Precision resistors

Temp. Drift	+/-50ppm/Deg. K
Long term drift	<+ 500ppm/year
Failure rate	< 0.7 fit

- Trimmers

Temp. Drift	+/-100ppm/Deg. K
Long term drift	<+ 500ppm/year
Failure rate	< 100 fit

9.5.3 Calibration rules

During calibration the previously frequency sources and measuring instruments must be used.
Measurements should be compared with calibration values and any variances noted.

- Calibration of the analog outputs:

Input frequency corresponding to configured start value:
Actual value = start value
Analog output value = 0.00% (display only with FTW 3013)
Input frequency < 'Min displayed measured value' configured = display of 0000.

FTW 3013 analog output corresponds to configured start value.

Input frequency corresponding to configured end value:
Actual value = end value
Analog output value = 100.00% (display only with FTW 3013)

FTW 3013 analog output corresponds to configured end value.

Input frequency in the middle of configured start and end values:
Actual value = mid value
Analog output value = 50.00% (display only with FTW 3013)

FTW 3013 analog output corresponds to mid value.

Display or output variances can, within limits, be adjusted at a suitably equipped work station.

- Set point calibration:

Operating status - on.

When the frequency is raised past the upper set points, the relays configured 'normal' energise and those configured 'inverse' de-energise.

When the frequency drops back down to the lower set points, the relays configured 'normal' de-energise and those configured 'inverse' energise.

Limit value/relay status display: *active* - when energised
Inactive - when de-energised.

Inaccurate set points can only be adjusted at the factory.

9.6 Calibrating the sensor monitor

- Measurement of sensor current limit values:
  Multimeter with an accuracy better than 0.1%
- Load resistor - 470 Ohm, 0.5W
- Variable resistor - 1 KOhm, 100mA, 0.5W
  The 470 Ohm resistor is connected in series with the 1 KOhm to form a supply load limited to 25mA max.
- Variable resistor - 50 KOhm, 15mA, 0.5W
  The 1 KOhm resistor is connected in series with the 50 KOhm to form a supply load limited to 12mA max.

9.6.1 Factors influencing accuracy

• Reference sources:	Temp. Drift	+/-10% over the total temp. Range
	Long term drift	< +/- 12mV/1000hrs
	Failure rate	< 200 fit
Precision resistors:	Temp. Drift	+/-50ppm/Deg. K
	Long term drift	< + 500ppm/year
	Failure rate	< 0.7 fit

9.6.2 Calibration rules

- Measurements should be compared with calibration values and any variances noted.

  easure the sensor supply with no load and loaded to 25mA.

  If the supply is outside of tolerance this can only be adjusted at the factory.

  With a load exceeding 25mA the supply will dip.

- Measure the sensor supply current with various loads:

  If the current falls outside of the Imax and Imin values configured, the sensor *monitor led MO red goes on*.

  At Imin + 0.4mA or Imax - 0.4mA the sensor monitor is inactive.

  Errors to the set points can only be adjusted at the factory.

10 Mechanical construction

See also sections 3 and 4.

Up to 21 19" rack modules of 4 unit width can be installed in one rack. Every module is fixed into the rack using slides and retained screws. The screws provide an earth connection to the module's front panel.

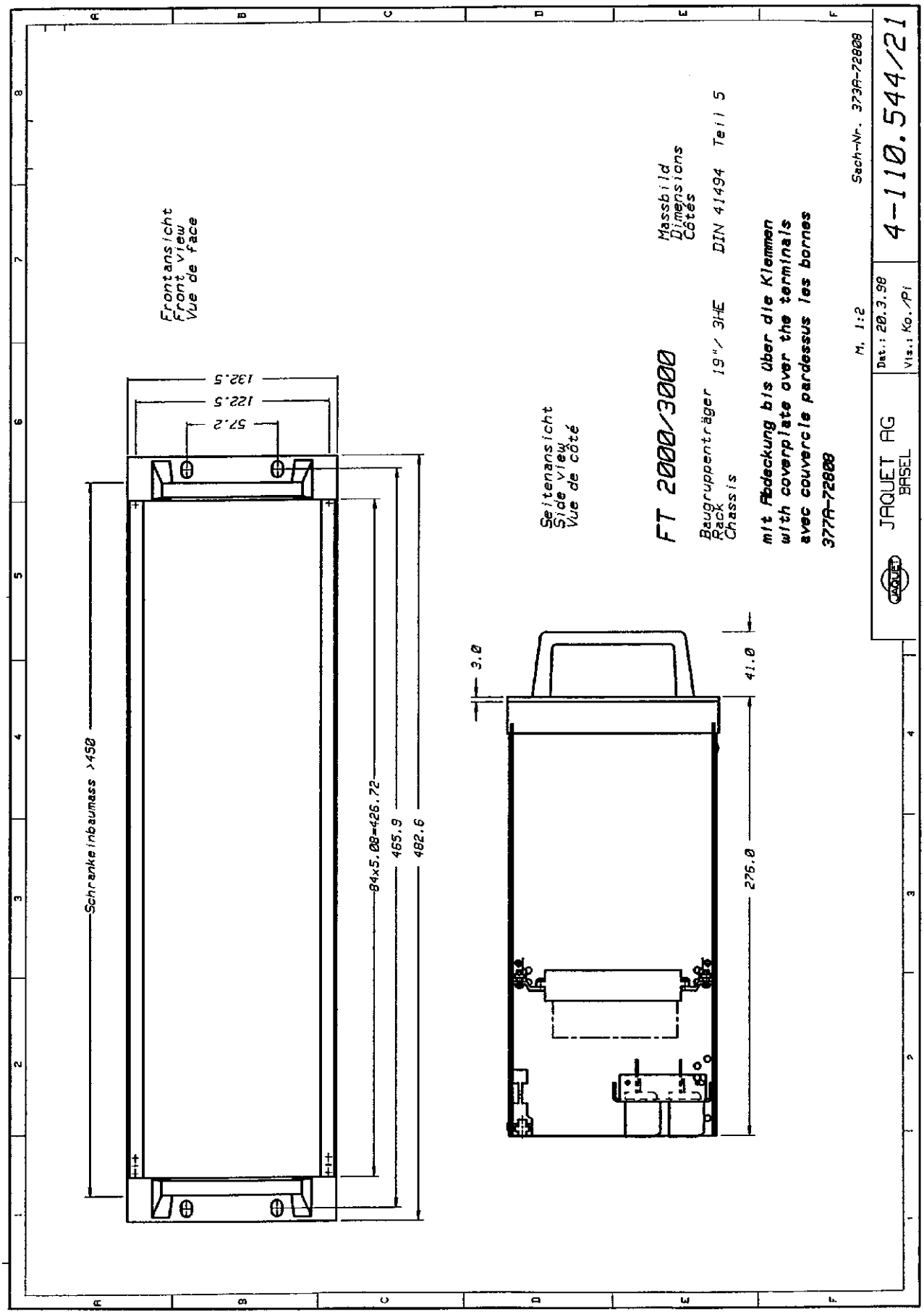
Every module consists of an electronic card fixed to the front panel along with eventual additional components. Electrical connections are via card connectors in accordance with DIN 41612.

Auxiliary cards such as the FTW 3013 converter and FTV 3090 relay card are plugged onto the FTFU 3024 motherboard, with connections via the internal local bus. These cards can therefore only be plugged in or removed together despite having separate front panels.

The arrangement of auxiliary modules is such that the motherboard is always far left and any relay card is far right.

A converter card would sit in between.

The input card is also plugged onto the motherboard but without a front panel.


Frontansicht
Front view
Vue de face
Seitenansicht
Side view
Vue de côté
Massbild
Dimensions
Côtés
FT 2000/3000
Baugruppenträger
Rack
Chassis
19" / 3HE
DIN 41494 Teil 5
mit Abdeckung bis über die Klemmen
with coverplate over the terminals
avec couvercle pardessus les bornes
377A-72808
Sach-Nr. 373A-72808
M. 1:2
Dat.: 20.3.98
Vis.: Ko./Pi
JAQUET AG
BASEL
4-110.544/21
132.5
122.5
57.2
Schrankeinbaumass >450
84x5.08=426.72
465.9
482.6
3.0
41.0
276.0

11 Circuit description

See also section 5

11.1 FTFU 3024 Motherboard and input card

11.1.1 Frequency measurement

The measurement chains for the 3 frequency measurements are implemented in hardware in the 3 ASIC's.
The resultant floating point measurements <AbsolutA>, <AbsolutB> and <AbsolutC> are fed to the mpu for further processing.

Every measurement input is fed with one of 5 possible input signals configured via software -
none, F1, F2, F3, F4.

A 10MHz quartz oscillator provides the timebase for the frequency measurement and speed monitors.

11.1.2 Speed monitors

The speed monitors are implemented in ASIC's. Since there are 3 ASIC's, 3 speed monitors are available.
The ASIC has two 32 Bit registers for measuring time and one 8 Bit register for pulses.
The resultant max measuring time is 859s with max processable frequency of 510khz.
The measurement resolution is 400ns.

11.1.3 Micro controller

internally 1 K Byte of RAM
8 channel, 10 Bit A/D converter
serial interface

Operation in expanded Multiplex mode
Quartz frequency 16 Mhz
Clock cycle 250ns
Address demultiplexer
32 K Byte EPROM (one time programmable)

11.1.4 Supply

The supply voltage is derived from 2 redundant PSU's, PS1 and PS2, that are separately fused. The 2 voltages are monitored after the fuses by the mpu using A/D converters. The green front panel LED's *PS1OK* and *PS2OK* are on when the PSU's are within tolerance:

Continuous overvoltage >= 38Vdc on the supply input causes the fuse to break
Continuous overvoltage > 33Vdc on the supply input can cause the fuse to break
Continuous undervoltage 13...18Vdc on the supply input does not affect the fuse
Continuous undervoltage < 13Vdc on the supply input can cause the fuse to break

Any relay on either the FTFU 3024 motherboard or the FTV 3090 relay card can be used to signal PSU status. Relay 3 on the FTFU 3024 is allocated at the factory for this function.

After the fuses the 2 voltages PS1 and PS2 are diode decoupled to form a secure supply PS3. The diodes also provide reverse polarity protection. Over voltage protection and storage capacitors ensure a secure 24V internal supply.

The **power on surge** of the FTFU 3024 is limited to 7A for 2.2ms by a 4.7 Ohm resistor.

The **power on surge** of the E01 input card is limited to 3.3A for 1ms by a 10 Ohm resistor.

The following **supply voltages** are generated on the FTFU 3024:

Ulogic	=	+5.00Vdc: Switched regulator to supply the logic, mpu, ASIC etc.
UFOut1	=	+12Vdc: Linear regulator to supply the frequency output drivers.
UFOut2	=	+12Vdc: DC/DC converter to supply the isolated frequency outputs.
Uin	=	+12 Vdc:DC/DC converter to supply the input module

11.1.5 Reset and non-maskable interrupt (NMI)

A hardware NMI reset circuit monitors the voltage Ulogic. The reset time constant is 200ms.
Following this time, the mpu carries out a reset routine.

A hardware **NMI reset** circuit monitors the input voltage +Vin to the Ulogic regulator.

If +Vin < 16V, NMI ouput = Low
+Vin > 16V, NMI o/p = High

The NMI input on the mpu reacts to a negative edge, ie if the input voltage sinks below +16V (eg if the supply is turned off)

The NMI routine causes the following:

Termination of current measurement
mpu ports become high resistance to reduce current demand
NMI input to the mpu is monitored so as to initiate a reset routine

Should the supply suddenly fail, there is enough charge in the storage capacitor to ensure the above actions are executed before the reset circuit becomes active.

11.1.6 Input amplifier

Current limited signal input, ac coupled with subsequent Schmitt trigger.
Sensor supply with protection diode, current limiting, shunt and differential amplifier for sensor current monitoring.

11.1.7 Sensor monitoring

Sensor monitoring is possible via static or dynamic monitoring or a combination of both. The front panle LED 'MO' is on when no sensor fault has been detected. Otherwise the red LED lights.
Any relay on the FTFU 3024 or the FTV3090 relay card can be allocated to the sensor monitor function.
Relay 2 on the FTFU 3024 is allocated at the factory.

Static monitoring (realised in hardware on the input card)

A code resistor on the input card tells the mpu's A/D converter what input card type is installed and the number of sensors to monitor.

The current consumption of every sensor is monitored to be within the limits set via the front panel potentiometers.

Dynamic monitoring (by the mpu)

For multi-channel applications (2 of 3 or 1 of 2), the dynamic sensor monitor compares the sensors frequencies.

For 2 of 3 monitoring, the max permissible difference between 2 measurements (as absolute speed or % of nominal) is monitored ie Measured value A - Measured value B, Measured value B - Measured value C and Measured value C - Measured value A. The sensor status is derived from these differences as follows:

C-A	B-C	A-B	Sensor C	Sensor B	Sensor A
NOT OK	NOT OK	NOT OK	NOT OK	NOT OK	NOT OK
NOT OK	NOT OK	OK	NOT OK	OK	OK
NOT OK	OK	NOT OK	OK	OK	NOT OK
NOT OK	OK	OK	*OK	*OK	*OK
OK	NOT OK	NOT OK	OK	NOT OK	OK
OK	NOT OK	OK	*OK	*OK	*OK
OK	OK	NOT OK	*OK	*OK	*OK
OK	OK	OK	OK	OK	OK

* In this case the double difference is allowed.

For 1 of 2 monitoring the max permissible difference between 2 measurements (as absolute speed or % of nominal) is monitored ie Measured value A - Measured value B. The sensor status is derived from this difference as follows:

Difference > permissible value - the sensor delivering the higher value is assumed OK.

11.1.8 Module monitoring

The following functions can be logically configured via software to provide module monitoring:

- System OK
- PS1 OK
- PS2 OK
- Sensor OK

If the module is OK or when the logically combined functions are OK the green OK LED lights and the red LED is off.

Any relay on the FTFU 3024 or on the FTV 3090 can be used for signalling module status. Relay 1 on the motherboard is assigned at the factory.

11.1.9 Relay outputs

The motherboard has 3 relays with change over contacts. The relays can be assigned to various functions via software.

11.1.10 LIMIT LED's

The 4 green and 4 red LIMIT LED's can be configured via software such that either red or green light at the corresponding upper/lower set points.

11.1.11 Frequency generator

The frequency generator consists of a 32 Bit down counter in ASIC 3. From the zero state it is loaded from one of 2 software defined setable reload registers. 2 test frequencies can thereby be programmed and reliably selected.
A frequency change can only occur after one half period of the previous frequency, thereby avoiding any sudden change to the dc average voltage of the test signal.
The frequency generator output from ASIC 3 is fed to all ASIC inputs F4 via the input card.

11.1.12 Frequency outputs

Each of the 2 frequency outputs can be fed with one of 5 input signals - None, F1, F2, F3, F4, via software configurable ASIC.
Following power up and as long as the reset routine is in progress, no output signals are provided.

11.1.13 Binary inputs

The binary inputs B1 and B2 have common reference with the minus terminal on the supply and have an internal pull up resistor of 10KOhm to +5V. To active the input it need only be pulled down to 0V (=minus terminal on the internal 24V module supply).

Binary inputs B3...B6 have a common floating reference. The isolation is via 4 optocouplers. To activate these inputs an external supply is required.
If more than one input is given the same allocation, the input with the highest index is dominant (eg B3 in place of B2).

11.1.14 Test

The test frequency from the generator can only be switched to one of the 3 speed monitors at any one time.
(See 9.1.2)
As long as the test frequency is connected, the green OK LED flashes (0.5s on, 0.5s off).
During activation/deactivation of the test, the original speed monitor status is retained such that no illegal operating conditions can arise.

11.1.15 Direction of rotation discriminator

The determination of phase relationship between the input signals enables the direction to be established.
The required logic is in the ASIC's. The mpu controls the display and eventual relay status. The front panel LED's *BW* (backwards) and *FW* (forwards) signal the direction of rotation.

11.1.16 Lamp test

The lamp test applies to all FTFU 3024 and eventual auxiliary module LED's. It is activated via the configured binary input. During testing only the LED's are affected. The relays remain under control of the measurement system.

11.2 FTW 3013 - A/D converter auxiliary module.

11.2.1 Supply

The **supply is fed** in via the local bus.

The **power on surge** is limited to 0.1A for 155ms by a 330 Ohm resistor.
With this module, the current limiting resistor is short circuited after approx. 0.8s following power up.

11.2.2 Analog outputs

Three separate isolated converters are available to provide dc signal outputs. Each output is controlled by a 12 Bit digital value from the local bus, derived from the PWM (pulse width modulation) output from the ASIC.

The PWM frequency is dependent upon the output value and is 312Hz min. A subsequent single ended low pass filter lampens the ripple to less than 0.1%.

An additional single ended digital low pass filter with software configurable time constant enables further suppression of fast changes to the output signal.

A noise filter suppresses external interference on the line.

11.3 FTV 3090 Relay card

11.3.1 Supply

The **supply is fed** in via the local bus.

The **power on surge** is limited to 0.1A for 155ms by a 330 Ohm resistor.

With this module, the current limiting resistor is short circuited after approx. 0.8s following power up.

11.3.2 Relay outputs

The FTV 3090 possesses 4 extra relays each having change over contacts. The relays can be assigned via software to various functions.

11.4 FTK 3072 Comms module

11.4.1 Rack bus

The rack bus is laid out as a RS 485 serial data bus and provides communications between the FTK 3072 and those modules equipped with a corresponding interface:

- FTFU 3024 motherboard
- FTM 3000 micro terminal

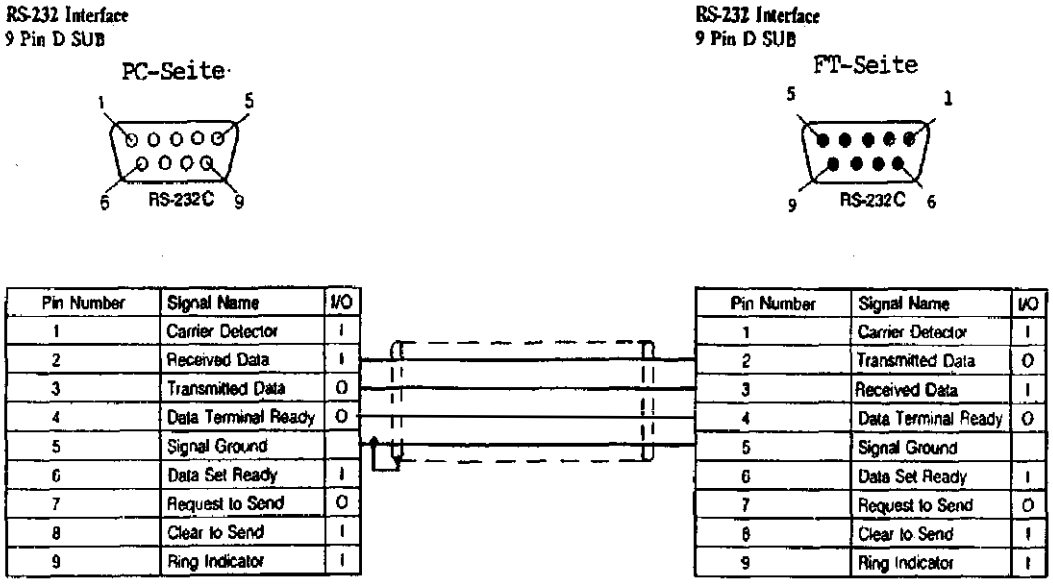
The rack bus connections to the modules are via the card connectors.

11.4.2 RS 232 interface

The interface is accessed via the front panel D9 connector on the FTK 3072.

Transfer rate:	2400	Baud
Parity:	None	The connection diagram shows the names with respect to
Data bits:	8	the equipment interface. RXD on the FT3000 must be
Stop bits:	2	connected to RXD on the PC, and also for TXD.
Connector:	D9	

The interface operates at the standard voltages. Protection against external overvoltage is provided.



Pin Number	Signal Name	I/O
1	Carrier Detector	I
2	Received Data	I
3	Transmitted Data	O
4	Data Terminal Ready	O
5	Signal Ground	
6	Data Set Ready	I
7	Request to Send	O
8	Clear to Send	I
9	Ring Indicator	I

Pin Number	Signal Name	I/O
1	Carrier Detector	I
2	Transmitted Data	O
3	Received Data	I
4	Data Terminal Ready	O
5	Signal Ground	
6	Data Set Ready	I
7	Request to Send	O
8	Clear to Send	I
9	Ring Indicator	I

12 Maintenance

The electronic boards do not need any special maintenance activity.

12.1 Periodic test

12.1.1 Description

The periodic test is used for proving the capacity of the system to detect an overspeed and to transmit the detection. This has to be applied to the Overspeed Protection System, and to the Trip Chain Control System if available.

The periodic test is realised for each channel separately. It is a serious error trying to test more than one channel at one time. It would generate systematically an overspeed trip.

By asserting a binary input of the system the corresponding channel is tested. Each channel has an own logic input.

12.1.2 IEC 61508-2-3 specifications

The periodic test is necessary for reaching the IEC 61508-2-3 requirements, then obligatory.

The periodicity of this test must be ≤ 3 months.

Between each channel test, a no test delay of 10 minutes must be implemented.

The execution of the test removes the sensor signal on the tested channel and replaces it by the signal coming from the on the module FTFU3024 implemented frequency generator configured to a frequency about 1% higher than the overspeed frequency. The relay corresponding to the overspeed set point must de-energise. The effect of the de-energised overspeed relay must be checked by the end user.

Periodic test for the Saignal Monitoring System :
Mostly of the integrated fonctionalities of the FTBU 3x34 card are on board redundant. Espescially the inputs stages of the signal monitoring paths. The execution of the test replaces the input logic combination witch is needed to generate a trip on the OUT output, and the output is asserted (relay OUT deenergized). The effect of the deenergized relay must be checked by the end user.

12.2 Trouble shoting :

Trouble shoting is needed when the S + M + P Alarm signal is asserted, or when the system behaviour under periodic test condition is false.

12.2.1 Procedure for the OSPS

The Following procedure has to be applied :

- If the red MO LED of a channel is on : (Sensor Monitoring)
  Exchange the channel module (see chapter Module exchanging)
  If the trouble stays, replace the original channel module and exchange the sensor.
  If the trouble stays, exchange the channel module and the sensor.
  If the trouble stays, check the rack and sensor wiring,
  check the 3 sensor signals, exchange the sensor if signal false.

- If the OK LED of a channel is red : (System Monitoring)
  Exchange the channel module (see chapter Module exchanging)
  If the trouble stays, check the rack wiring.

- If the PSI or PSII led is off on each channel : (Power suply Monitoring)
  Exchange the corresponding power supply
  If the touble stays, check the rack wiring.

- If the PSI and/or PSII led is off on one channel : (Power suply Monitoring)
  Exchange the corresponding channel module
  If the touble stays, check the rack wiring.

- If no red LED is on, and no PSI/II LED off and the periodic test for one channel is false :
  Exchange the corresponding channel Module
  If the trouble stays, remove the new module, check the rack wiring, and terminal connections.

After a repair, a periodic test must be performed for each channel.(see chapter Periodic test).

Description of the diacgnostic who's continiously performed in the system :

- System monitor: If a system failure occurs (CPU Test, Configuration parameter integrity test, Process parameter integrity test and Service parameter integrity test , both power supply out of range, auxiliary module not present, FPGA not programmed) the red Led MO\ on the front plate goes on and the green Led MO goes off or blinks depending if the failure occurs in process mode, configuration mode or service mode. The Module OK relay de-energise. All the relays on FTFU3024 and FTV3090 de-energise, the analog outputs goes to 0 mA/V. So in a 3 channel system, when trip contact is open to trip, the channel goes in a safe state.
- Supply monitor : If a supply failure occurs (power supply voltage out of the 18...33VDC range) the corresponding green Led PS1 or PS2 on the front plate goes off and the Module OK relay de-energise. The case of an out off range of both power supplies is taken in account by the system monitor.
- Sensor monitor: The sensor and the line between sensor an rack is monitored by the static monitoring. The signal delivered by the sensor is also monitored by the dynamic monitoring. If a sensor failure occurs in one channel the relay corresponding to the overspeed set point de-energise i.e. takes the state as in overspeed : the channel goes in a safe state.

12.2.2 Procedure for the TCCC :

The Following procedure has to be applied :

- If the OK LED of a channel is red : (System Monitoring)
  Exchange the channel module (see chapter Module exchanging)
  If the trouble stays, check the rack wiring.

- If the PSI or PSII led is off on each channel : (Power suply Monitoring)
  Exchange the corresponding power supply
  If the touble stays, check the rack wiring.

- If the PSI and/or PSII led is off on one channel : (Power suply Monitoring)
  Exchange the corresponding channel module
  If the touble stays, check the rack wiring.

- If no red LED is on, and no PSI/II LED off and the periodic test for one channel is false :
  Exchange the corresponding channel Module
  If the trouble stays, remove the new module, check the rack wiring, and terminal connections.

After a repair, a periodic test must be performed for each channel.(see chapter Periodic test).

12.2.3 IEC 61508-2-3 specifications

The mean time to repair is fixed to 8 hours. The end user is responsible for reaching this repair time and has to realise the needed conditions por reaching it. The 8 hours include :

- 2 hours for the comeback of the service people.
- 2 hours for the trouble analysis.
- 2 hours for the correction definition.
- 2 hours for the trouble correction.

12.3 Module exchanging :

12.3.1 General

The repair is performed by exhanging modules. The exchanging module set includes :

- 1 sensor
- 1 configured channel modul including :
  1 FTFU 3024 card, if used one FTV3x90 card and one FTW3x13 card.
- 1 power supply if used
- if used, one TCCC channel modul FTBU 3x34

The electronic modules are field hot-replacable, the sensor too. Generally, one additional sensor is premonted in the process so one sensor exchange can be realised without stoping the main process.

Only modules in one channel can be removed at one time. It is a serious error trying to exchange modules in more than one channel at one time. It would generate systematically an overspeed trip.

12.3.2 IEC 61508-2-3 specifications :

The modules can not be realocated one channel to an other.

An exchanging module set has to be available at the installation so that the mean time to repair can be reached (8 hours). This module is configured in stock. After a repair where the in stock module were used, a new configured module must be set in stock. The burned-in Modules (100 Hours 50°C) are supplied from the OSPS supplier, the integrator configures the module and set it in stock at the installation.

Only trained service people is allowed to performe any maintenance activity : Periodic test, trouble shooting. Trained people means people who have a good knowledge of the installation and maintenance procedure of the system, people who know the significance of a 2oo3 system, people who have at one's disposal all the 4 core system descriptions :

- The bloc fonction description of the system
- The face description of the system
- The terminal description of the system
- The operating instructions manual of the system

13 Storage

The long term storage temperature range is -25 ... +85ºC.

The short term storage temperature range is -40 ... +90ºC (max one day at any time, without any mechanical loading)

If the unit is suddenly cooled, condensation may occur, which considerably reduces the insulation resistance.

14 Warranty

The FT3000 is guaranteed for 12 months from the ship date. Please see JAQUET's full terms and conditions.

15 Drawings

Description	Type	Dwg. Nr.
Block circuit diagram		4-110.505
Lay-out of the rack		3-110.545
Occupancy and wiring of rack		3-110.536
Dimensions:		
• Rack		4-110.544/21
• Modules		4-110.544/2
Connection diagrams of the modules:		
• Motherboard	FTFU 3024	4-110.531/23
• Frequency to current converter	FTW 3013	4-110.531/24
• Relay module	FTV 3090	4-110.531/25
• Comms module	FTK 3072	4-110.531/26
• TCCC card	FTBU 3x34	4-110.531/30

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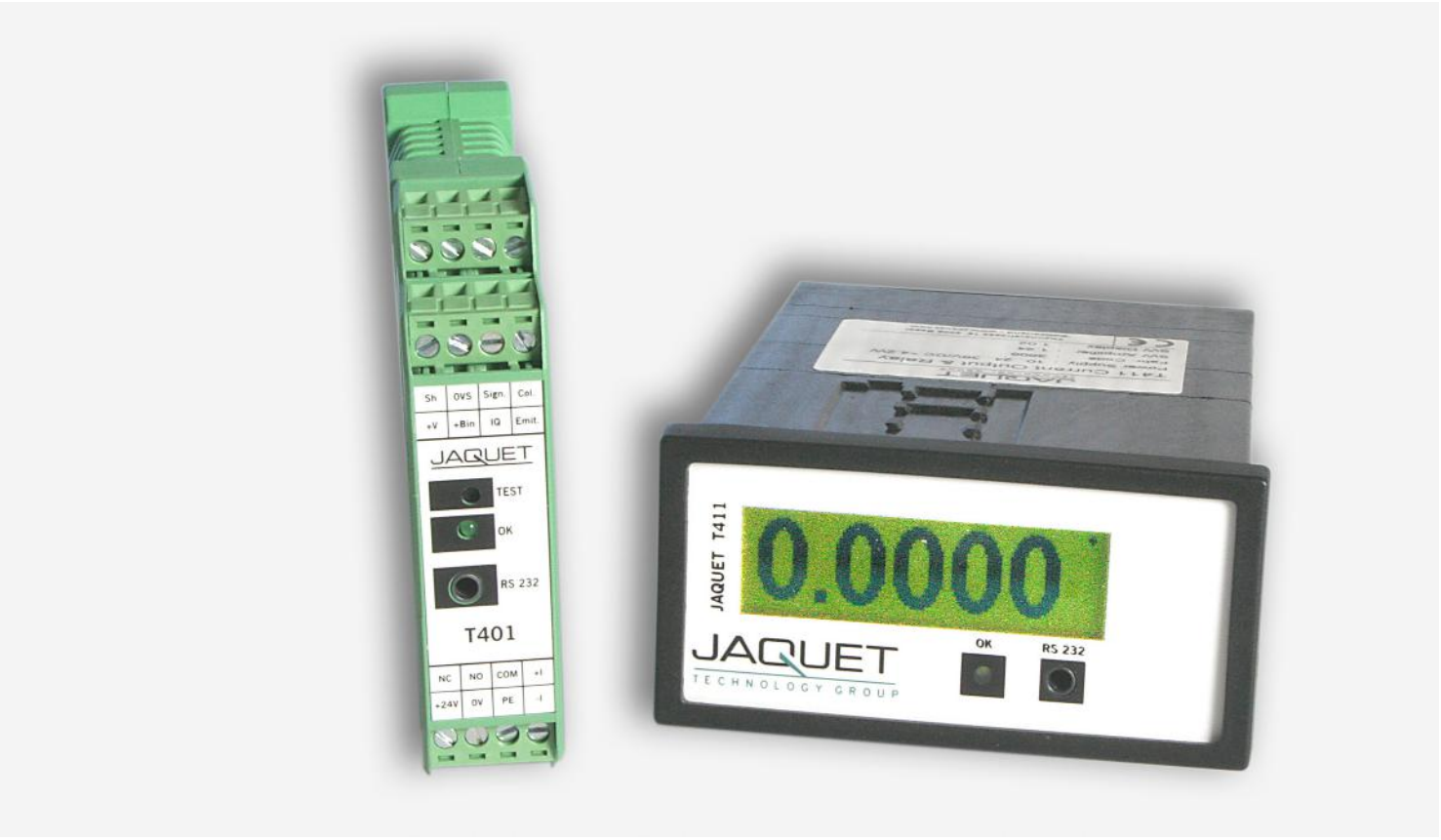


JAQUET T400 Speed measurement, switching and indicating instruments

Features

- Converts absolute speed into an analog signal
- Including 2 limits (A/B) with programmable hysteresis
- One changeover relay assigned via binary input to limit (A or B)
- T411 and T412 models with display
- Isolated signal input with automatic trigger level adjustment
- Built in isolated sensor supply with sensor monitoring
- Open collector output of sensor frequency
- Accuracy class 0.05% for limits and 0.5% for analog signals
- Configuration and status via Windows® software
- 5 digit machine factor allowing configuration and display in machine units
- Wide tolerance 10...36 VDC power supply

The T400 Advantage

- Fast response to over speed conditions
- Germanischer Lloyd's and ABS approval for marine applications
- Digital display of speed value for the models T411 and T412
- 0/4...20 mA or 0/2...10 V analog output with rising or falling characteristics
- Adaptive trigger provides high noise immunity e.g. with electromagnetic sensors
- Digital input for direct treatment of frequency signals
- 2 possible relay configuration sets e.g. for start up bridging, controlled via binary inputs
- Pluggable terminals
- Integrated 2 or 3 wire sensor monitoring and system watchdog

One channel tachometer family T400

Type and part numbers	T401.00 4..20mA output		383Z-05307
	T402.00	2...10 V ouput	383Z-05308
	T411.00	display; 4...20 mA output	383Z-05318
	T412.00	display; 2...10 V output	383Z-05319
	T411.03	display; 5 VDC sensor supply; 4...20 mA output	383Z-05595
	T412.03	display; 5 VDC sensor supply; 2...10 V output	383Z-05596
Optional accessories	Power supply	100-240 VAC /24 VDC / 1 A	383Z-05764
	Interface cable RS232 for configuration		830A-36889
	USB adapter for interface cable		830A-37598

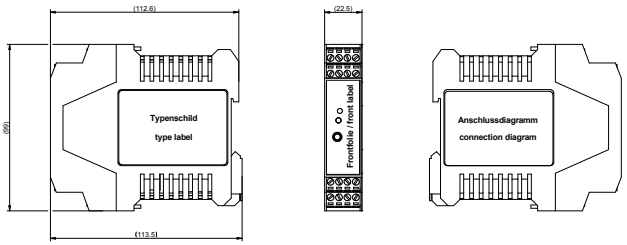
Technical Data

Measuring range	Lowest: 0...1.000 Hz	Highest: 0...35.00 kHz	
Measurement time	Configurable min. measurement time (tM): 2/5/10/20/50/100/200/500 ms, 1/2/5 s		
Reaction time	Current output:	Typical tM + 7.5 ms	Maximum Input period + tM + 7.5 ms
	Relays:	Typical tM + 10.5 ms	Maximum Input period + tM + 10.5 ms
Accuracy	0.5% referred to the analog output end of range value		
Analog output (1)	T401/T411: Current output 0...20 mA resp. 4...20 mA T402/T412: Voltage output 0...10 V resp. 2...10 V Programmable rising or falling transfer function (min. end value 1.00 Hz) Load T401/T411: max. 500 Ohms corresponding to a maximum of 10 V Load T402/T412: min. 7 kOhm corresponding to a maximum of 1.4 mA Maximum open circuit voltage: 12 V Resolution: 12 bit corresponding to 1:4096 Maximum linearity error: 0.1 % Temperature drift: typ. ± 100 ppm/degree K, max. ± 300 ppm/degree K		
Set points /relay (2)	Hysteresis: For each limit an upper and a lower set point may be set independently Change over contact: max. 250 VAC, 1250 VA (DC: see operating instructions)		
Data I/O	RS232 interface with +5 V-CMOS level 3-pole. 3.5 mm stereo headphone connector on the front side.		
Sensor inputs (1)			
Input resistance	Analog 30 kOhm / Digital 46 kOhm		
Frequency range	0.01 Hz /35 kHz		
Trigger level	Analog input: Adaptive trigger level from 28 mV to 6.5 V or 250 mV to 6.5 V peak depending on the amplitude of the input signal. Digital input: Digital fixed trigger at 3 V ± 1.5 V hysteresi		
Sensor supply			
Standard	+ 14 V, max. 35 mA, short-circuit proof		
S5 version	+ 5 V , max. 35 mA, short-circuit proof Built-in pull up resistor 820 Ohm for connection of two-wire transmitters or daisy chaining of T400's		
Sensor monitoring	3 wire sensors: programmable current consumption limits of 0.5...35mA. Outside the selected range the sensor is signaled as faulty. Electromagnetic sensors: continuity checked. Open circuit signaled as a fault. None: Both sensor monitoring functions may be disabled.		
Open collector output (1)	Galvanically separated output of sensor frequency		

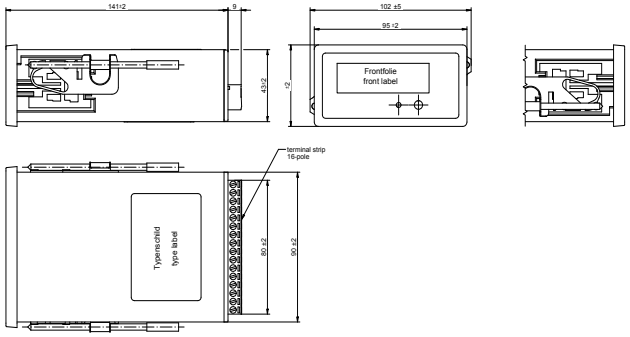
Binary inputs (1)	For external selection between two sets (A/B) of programmable relay control and acknowledge functions: (No external pull up needed) Low active :U ‹ +1.5V High (open) :U › +3.5V
Environmental	KUE according to DIN 40 040 Operating temperature: - 40...+85 ˚C Storage temperature: -40...+90 ˚C
Power supply	10...36 VDC power consumption max. 3 W
Insulation	Galvanic separation between power supply, current output and the sensor power supply. Isolation 700 VDC / 500 VAC. Relay contact isolation: 1500 AC
EMC	Electromagnetic compatibility: Radiation in accordance with international standards and EN 50081-2. Immunity in accordance with international standards and EN 50082-2 Conducted emissions: CISPR 16-1, 16-2 Radiated emissions: EN 55011 Electrostatic discharge: IEC 61000-4-2 Electromagnetic fields: IEC 61000-4-3 Conducted fast transients: IEC 61000-4-4 Conducted slow transients: IEC 61000-4-5 Conducted high frequency: IEC 61000-4-6 Pulse modul. elec. field: ENV 50140 Power frequency magnetic field: IEC 1000-4-8
Standards	EN 50155, GL / Germanischer Lloyd, ABS

Dimensions

T401/402



T411/412



Rail	Rail DIN 46277-3 (EN 50022) or mounting plate to DIN 43660 (41612)
Housing	Protection class IP40, terminals IP20
Terminals	Pluggable
Weight	T401/T402: 150 g , T411/T412: 210 g

T400 systems are supplied with a full documentation and the T400 Windows® Software.
The software allows:

- Quick and easy configuration of all operating parameters
- Unit interrogation of identity and parameters
- PC display of current measurement and relay status
- Archiving and printing of the configuration

RS-232 cable not included, see page 2 for optional accessories.
Please note: Information is subject to change. For more technical information please refer to operating instructions.

JAQUET
TECHNOLOGY GROUP

Swiss know-how and quality matched to your demands

JAQUET manufactures speed sensors in quantities from 1 to millions per project per year. These typically customer specific solutions add value through being matched to individual applications.
Since 1889, a spirit of excellence complementing tradition and innovation.

Automotive turbochargers

Turbocharger for trucks, passenger cars, construction equipment
- Speed of VG/VNT turbochargers
- Gearbox shaft and retarder speed

Railway systems

- Optimum traction control
- WSP (wheel slide protection) systems
- Speed information for automatic train control

Power generation

Gas, hydro, steam and wind turbines
- Overspeed protection
- Speed measurement and control

Hydraulics

Agricultural machinery, construction and mining equipment, cranes, ROV – remote operated vehicles
- Motors and pumps, flowrate measurement
- Position measurement, traction synchronization

Diesel and gas engines

Large diesel and gas engines in marine, rail, off-road applications and power production.
- Cam and crank shaft for dynamic position
- Turbocharger speed, engine diagnostics

Quality systems

ISO TS 16949
ISO 9001
AS 9100
IRIS

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ALPHABOX – the smart diagnostic system for diesel engines and turbochargers

ALPHABOX only requires the input signal from a speed sensor to analyze torsional vibrations as an early indication of efficiency loss and mechanical failure in your engine and turbocharger.

Designed for

Quick return on your investment
A cost efficient solution
Easy to install and commission
Maintenance-free use
Remote and local access to data
Easy to retrofit to engines
Continuous monitoring and reporting
Cylinder-by-cylinder diagnostics
Early detection of engine problems
Extension of engine lifespan
Clear and concise report
Entire fleet installation

impĕdance

VIB360™
inside powered by
IMPEDANCE™

No more unexpected breakdowns

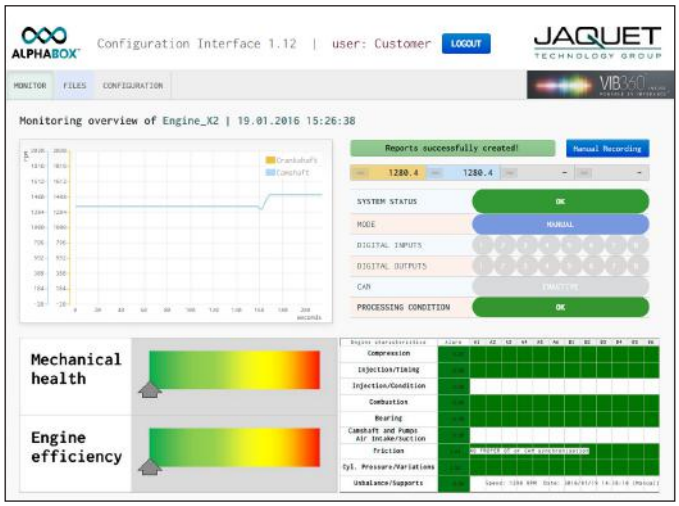
Transport and logistic companies using diesel engine fleets are highly dependent upon reliable and on timely delivery of the goods. Breakdowns of trains, vessels or trucks can lead to significant economic losses. JAQUET can help fleet owners to prevent such economic losses during its operation by monitoring the engine with the ALPHABOX diagnostic system. The system is able to detect not only engine problems, but also issues with the turbocharger, well in advance, giving time to plan a maintenance cycle to prevent mechanical breakdowns.

Extended engine lifetime and quick return on your investment

ALPHABOX is a cost-effective engine diagnostic system with powerful functionality. It is easy to retrofit to combustion engines, providing a complete picture of the engine health including the effects of the whole power train. The ALPHABOX is based on analysis of the torsional vibration of the crankshaft. The system helps fleet owners to optimize maintenance cycles by transitioning from time-based to a condition-based maintenance. ALPHABOX extends engine life, while avoiding expensive breakdowns and reducing operational and maintenance costs.

Easy to install and put into operation

Only a single speed sensor is necessary to obtain the general engine health status. For a detailed cylinder-specific health analysis, two speed sensors are required, one on the crankshaft and one on the camshaft. With a turbocharger speed sensor, its efficiency and mechanical health can also be determined. The built in webserver allows easy configuration by a standard web browser (no software installation on your PC or other devices required).



Clear diagnostic reports

Major engine and power train parameters (combustion, compression, injection, bearings, ...) are indicated in green/yellow/red colors for clear interpretation. Green means “all ok”, yellow highlights a condition that might need a follow-up in the next maintenance cycle and red indicates a severe problem which requires immediate intervention.

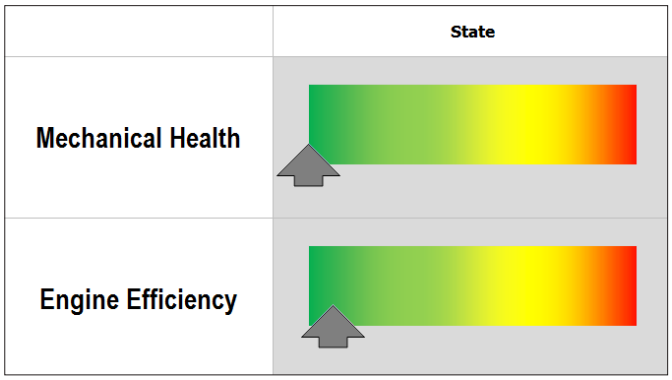
A modular concept

The ALPHABOX can be configured with various hardware modules (GSM and GPS, memory extension, I/O modules, bus connections etc.) to make it easy to integrate the diagnostic unit in an existing environment.

Features and Benefits

Product features	Customer benefits
Quick return of initial investment	Extended and optimized fleet lifetime Time-based maintenance to condition-based maintenance Significant cost reduction by better targeted maintenance
Easy to install	Combustion engines can be easily retrofitted No special training required Suitable for continuous or single measurements
Versatile usage	Used for inline, V-type and radial engines 2 stroke or 4 stroke engines Diesel or gasoline engines
Online data access	On-demand diagnostic results from control room possible Early detection of impending engine failures
Detailed diagnostics including cylinder-specific information	Easy for maintenance team to track down failures Only identifed parts need to be replaced Customer can prioritize maintenance according to the seriousness of the engine condition

☑ Healthy engine

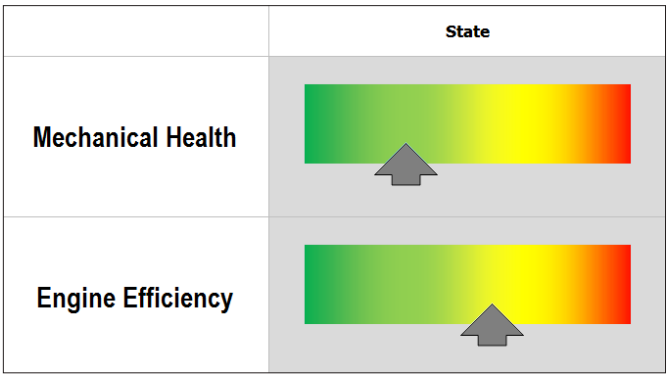


Indicator	Alarm	1	5	3	6	2	4
Compression/Variations	0.00						
Injection/Timing	0.33						
Injection/Condition	0.00						
Combustion	0.00						
Bearings Moving Parts	0.00						
Cam & Pumps/Regulation Air Intake / Suction	0.20						
Stresses	1.94						
Cyl. pressure/Variations	1.72						
Unbalance/Supports	0.12						

6 Cylinder Volvo Diesel engine

This engine shows all indicators in the normal range.

☒ Problematic engine



Indicator	Alarm	1	5	3	6	2	4
Compression/Variations	0.08						
Injection/Timing	0.79						
Injection/Condition	0.79						
Combustion	0.03						
Bearings Moving Parts	0.00						
Cam & Pumps/Regulation Air Intake / Suction	0.22						
Stresses	2.15						
Cyl. pressure/Variations	1.99						
Unbalance/Supports	0.12						

6 Cylinder Volvo Diesel engine

This report shows the effect of a defective fuel injector.

☑ Healthy turbocharger

Indicator	Turbo Speed	Turbo Speed Variation	Turbo Friction
Compression/Variations	7058	0.20	2.33

Turbocharger shows all indicators in the normal range.

☒ Problematic turbocharger

Indicator	Turbo Speed	Turbo Speed Variation	Turbo Friction
Compression/Variations	10707	4.81	3.13

This report shows an instability caused by a bad bearing resulting in a power loss of the engine.

Technical data

Supply voltage range:	Nominal : 24 VDC Range: 17 to 33 VDC (according to EN50155)
Maximum Power:	20 W
Communication interfaces:	CAN 2.0B, Ethernet 10/100 Mbit/s, IEEE 802.3, USB
Operating system:	Linux
Number of digital input channels:	8
Number of digital output channels:	7
Number of speed sensor inputs:	4
Operating temperature:	-40°C to +70 °C
Protection rating:	IP20
Max number of engines to be measured with one box:	2
Certificates:	CE, cULus, Ex EU 94/9/EC Zone 2, FCC, IECEx Zone 2, LR, UL HAZLOC Class I Division 2 (Zone 2) Fully compliant with RoHS and REACH, EN50155

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Turbocharger for trucks, passenger cars, construction equipment
- Speed of VG/VNT turbochargers
- Gearbox shaft and retarder speed

Railway systems

- Optimum traction control
- WSP (wheel slide protection) systems
- Speed information for automatic train control

Power generation

Gas, hydro, steam and wind turbines
- Overspeed protection
- Speed measurement and control

Hydraulics

Agricultural machinery, construction and mining equipment, cranes, ROV – remote operated vehicles
- Motors and pumps, flowrate measurement
- Position measurement, traction synchronization

Diesel and gas engines

Large diesel and gas engines in marine, rail, off-road applications and power production.
- Cam and crank shaft for dynamic position
- Turbocharger speed, engine diagnostics

Quality systems

ISO TS 16949
ISO 9001
AS 9100
IRIS

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JAQUET
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SIL3

Maximum safety without sacrificing system availability

Multi-channel overspeed protection and monitoring system

Protection

Multi shaft aero derivative gas turbines
Common solution for combined gas/steam turbine
Compressor overspeed protection in chemical plants
Pump monitoring and control
Hydro electric power stations
Demanding marine applications

Features

- High integrity redundant system concept
- Conform for safety applications up to SIL3
- Fast 10ms reaction time to overspeed
- Acceleration measurement with set point control
- 3 status and 4 limit relays per channel - internal relay voting e.g. 1oo3, 2oo3
- Isolated analogue outputs with scalable ranges
- Voted / averaged and max speed values
- Clear front panel displays of unit status
- Control functions via binary inputs or PC
- 3 level password protection

The FT 3000 Advantage

- SIL3 certified system according to IEC 61508:2010
- Up to 3 shafts monitored in one rack
- Multiple set points and status outputs
- On line self-testing via internal generators and channel cross checking
- Hot module exchange
- Configuration and status monitoring via PC
- Direction sensing
- Sensor, power and system watchdogs

Module Overview

The FT 3000 is comprised of modules that are configured in a 19“ rack to suit the particular application. A measurement channel may be just a FTFU 3024 motherboard or a combination of motherboard + FTV 3090 relay card + FTW 3013 analog card.

FTFU 3024 Motherboard

Overview	Performs measurement and watchdog functions. 3 hardware speed limit monitors for fast overspeed detection plus one comparator for acceleration limit. 3 single contact change over relays for status or limits. 3 test generators for online testing. Max speed memory. Direction sensing. Front panel LED’s for system status.
Measuring range	Lowest: 0 ... 1Hz Highest: 0 ... 35kHz
Accuracy	0.1% of the set point
Set points	
Range	See above. Values in rpm once number of gear teeth entered.
Hysteresis	Individually programmable High switching and Low reset values for each limit. Configurable number of teeth used for limit control.
Response time	Overspeed typically signalled via relay output in 10ms
Sensor input	Isolated inputs, available for speed sensors with signal input voltage 50mV ... 80Vrms or proximity sensors with signal input voltage -24V ... 0V
Input impedance	100kOhms, suitable for passive or active sensors.
Adjustable trigger level	0 ... +3.5V
Sensor supply	14V, 25mA or -24V, 25mA. (Short circuit proof; 40mA)
Sensor monitoring	Static (speed sensors): Low & High consumption values selectable in the range 0.5 ... 30mA. Sensors with consumption ‹ I min. or › I max. are signalled as defective. Static (proximity sensors): Low & High signal level values selectable in the range -15 ... 0V. Sensors signal level ‹ U min. or › U max. are signalled as defective. Dynamic: Programmable channel cross check values. Sensor fault may be assigned to a relay.
Binary inputs	May be assigned to control functions e.g. online testing, trip reset, lamp test. B. 1 & 2. Not isolated. +5V level with pull up resistor Low, active = 0 ... +1V High = +3.5 ... +33V or open B. 3 to 6: Isolated. Low = 0 ... +5V or open; High = +10 ... +33V
Frequency outputs	Sensor signal repeat with insignificant time delay. Push-pull square wave o/p. Isolated. Amplitude 15Vpp. 100Ohms source impedance.

FTV 3090 Relay card

Overview	Added to motherboard as required. 4 relays, each having 4 change over contacts. May be assigned to any limit or status function. Used for voting control, e.g. 2oo3 trip outputs. Front panel status LED’s.
Relays	Potential free, selectable normal/inverse mode 250Vac, 2A, 125VA / 220Vdc, 2A, 60W UL / CSA rating: AC: 30V , 2A , 60VA DC: 60V, 2A , 60W Programmable non latching, monostable or latch modes

FTW 3013 Analogue card

Overview	Added to motherboard, as required, with or without relay card. 3 isolated and independently scaleable ranges. May be assigned to any measured, calculated or stored value, e.g. max speed.
Analog outputs	3 x 0/4 ... 20mA, configurable for narrow or wide speed ranges. Programmable rising or falling characteristic. Resolution: 12 bit corresponding to 1:4096. Maximum linearity error: 0.1%

FTK 3073 Communications card

Overview	Communications card; one per rack; used with FT 3000 Windows software supplied with each unit.
Data I/O	USB interface

Power supply modules

Overview	1 or any combination of 2 per rack. Motherboards diode decouple 2 PSU lines for redundancy and monitor supply status. Supply status is available for relay control.
FTZ 3061	115 or 230Vac, 50 / 60Hz
FTZ 3062	24 or 48Vac, 50 / 60Hz
FTZ 3064	14 ... 70Vdc
FTZ 3065	88 ... 372Vdc / 85 ... 264Vac
FTZ 3069	Filter only. 19 ... 33Vdc (rack bus supply)
Environmental	Operating temp 0 ... +60˚C, (+70˚C for max 2 hours) Storage temp -25 ... +85˚C rH 75% yearly average, max 90% over 30 days

All FT 3000's are supplied with a CD-Rom providing full documentation and the FT 3000 Windows® Software.

The software allows:

- Configuration of all operating parameters
- Unit interrogation of identity and parameters
- PC display of current measurement and relay status
- Archiving and printing of the configuration

Full technical details can be seen in the detailed specification. The operating instruction, SIL-certificate and certification report have to be followed. In case of discrepancy, these documents overrule the information of this brochure.

JAQUET TECHNOLOGY GROUP

Swiss know-how and quality matched to your demands

JAQUET manufactures speed sensors in quantities from 1 to millions per project per year. These typically customer specific solutions add value through being matched to individual applications.
Since 1889, a spirit of excellence complementing tradition and innovation.

Automotive turbochargers

Turbocharger for trucks, passenger cars, construction equipment

- Speed of VG/VNT turbochargers
- Gearbox shaft and retarder speed

Railway systems

- Optimum traction control
- WSP (wheel slide protection) systems
- Speed information for automatic train control

Power generation

Gas, hydro, steam and wind turbines

- Overspeed protection
- Speed measurement and control

Hydraulics

Agricultural machinery, construction and mining equipment, cranes, ROV – remote operated vehicles

- Motors and pumps, flowrate measurement
- Position measurement, traction synchronization

Diesel and gas engines

Large diesel and gas engines in marine, rail, off-road applications and power production.

- Cam and crank shaft for dynamic position
- Turbocharger speed, engine diagnostics

Quality systems

ISO TS 16949
ISO 9001
AS 9100
IRIS

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JAQUET
TECHNOLOGY GROUP

GREEN LINE
INDUSTRIAL SPEED SENSORS

Industrial speed sensors and tachometers

The GreenLine family is the newest line of industrial speed sensors and control modules from JAQUET Technology Group. These sensors and tachometers provide solutions for speed sensing and control applications both for end users and small OEM's. Our offering of 50 plus sensors and 4 tachometer modules allows straight forward signal detection, monitoring and conditioning.

Sensors are available with VR or Hall technologies with cable or connector interfaces. Sizes range from 3/8-24 and M10X1 to 3/4-16 and M16X1.5. Sensor capability ranges from zero speed to high frequency detection and all units have sealed sensing areas to prevent liquid intrusion. Also available are direction sensing units and hazardous location versions for both North America (NEC, CEC) and Europe (ATEX).

The JAQUET T400 series F-DC tachometers are available with current or voltage analog output and they also provide a sine to square wave converter/re-transmit signal, sensor health monitoring and a high/low limit relay. All inputs and outputs are galvanically isolated. T400's are configured via a PC with supplied software using the PC-T400 cable. Available packages include DIN-rail mount and panel mount with display.

The new GreenLine sensors and tachometers can be used to provide either a complete measurement chain solution or individual speed sensing products as needed. Technical product overviews follow in this brochure.

VR Electromagnetic Speed Sensors

- Temperature rating: -40...125°C • Signal output: Frequency and amplitude proportional to speed • Frequency range: up to 20 kHz
- Electrical: Sine wave output, 850 Ohm, 135 mH • Module / DP Range: M: 0.5 or larger / DP: 50 or coarser

Type		Housing	Connection	Mechanical
E12A		Threaded M12x1 stainless steel IP67	Connector, M12x1, 4 pin, sealed	Overall length: 60 mm Thread length: 40 mm
E12S		Threaded M12x1 stainless steel IP67	Cable, silicone, 1m 0.34 mm², AWG 22	Overall length: 69 mm Thread length: 50 mm
E16A		Threaded M16x1.5 stainless steel IP67	Connector, M12x1, 4 pin, sealed	Overall length: 60 mm Thread length: 40 mm
E16A25		Threaded M16x1.5 stainless steel IP67	Connector, M12x1, 4 pin, sealed	Overall length: 84 mm Thread length: 64 mm
E16A40		Threaded M16x1.5 stainless steel IP67	Connector, M12x1, 4 pin, sealed	Overall length: 122 mm Thread length: 102 mm
E16AM		Threaded M16x1.5 stainless steel IP67	Connector, MS 3102A-10SL-4P, 2 pin	Overall length: 61 mm Thread length: 33 mm
E16AM25		Threaded M16x1.5 stainless steel IP67	Connector, MS 3102A-10SL-4P, 2 pin	Overall length: 92 mm Thread length: 64 mm
E16AM40		Threaded M16x1.5 stainless steel IP67	Connector, MS 3102A-10SL-4P, 2 pin	Overall length: 130 mm Thread length: 102 mm
E16S		Threaded M16x1.5 stainless steel IP67	Cable, silicone, 1 m 0.34 mm², AWG 22	Overall length: 69 mm Thread length: 50 mm
E16S25		Threaded M16x1.5 stainless steel IP67	Cable, silicone, 1 m 0.34 mm², AWG 22	Overall length: 83 mm Thread length: 64 mm
E16S40		Threaded M16x1.5 stainless steel IP67	Cable, silicone, 1 m 0.34 mm², AWG 22	Overall length: 121 mm Thread length: 102 mm
E38A		Threaded 3/8"- 24 UNF stainless steel IP67	Connector, M12x1, 4 pin, sealed	Overall length: 48 mm Thread length: 34 mm
E38S		Threaded 3/8"- 24 UNF stainless steel IP67	Cable, silicone, 1m 0.34 mm², AWG 22	Overall length: 54 mm Thread length: 34 mm
E58A		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, M12x1, 4 pin, sealed	Overall length: 60 mm Thread length: 40 mm
E58A25		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, M12x1, 4 pin, sealed	Overall length: 84 mm Thread length: 64 mm
E58A40		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, M12x1, 4 pin, sealed	Overall length: 121 mm Thread length: 102 mm
E58AM		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, MS 3102A-10SL-4P, 2 pin	Overall length: 61 mm Thread length: 33 mm
E58AM25		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, MS 3102A-10SL-4P, 2 pin	Overall length: 92 mm Thread length: 64 mm
E58AM40		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, MS 3102A-10SL-4P, 2 pin	Overall length: 130 mm Thread length: 102 mm
E58S		Threaded 5/8"- 18 UNF stainless steel IP67	Cable, silicone, 1m 0.34 mm², AWG 22	Overall length: 69 mm Thread length: 50 mm
E58S25		Threaded 5/8"- 18 UNF stainless steel IP67	Cable, silicone, 1 m 0.34 mm², AWG 22	Overall length: 83 mm Thread length: 64 mm
E58S40		Threaded 5/8"- 18 UNF stainless steel IP67	Cable, silicone, 1 m 0.34 mm², AWG 22	Overall length: 121 mm Thread length: 102 mm

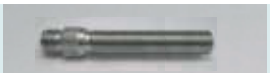
VR Electromagnetic Speed Sensors

- Temperature rating: -40...200°C • Signal output: Frequency and amplitude proportional to speed
- Frequency range: up to 20 kHz • Electrical: Sine wave output, 850 Ohm, 135 mH
- Module / DP Range: M: 0.5 or larger / DP: 50 or coarser

Type		Housing	Connection	Mechanical
E58HAM		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, MS 3102A-10SL-4P, 2 pin	Overall length: 61 mm Thread length: 33 mm

Digital Electromagnetic Speed Sensors

- Temperature rating: -40...125°C • Signal output: Frequency proportional to speed • Frequency range: up to 20 kHz
- Supply Voltage: 5...32 VDC • Electrical: Square wave, NPN with 2.2 kOhm pull up
- Module / DP Range: M: 0.5 or larger / DP: 50 or coarser

Type		Housing	Connection	Mechanical
EV58AM		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, MS 3102A-10SL-3P, 3 pin	Overall length: 61 mm Thread length: 33 mm
EV58AM25		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, MS 3102A-10SL-3P, 3 pin	Overall length: 92 mm Thread length: 64 mm
EV58AM30		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, MS 3102A-10SL-3P, 3 pin	Overall length: 105 mm Thread length: 77 mm
EV58AM40		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, MS 3102A-10SL-3P, 3 pin	Overall length: 130 mm Thread length: 102 mm
EV58S		Threaded 5/8"- 18 UNF stainless steel IP67	Cable, silicone, 1m 0.34 mm², AWG 22	Overall length: 69 mm Thread length: 50 mm
EV58S25		Threaded 5/8"- 18 UNF stainless steel IP67	Cable, silicone, 1 m 0.34 mm², AWG 22	Overall length: 83 mm Thread length: 64 mm
EV58S40		Threaded 5/8"- 18 UNF stainless steel IP67	Cable, silicone, 1 m 0.34 mm², AWG 22	Overall length: 121 mm Thread length: 102 mm

VR Electromagnetic Speed Sensors - EX ATEX Zone 1/ EX NA Class 1 Div 1

- Temperature rating: -40...125°C • Signal output: Frequency and amplitude proportional to speed
- Frequency range: up to 20 kHz • Electrical: Sine wave output, 250 Ohm, 70 mH coil
- Module / DP Range: M: 1.0 or larger / DP: 25 or coarser CERTIFIED FOR USE IN EXPLOSIVE ATMOSPHERES

Type		Housing	Connection	Mechanical
EX58H		Threaded 5/8"- 18 UNF stainless steel IP67	½ - 14 NPT Cable PTFE, 3 m	Overall length: 88 mm Thread length: 48 mm
EX58H35		Threaded 5/8"- 18 UNF stainless steel IP67	½ - 14 NPT Cable PTFE, 3 m	Overall length: 129 mm Thread length: 89 mm
EX58H85		Threaded 5/8"- 18 UNF stainless steel IP67	½ - 14 NPT Cable PTFE, 3 m	Overall length: 256 mm Thread length: 216 mm
EX34H		Threaded 3/4"- 20 UNF stainless steel IP67	½ - 14 NPT Cable PTFE, 3 m	Overall length: 88 mm Thread length: 48 mm
EX34H35		Threaded 3/4"- 20 UNF stainless steel IP67	½ - 14 NPT Cable PTFE, 3 m	Overall length: 120 mm Thread length: 89 mm

VR Electromagnetic Speed Sensors - EX NA Class 1 Div 2

- Temperature rating: -40...125°C • Signal output: Frequency and amplitude proportional to speed
- Frequency range: up to 20 kHz • Electrical: Sine wave output, 850 Ohm, 135 mH
- Module / DP Range: M: 0.5 or larger / DP: 50 or coarser CERTIFIED FOR USE IN EXPLOSIVE ATMOSPHERES

Type		Housing	Connection	Mechanical
EX10A		Threaded M10x1 stainless steel IP67	Connector, M12x1 4 pin, sealed	Overall length: 48 mm Thread length: 34 mm
EX10S		Threaded M10x1 stainless steel IP67	Cable, PTFE, 3m 0.21 mm², AWG 24	Overall length: 54 mm Thread length: 34 mm
EX12A		Threaded M12x1 stainless steel IP67	Connector, M12x1 4 pin, sealed	Overall length: 60 mm Thread length: 40 mm
EX12A35		Threaded M12x1 stainless steel IP67	Connector, M12x1 4 pin, sealed	Overall length: 109 mm Thread length: 89 mm
EX38A		Threaded 3/8"- 24 UNF stainless steel IP67	Connector, M12x1 4 pin, sealed	Overall length: 48 mm Thread length: 34 mm
EX38S		Threaded 3/8"- 24 UNF stainless steel IP67	Cable, PTFE, 3m 0.21 mm², AWG 24	Overall length: 54 mm Thread length: 34 mm
EX58AM		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, MS 3102A-10SL-4P, 2 pin	Overall length: 61 mm Thread length: 33 mm
EX58AM25		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, MS 3102A-10SL-4P, 2 pin	Overall length: 92 mm Thread length: 64mm
EX58AM40		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, MS 3102A-10SL-4P, 2 pin	Overall length: 130 mm Thread length: 102 mm
EX58S		Threaded 5/8"- 18 UNF stainless steel IP67	Cable, PTFE, 3 m 0.21 mm², AWG 24	Overall length: 69 mm Thread length: 50 mm
EX58S25		Threaded 5/8"- 18 UNF stainless steel IP67	Cable, PTFE, 3 m 0.21 mm², AWG 24	Overall length: 83 mm Thread length: 64 mm
EX58S40		Threaded 5/8"- 18 UNF stainless steel IP67	Cable, PTFE, 3 m 0.21 mm², AWG 24	Overall length: 121 mm Thread length: 102 mm

Differential Hall Effect Speed Sensors

- Temperature rating: -40...125°C • Signal output: Frequency proportional to speed
- Frequency range: 5 Hz to 20 kHz • Supply Voltage: 8...32 VDC
- Electrical: Square wave push-pull output • Module / DP Range: M: 0.5 or larger / DP: 50 or coarser

Type		Housing	Connection	Mechanical
D12A		Smooth 10.8 mm OD flange mount IP67	Connector, M12x1 4 pin, sealed	Overall length: 60 mm Shaft length: 25.7 mm
D12P		Threaded M12x1 stainless steel IP67	Cu cable insulation PTFE, 0.35 m, 021 mm² AWG 24 with connector 3 pin AMP	Overall length: 92 mm Thread length: 64 mm

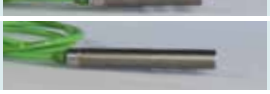
Dual Channel Hall Effet Speed and Direction Sensors

- Temperature rating: -40...125°C • Signal output: Frequency proportional to speed (channel 1) and direction (ch 2)
- Frequency range: 0 Hz to 15 kHz • Supply Voltage: 8...32 VDC
- Electrical: Square wave output, NPN plus direction line • Module / DP Range: M: 1.0 or larger / DP: 25 or coarser

Type		Housing	Connection	Mechanical
Y12AD		Threaded M12x1 with O-ring and locator key	Connector, M12x1 4 pin, sealed	Overall length: 75 mm Shaft length: 36 mm

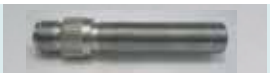
Dual Channel Hall Effet Speed and Direction Sensors

- Temperature rating: -40...125°C • Signal output: Frequency proportional to speed (channel 1) and direction (ch 2)
- Frequency range: 0 Hz to 15 kHz • Supply Voltage: 8...32 VDC
- Electrical: Square wave output, NPN plus direction line • Module / DP Range: M: 1.0 or larger / DP: 25 or coarser

Type		Housing	Connection	Mechanical
F12A		Threaded M12x1 stainless steel IP67	Connector, M12x1 4 pin, sealed	Overall length: 60 mm Thread length: 40 mm
F12S		Threaded M12x1 stainless steel IP67	Cable, silicone, 1 m 0.34 mm², AWG 22	Overall length: 69 mm Thread length: 50 mm
F16A		Threaded M16x1.5 stainless steel IP67	Connector, M12x1 4 pin, sealed	Overall length: 60 mm Thread length: 40 mm
F16A25		Threaded M16x1.5 stainless steel IP67	Connector, M12x1 4 pin, sealed	Overall length: 84 mm Thread length: 64 mm
F16A40		Threaded M16x1.5 stainless steel IP67	Connector, M12x1 4 pin, sealed	Overall length: 121 mm Thread length: 102 mm
F16S		Threaded M16x1.5 stainless steel IP67	Cable, Silicone, 1m 0.34 mm², AWG 22	Overall length: 69 mm Thread length: 50 mm
F16S25		Threaded M16x1.5 stainless steel IP67	Cable, Silicone, 1m 0.34 mm², AWG 22	Overall length: 83 mm Thread length: 64 mm
F16S40		Threaded M16x1.5 stainless steel IP67	Cable, Silicone, 1m 0.34 mm², AWG 22	Overall length: 121 mm Thread length: 102

Zero Speed Hall Effect Speed Sensors - continued

- Temperature rating: -40...125°C • Signal output: Frequency proportional to speed
- Frequency range: 0 Hz to 15 kHz • Supply Voltage: 8...25 VDC
- Electrical: Square wave, NPN with 2.7 Ohm pull up • Module / DP Range: M: 1.0 or larger / DP: 25 or coarser

Type		Housing	Connection	Mechanical
F58A		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, M12x1 4 pin, sealed	Overall length: 60 mm Thread length: 40 mm
F58A25		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, M12x1 4 pin, sealed	Overall length: 84 mm Thread length: 64 mm
F58A40		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, M12x1 4 pin, sealed	Overall length: 121 mm Thread length: 102 mm
F58AM		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, MS 3102A-10SL-3P, 3 pin	Overall length: 61 mm Thread length: 33 mm
F58AM25		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, MS 3102A-10SL-3P, 3 pin	Overall length: 92 mm Thread length: 64 mm
F58AM40		Threaded 5/8"- 18 UNF stainless steel IP67	Connector, MS 3102A-10SL-3P, 3 pin	Overall length: 130 mm Thread length: 102 mm
F58S		Threaded 5/8"- 18 UNF stainless steel IP67	Cable, silicone, 1m 0.34 mm², AWG 22	Overall length: 69 mm Thread length: 50 mm
F58S25		Threaded 5/8"- 18 UNF stainless steel IP67	Cable, silicone, 1m 0.34 mm², AWG 22	Overall length: 83 mm Thread length: 60 mm
F58S40		Threaded 5/8"- 18 UNF stainless steel IP67	Cable, silicone, 1m 0.34 mm², AWG 22	Overall length: 121 mm Thread length: 102 mm

Mating Cable Assembly for all Sensors with M12x1 Connector

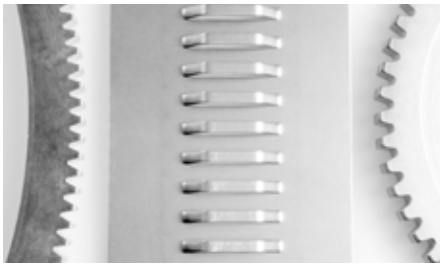
Type		Material	Connection
C20A		PUR (poly-urethane), Length: 2 m, Color: Green Temperature rating: -20...85°C	M12 standard, overmoulded. Pin 1 = brown, Pin 2 = white, Pin 3 = blue, Pin 4 = black
C50A		PU (poly-urethane), Length: 5 m, Color: Green Temperature rating: -20...85°C	M12 standard, overmoulded. Pin 1 = brown, Pin 2 = white, Pin 3 = blue, Pin 4 = black
C65A		PTFE, Length: 6.5 m, Color: White, Temp. rating: Cable -40...260°C / Connector -30...90°C	M12 standard, overmoulded. Pin 1 = red, Pin 2 = black, Pin 3 = brown, Pin 4 = yellow

Complete measurement chain by JAQUET

JAQUET speed sensors - OEM or customized

JAQUET speed sensors are designed to endure the most demanding ambient conditions and are used in a multitude of applications e.g. turbochargers, hydraulic motors, diesel and gas engines, turbines, pumps and compressors, just to name a few. Our platform approach enables us to take an appropriate sensing technology and package it in either one of our huge array of existing housings or in something matched to your specific requirements. Need a high temperature helicopter turbine sensor or a railway traction control sensor that delivers tooth frequency x 16 from the first tooth? Consider it done!
We are ready for the next challenge.

JAQUET pole wheels and pole bands



JAQUET pole wheels and pole bands represent the highest quality of target technology and complement the chain of speed measurement. Please refer to the pole wheels and pole bands brochure for further information.

JAQUET systems

From hydro electric power stations high in the Pyrenees to nuclear submarines at the bottom of the ocean, JAQUET tachometer products are in service providing
optimum solutions for measurement, control and that all important machine protection function.

Find more information about the JAQUET T400 family in the following chapter of this brochure.

JAQUET Handheld tachometers

To complete our speed measurement portfolio - JAQUET also offers handheld tachometers. For more information about these products, please take a look at the last section of this brochure.

JAQUET T400 Speed measurement, switching and indicating instruments

Features

- Converts absolute speed into an analog signal
- Including 2 limits (A/B) with programmable hysteresis
- One changeover relay assigned via binary input to limit A or B
- T411 and T412 models with display
- Isolated signal input with automatic trigger level adjustment
- Built in isolated sensor supply with sensor monitoring
- Open collector output of sensor frequency
- Accuracy class 0.05% for limits and 0.5% for analog signals
- Configuration and status via Windows® software
- 5 digit machine factor allowing configuration and display in machine units
- Wide tolerance 10...36 VDC power supply

T400 advantage

- Fast response to over speed conditions
- Germanischer Lloyd's approval for marine applications
- CSA Ordinary Location Approval
- Digital display of speed value for models T411 and T412
- 0/4...20 mA or 0/2...10 V analog output with rising or falling slope
- Adaptive trigger provides high noise immunity e.g. with electromagnetic sensors
- 2 possible relay configuration sets e.g. for start up bridging, controlled via binary inputs
- Quick Disconnect terminals - programmable measurement & analog output filter times
- Integrated 2 or 3 wire sensor monitoring and system watchdog

One channel tachometer with relay and 0/4-20 mA output:

Type number: T401.00 (without display)	Product number: 383Z-05307
Type number: T401 .03 (without display)	Product number: 383Z-05671
Type number: T411.00 (with display)	Product number: 383Z-05318
Type number: T411 .03(with display)	Product number: 383Z-05595

One channel tachometer with relay and 0/2-10 V output:

Type number: T402.00 (without display)	Product number: 383Z-05308
Type number: T402 .03 (without display)	Product number: 383Z-05672
Type number: T412.00 (with display)	Product number: 383Z-05319
Type number: T412 .03 (with display)	Product number: 383Z-05596

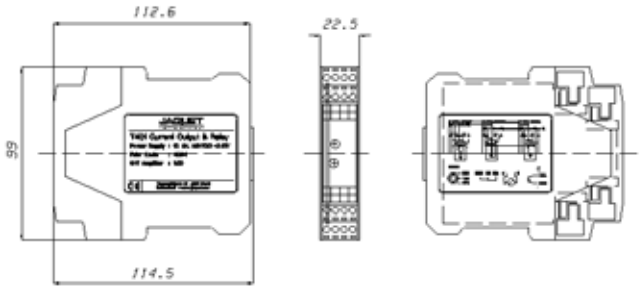
Technical Data

Measuring range	Lowest: 0...1.000 Hz Highest: 0...35.00 kHz
Accuracy	0.5% referred to the analog output end of range value
Analog output	T401/T411: Current output 0...20 mA or 4...20 mA T402/T412: Voltage output 0...10 V resp. 2...10 V Programmable rising or falling transfer function (min. end value 1.00 Hz) Load T401: max. 500 Ohms corresponding to a maximum of 10 V Load T402: min. 7 kOhm corresponding to a maximum of 1.4 mA Maximum open circuit voltage: 12 V Resolution: 12 bit corresponding to 1:4096 Maximum linearity error: 0.1 % Temperature drift: typ. ± 100 ppm/degree K, max. ± 300 ppm/degree K
Set points /relay	Range: See measuring range above Hysteresis: For each limit an upper and a lower set point may be set independently Change over contact: max. 250 VAC, 1250 VA (DC: see operating instructions)
Data I/O	(Serial EIA) RS232 interface with +5 V-CMOS level 3-pole, 3.5 mm stereo headphone connector on the front side, common reference potential with negative pole of sensor supply.
Measuring / response time	The min. measuring time (fix-time) is programmable: 2/5/10/20/50/100/200/500 ms, 1/2/5 s For input frequencies with a period SHORTER than the fix-time: Analog output: - Maximum: 2* fix time + max. period of the input frequency + 7.5 ms - Typical: fix time + 1 period of the input frequency + 7.5 ms Relay: - Maximum: 2* fix time + max. period of the input frequency + 10.5 ms - Typical: fix time + 1 period of the input frequency + 10.5 ms For input frequencies with a period LONGER than the fix time: Analog output: - Maximum: Period of the input frequency + 7.5 ms Relay: - Maximum: Period of the input frequency + 10.5 ms
Sensor input	Input resistance: 30 kOhm Frequency range: (-3 dB): 0.01 Hz / 35 kHz Trigger level: adaptive trigger level from 20 mV to 5 V or 500 mV to 5 V (factory configuration) peak depending on the amplitude of the input signal
Sensor supply	Built-in sensor power supply: + 14 V, max. 35 mA, short-circuit proof / + 5 V for .03 versions Built-in pull up (+14 V / + 5 V) and pull down (0 V) resistor 820 Ohm for connection of two-wire transmitters or daisy chaining of T400's
Sensor monitoring	Powered 2 and 3 wire sensors: min. and max. current consumption values are selectable in the range 0.5...25 mA. Sensors with consumption below min. or above max. current will be signalled as defective. Electromagnetic/VR sensors: Open circuit state of sensors. This supervision runs permanently. Both monitoring functions can be switched off via the configuration software.
Open collector output	Galvanically separated output of sensor frequency

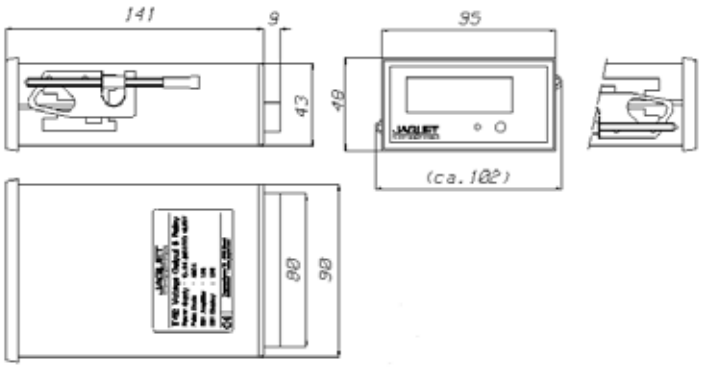
Binary inputs	For external selection between two sets (A/B) of programmable relay control and acknowledge functions: (No external pull up needed) Low active :U ‹ +1.5 V High (open) :U › +3.5 V
Environmental	KUE according to DIN 40 040 Operating temperature: - 40...+85 ˚C Storage temperature: -40...+90 ˚C Relative humidity up to 75% average over one year period, up to 90% max. for 30 days
Power supply	10...36 VDC power consumption max. 3 W
Insulation	Galvanic separation between power supply, current output and the sensor power supply. Isolation 700 VDC / 500 VAC. Relay contact isolation: 1500 AC
EMC	Electromagnetic compatibility: Radiation in accordance with international standards and EN 50081-2. Immunity in accordance with international standards and EN 50082-2 Conducted emissions: CISPR 16-1, 16-2 Radiated emissions: EN 55011 Electrostatic discharge: IEC 61000-4-2 Electromagnetic fields: IEC 61000-4-3 Conducted fast transients: IEC 61000-4-4 Conducted slow transients: IEC 61000-4-5 Conducted high frequency: IEC 61000-4-6 Pulse modul. elec. field: ENV 50140 Power frequency magnetic field: IEC 1000-4-8
Standards	EN 50155 GL / Germanischer Lloyd CSA Ordinary Location

Dimensions:

T401/T402



T411/T412



Rail	**Rail DIN 4622713 (EN 50022) or mounting plate to DIN 43660 (46121)**
Housing	**Protection class IP40, terminals IP20**
Terminals	**See operating instructions**
Weight	**T401/T402: 150 g T411/T412: 210 g**

Full technical details can be seen in the operating instructions.

T401/T402 and T411/T412 are supplied with full documentation and the T400 Windows Software.
The software allows:

- Quick and easy configuration of all operating parameters
- Unit interrogation of identity and parameters
- PC display of current measurement and relay status
- Archiving and printing of the configuration

RS-232 programming cable not included.

JAQUET Handheld tachometers - HO 100, HM 100 and HC 100

JAQUET HO 100 Optical Tachometer uses precision optics and reflective tape to measure the RPM of rotating devices such as fans and gears.

JAQUET HM 100 Contact Tachometer uses convex and concave attachments to measure RPM. It also has a built-in wheel to measure the linear surface speed of moving devices such as conveyors and treadmills.

General specifications

Display	5-digit LCD display	
Range selection	Automatic range selection	
Time base	4 MHz quartz crystal	
Sampling time	1 second (› 60 rpm); › 1 second (10 to 60 rpm)	
Photo tachometer distance	2 to 12” (5 to 30 cm)	
Operating temperature	0...50 °C (32...122 °F)	
Operating humidity	80% RH max.	
Power supply	9 V battery	
Battery life	40 hours (approx.)	
Applicable standards	HO 100: EN 50081-1/1992 (EN 55022)	HM 100: EN 50082-1/1997 (EN 55024)
Dimensions	HO 100: 124 x 51 x 33 mm	HM 100: 150 x 51 x 33 mm
Weight	HO 100: 114 g / HM 100: 142 g	

Range specifications

Measurement	Range	Accuracy
Rotation - HO 100 Optical	10.000 to 99999 rpm	± (0.1% reading + 2 digits)
Rotation - HM 100 Contact	10.000 to 9999 rpm	± (0.1% reading + 2 digits)
Surface Speed - HM 100 Contact	1.0000 to 1999.9 m/min	± (1.5% reading + 2digits)

JAQUET TECHNOLOGY GROUP

Swiss know-how and quality matched to your demands

JAQUET manufactures speed sensors in quantities from 1 to millions per project per year. These typically customer specific solutions add value through being matched to individual applications.
Since 1889, a spirit of excellence complementing tradition and innovation.

Automotive turbochargers

Turbocharger for trucks, passenger cars, construction equipment
- Speed of VG/VNT turbochargers
- Gearbox shaft and retarder speed

Railway systems

- Optimum traction control
- WSP (wheel slide protection) systems
- Speed information for automatic train control

Power generation

Gas, hydro, steam and wind turbines
- Overspeed protection
- Speed measurement and control

Hydraulics

Agricultural machinery, construction and mining equipment, cranes, ROV – remote operated vehicles
- Motors and pumps, flowrate measurement
- Position measurement, traction synchronization

Diesel and gas engines

Large diesel and gas engines in marine, rail, off-road applications and power production.
- Cam and crank shaft for dynamic position
- Turbocharger speed, engine diagnostics

Quality systems

ISO TS 16949
ISO 9001
AS 9100
IRIS

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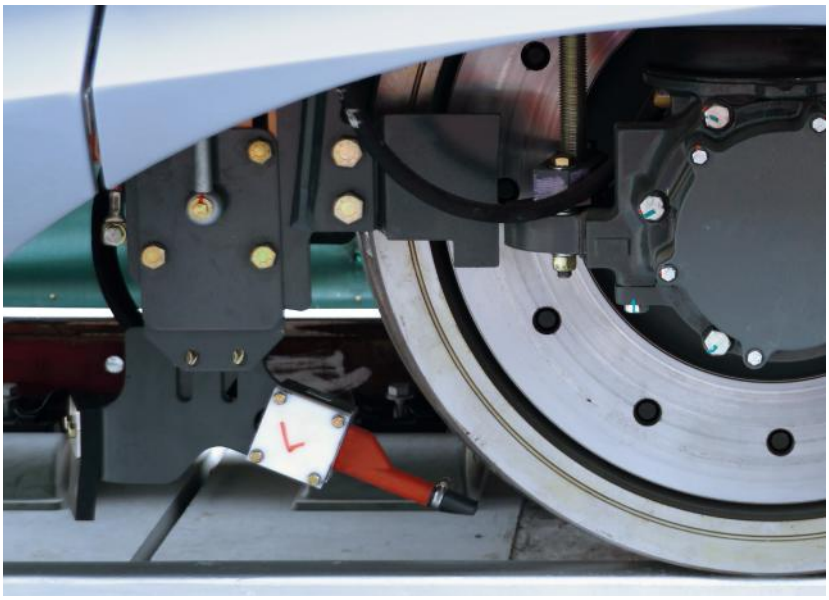
Experts in Railway Applications

Sensors, pole wheels and diagnostic system for rolling stock

High-speed Train
EMU/DMU
Tramway
Subway
Trolleybus

IRIS Certification

SIGNALLING



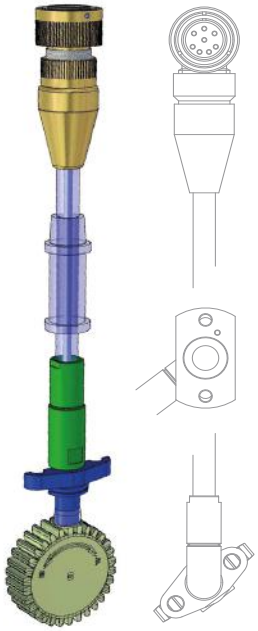
BRAKE

Multi Channel Speed Sensor

- 2 or 3 galvanic insulated circuits
- 3 or 4 channels
- Robust design
- Effective combined solution for upgrade, retrofit and new applications

Eddy Current Speed Sensor

- Works with aluminum and steel targets
- Low power consumption
- Wide range of power supply
- Frequency up to 20 kHz
- Target module 2 to 7
- According to EN 50155

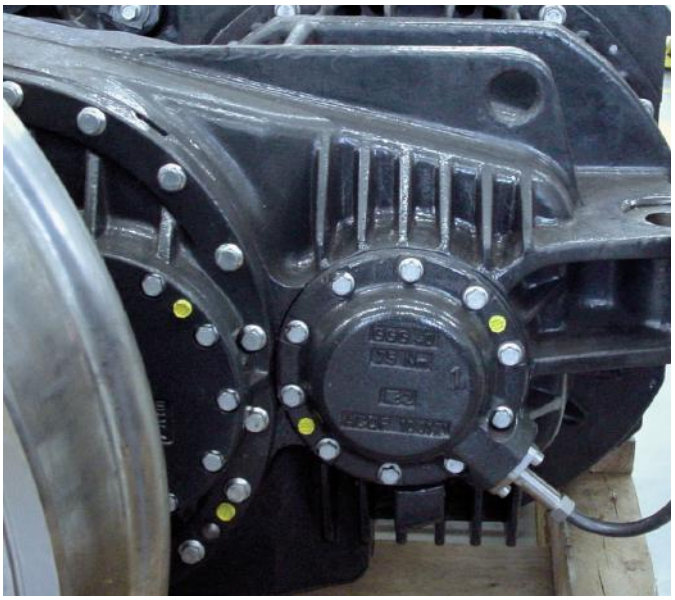


Modular Design matched to your demands

We develop, produce and distribute speed sensors for advanced equipment in the railway industry. More than 155,000 railway sensors are in operation.

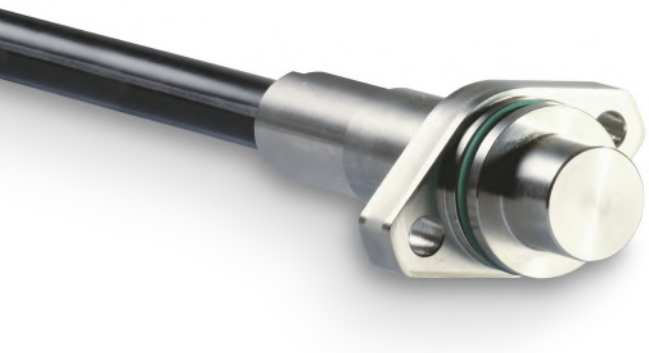
Targets – Pole Wheels

- Teeth designed for optimum signal output
- No contact to the sensor
- In steel, aluminum or other magnetic materials
- Module 1 to 6, on request
- Customized solutions



PROPULSION

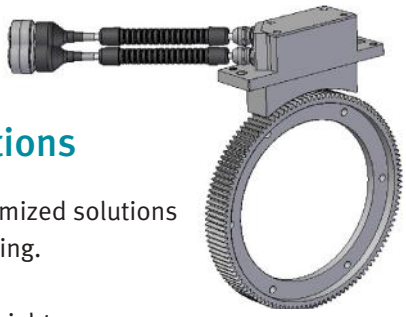
ENGINE DIAGNOSTICS



Hall Effect Speed Sensor

- Stainless steel flange version for harsh environments
- Reliable 1- to 4-channel sensors
- High degree of EMI immunity
- Long term stability
- Static or dynamic behavior

Optional: galvanic separation, interpolation, integrated temperature measurement



Integrated Solutions

We offer complete customized solutions including signal processing.

- Reduced space and weight
- Easy maintenance easy replacement
- Combined temperature and speed measurement

ALPHABOX – The Predictive Diagnostic System for Engines

ALPHABOX only requires the input signal from a crankshaft speed sensor to analyze torsional vibrations as an early indication of possible mechanical failure in your engine.

Designed for

- Cylinder-by-cylinder diagnostics
- Early detection of engine problems
- Extension of engine lifespan
- Clear and concise report
- Entire fleet installation
- Quick return on your investment
- A cost efficient solution
- Easy to install and commission
- Maintenance-free use
- Remote and local access to data
- Ideally suited for retrofit engines
- Continuous monitoring and reporting

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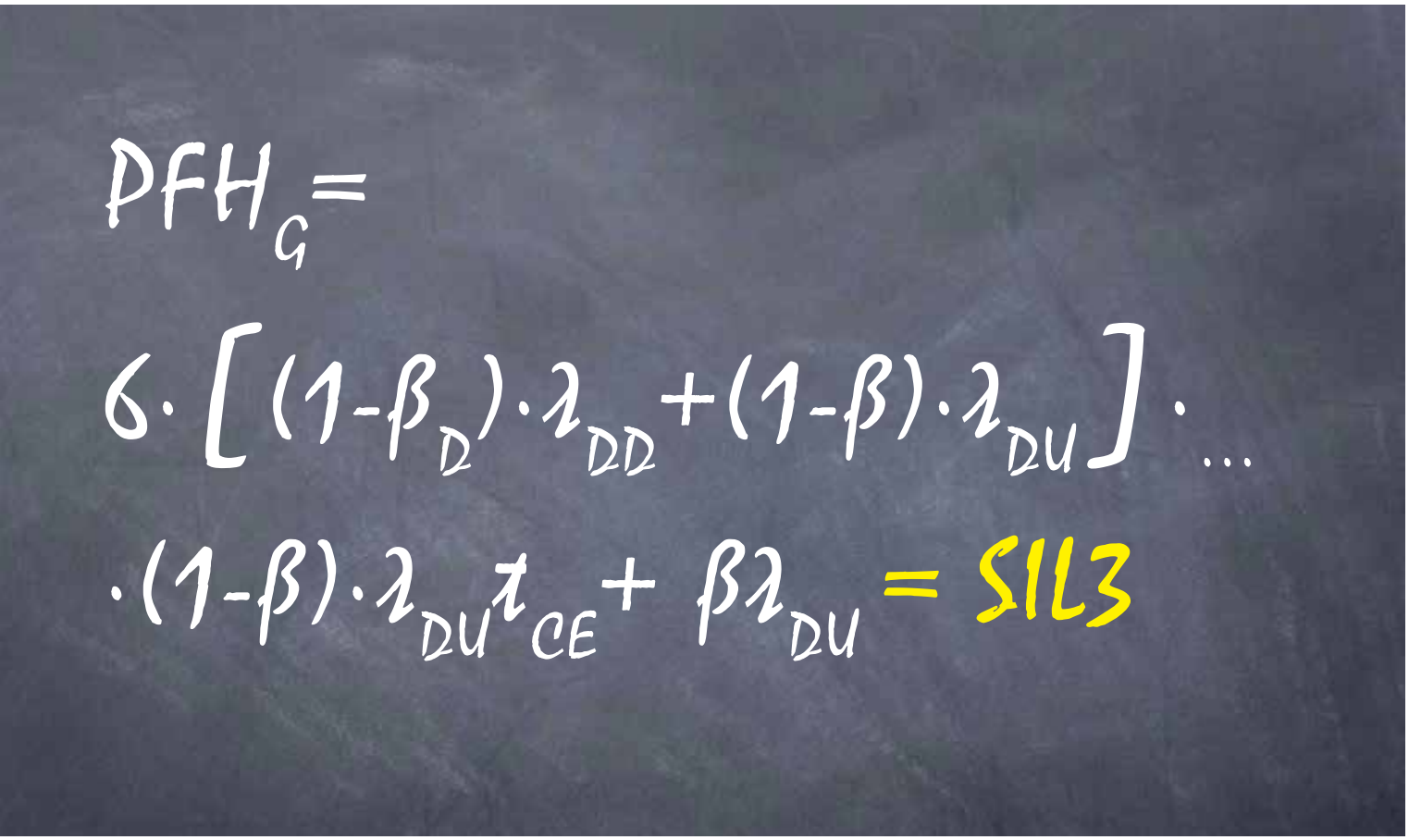

SIL3 Speed Sensors

Completing fully certified safety systems

The importance of numbers:
200'000 man days experience in supplying quality speed sensors;
2'000 man hours to create the first SIL certified speed sensor;
all to achieve the number 3.

Chances are your life was influenced by JAQUET speed sensors today:

Monitoring turbines that generated the electricity to power your lights at home.

Optimizing turbo speed in supermarket delivery trucks.

Measuring the engine speed in the harvesting machine for your daily bread.

Controlling the railway traction motors and brakes on your train to work.

JAQUET's new line of SIL3 capable speed sensors now enables added functional safety in these and many other applications with an associated reduction in risk level.

Designed to conform to safety standards ANSI/ISA 84.00.01, IEC61508 & IEC61511 plus certified by TÜV, these new speed sensors from JAQUET are intended & approved for use in high demand applications up to and including SIL3. These are defined as having a probability of dangerous failure per hour (PFH) of $\geq 10^{-8}$ to $< 10^{-7}$

Protecting the compressor sets that produce fertilizer for your lunchtime salad.

Making street sweepers that keep your city streets clean more efficient.

Synchronizing road roller speeds to smooth your high-way journey.

In the fast patrol boats and submarines that keep our shores safe.

3 VR coil systems are initially offered for targets ranging from Module 1 to 10, Pitch (DP) 2.5 to 25 in housings fully closed at the front & potted at the back to eliminate ingress risks.

VR sensors are offered in the temperature range of -40 ... +150°C with either integral connector or integral cable.
All in a package best matched to your application.

Dual coil & Ex rated VR sensors plus various Hall models will be introduced under a rolling program driven by customer demand.
When used in conjunction with Safety Instrumented Systems, JAQUET SIL3 sensors provide the hitherto missing link in the fully certified speed measurement safety chain.

Challenge us with your application requirements. The safety team is ready.

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