Swiss Made

JAQUET

FT 100

Frequency Measurement and Switching Instruments Series FT 100

Operating instructions
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CONTENTS

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1 Safety Instructions

Certain components within the tachometers FT 100 are only then under dangerous voltages, if the connected circuits have dangerous potentials.

The instruments comply with Class of Protection I . Hence it is mandatory to connect a protective earth on the PE-terminal. The instruments are designed and manufactured according to IEC-Publication 348 and they left the works in a perfect condition.

These operating instructions contain informations referring to risks, which must be considered scrupulously for reasons of safety of the instrument and it´s operation.

Instruments in a doubtful condition after electrical, climatic or mechanical overload have immediately to be put out of operation and returned to the manufacturer for repair.

2 Functional Purpose of the Apparatus

The tachometers FT 100 serve for measuring and monitoring a frequency within the range of 0 to 30 000 Hz respectively to a measured value proportional to a frequency, i.e. rotational speed.

The family consists of the three types

- **FTW 113 DC24 I** Frequency/Current-Converter with output 0/4...20 mA **Art.-No. 830A-36300**
- **FTW 113 DC24 U** Frequency/Voltage-Converter with output 0/2...10 V **Art.-No. 830A-36521**
- **FTF 123 DC24** Frequency Relay with one switching limit resp. relay **Art.-No. 830A-36301**

At the moment there are no variants for the three types with other supply voltages than 24 V DC.

3 The Composition of the complete Apparatus

The instruments are mounted within a plastic housing for installation on rails according to EN 50 022-35 resp. DIN 46 277.

The parametrization of the measuring range, the monitoring- and the and relay-functions takes place via an RS232- interface with a 3.5mm stereo headphone connector on the front side.

The housing has to be opened only for changing the pull-up resistor resp. the pull-down resistor at the frequency input or for repair purposes (see paragraph 1 Safety Instructions and 6 Installation.

4 Specifications

Reference-conditions: ambient temperature + 20 degrees C

power supply voltage within specifications

	FTW 113:	**FTF 123**
Lowest Measuring Range	0 . . . 1.000 Hz	0 . . . 1.000 Hz
Highest Measuring Range	0 . . . 35.00 kHz	0 . . . 35.00 kHz

Measuring range and setpoints are entered directly in physical units (e.g. rpm) after the determination of the Machine Factor M = frequency (Hz) / measured value (rpm)

The input frequency may be beyond the measuring range (up to a maximum of 55 kHz) for an unlimited time, without disturbing the proper functioning of the instrument.

Signal Output Range (with FTW 113)	
Execution FTW 113 DC24 I Current output	0 . . . 20 mA resp. 4 . . . 20 mA selectable for rising or falling transfer function Maximum Load 500 Ohm corresponding to a maximum of 10 V
Special Execution S3 Current output	0 . . . 5 mA resp. 1 . . . 5 mA selectable for rising or falling transfer function Maximum Load 2 000 Ohm corresponding to a maximum of 10 V
Execution FTW 113 DC24 U Voltage Output	0 . . . 10 V resp. 2 . . . 10 V selectable for rising or falling transfer function Minimum Load 7 kOhm corresponding to a maximum of 1.4 mA
Maximum open-circuit Voltage :	20 V
Resolution	12 bit corresponding to 1 : 4096
Maximum Linearity Error	0.1 %
Accuracy Class	0.5 % referred to the analog output end of range value
Temperature Drift	typ. ± 100 ppm/degree K, max. ± 300 ppm/degree K
Response Time (step response)	The minimum measuring time is programmable as a Fix Time of 2/5/10/20/50/100/200/500 ms /1/2/5 s - For input-frequencies with a period shorter than the Fix Time, the response time is in 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 - For input-frequencies with a period longer than the Fix Time, the response time is in maximum: period of the input frequency + 7.5 ms

Limits (only with instruments FTF 123):	
Hysteresis of setpoints	for each limit an upper and a lower setpoint may be set independently
Relay functions	monostable relay, function individually selectable as „normal“ or „inverse“ and starting with SW version 1.06 „without / with acknowledge resp. hold via binary input“
Relay output	change-over contacts max. 250 V, 1 A, 50 W and 24 V, 3 A, 72 W
Accuracy class	0.05% referred to the setpoint
Temperature tolerance	max. ± 10 ppm

Time delay (continued FTF 123)	The minimum measuring time is programmable as a one period or a Fix-Time of 2/5/10/20/50/100/200/500 ms 1/2/5 s - For input-frequencies with a period shorter than the Fix Time, the delay time is in 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, the delay time is in maximum: max. period of the input frequency + 10.5 ms

Sensor input	The reference potential is common with the minus pole of the power supply and the analog output. The terminal for the cable shield is galvanically connected to the minus pole of the power supply and protective earth. Input resistance: 30 kOhm Input voltage : 50 mVeff . . . 80 Veff Frequency range (-3dB): 0.5 Hz / 30 kHz for connection of passive or active sensors (electromagnetic, Ferrostat- or HF-transmitters, proximity detectors and sensors with built-in amplifiers trigger level : not programmable (fixed hysteresis of 50mVeff = 141mVpp) built-in sensor power supply : +11.5... 12.5 V , max. 25mA short-circuit proof (max. 40mA) built-in Pull-up (+12 V) and Pull-down (0 V) resistor 820 Ohm for connection of two-wire transmitters, programmable via DIL-switch Sensor monitoring: 2- and 3-wire-sensors (selection via code switch) with a current consumption < I min resp. > I max will be signalled defective by switching off the „OK“- LED and, for the frerquency converter by freezing the actual output value and for the frequency relay by deenerizing the relay (fail-safe action). As long as the sensor error is active there is no further frequency measured and the serial output indicates a measured value of „0“. The values for $I_{min.}$ resp. $I_{max.}$ may be programmed within the range of 0.5 .... 25.0 mA.

Binary input	FTW 113 : none FTF 123 : for external selection between two sets (A/B) of programmable relay controls and acknowledge functions: TTL - level (+5V) with 100 kOhm pull-up resistor active low : U < +1.5V (Relay control parameter set „B“) high (open) : U > +3.5V (Relay control parameter set „A“) common reference potential with negative pole of power supply
Data communication:	Serial interface similar to EIA RS 232, but with a +5V-CMOS level 3-pole 3.5 mm stereo headphone connector on front side common reference potential with negative pole of power supply

Power supply	DC1 16 ... 36 VDC Power consumption max. 2.5 W maximum allowable power supply interruption with 16 V: 4 ms 24 V: 25 ms 36 V: 75 ms The inrush current is limited to max. 20A.

Climatic conditions	KUE according to DIN 40 040 Operating temperature 0 . . . + 60 degrees C Storage temperature - 25 . . . + 70 degrees C relative humidity 75% average over a year, up to 90% for 30 days max. condensation is to be avoided

Test voltages between relay contacts and all other circuits	2 kVAC, 50 Hz, 1 Min

Electromagnetic Compatibility :	Radiation and immunity in accordance to international standards	
Radio Frequency Interference voltage on mains connection	Quasi Peak value	Mean value
0.15 - 0.50 MHz	79 dB(uV)	66 dB(uV)
0.50 - 30.0 MHz	73 dB(uV)	60 dB(uV)
Radiated Emission:	Quasi Peak value	
30 MHz - 230 MHz	30 dB(uV/m)	
230 MHz - 1000 MHz	37 dB(uV/m)	

Immunity:	power supply circuit	input- and output circuits
ANSI/IEEE C 37.90 (superposed AC voltage)	10% Vss	- -
IEC 255-4 common mode series mode	2,5 kVs 1,0 kVs	2,8 kVs - -
IEC 801-2 (ESD, indirect static discharge on antenna plate)	8,0 kVs	8,0 kVs
IEC 801-3 (influenco of radiated electromagnetic field)	1 ... 1000 MHz , amplitude modulated, 80% , 1 kHz : 10 V/m	
IEC 801-4 (HF-Bursts, common mode)	2,0 kVs	2,0 kVs

Housing Material	Lower part made out of Makrolon 2800, UL 94 V-2, beige frame with terminals made out of Makrolon 8020 (30% glass fibre), UL 94 V-1, black
Mounting	on rails according to EN 50 022-35 and DIN 46 277
Terminals	with self-lifting connection plates for 2.5 mm2 wire or 1.5 mm2 flex
Protection acc. to EN 60925 resp. IEC 925	Housing IP 40 Terminals IP 20
Dimensions	Drawing number 4-111.699
Connections	Drawing number 4-111.701

5 Principle of Operation

The electronic tachometers type FT 100 are controlled by a microprocessor. They work according to the period measurement principle with subsequent computing of the reciprocal value (computer principle).

The frequency is measured continuously. The number of cycles considered for one measurement depends on the minimum measuring time (=Fix Time) and the level of the input frequency respectively on the limits to be monitored.

After entering the Machine Factor M = f/n

- with f (Hz) = signal frequency of the speed transmitter at a determined machine speed
- and n (rpm) = machine speed

the limits for the frequency relay and the measuring range for the frequency/current-converter can be entered directly in rpm.

The relation between the signal frequency (f) of a speed sensor and the rotational speed (n) of a pole wheel is the following:

f = n * p / 60 with f = Frequency of the speed transmitter in Hz
n = Rotational speed of the pole wheel in rpm
p = Number of poles on the pole wheel

Consequently for rotational speed measurement the machine factor M = p/60.
Instead of the rotational speed n any frequency proportional physical quantity to be measured may be used in the above formula.

For the two limits on the frequency relay the **switch-on point** (= Limit high) and the **switch-off point** (= Limit low) can be entered separately, thus allowing for the realisation of practically any hysteresis:

- With the binary input connected to 0V (=low) relay control parameter set „B“ is active.
  With the binary input left open (=high) relay control parameter set „A“ is active.
- Hold-Function: If the input frequency goes above the upper limit value (or below the lower limit value) the relay changes its state and will be hold in this state, unless it is reset, even if the input frequency goes again below the lower (resp. the upper) limit value.
- The configuration of the Relay Control, the „Selection of Actuator“ allows to activate/disactivate the relay’s hold function for the upper limit value exceeded or for the lower limit value fallen short of, independently for both parameter sets „A“ and „B“.
- The relay is reset by shortly opening and closing again of the binary input (if parameter set „B“ is activated) resp. by shortly closing and opening again of the binary input (if parameter set „A“ is activated) for a time between 0.1 ... 0.3 s.
- If the binary input is opened (resp. closed) for a time longer than 0.3 s , the parameter set „A“ (resp. „B“) will get active and the communicated values (also displayed on the PC) and the relay will go to the actual state corresponding to the parameter set „A“ (resp. „B“)

The input of all measuring parameters is made by the user, the manufacturer or the supplier via a PC and the RS232 interface according to order specifications.

All parameters are stored independent of the power supply by an EEPROM .

The green LED on the front plate displays only, whether the instrument is working correctly (LED bright) or is in error (LED dark).

6 Installation

The instruments comply with Class of Protection I. Hence it is mandatory to connect a protective earth on the PE-terminal **before** connecting phase and neutral. The thickness of the wire for protective earth must be in minimum equal to the maximum thickness of phase and neutral.

Warning: Any interruption of the protective earth conductor inside or outside the apparatus is likely to make the apparatus dangerous. Intentional interruption is prohibited!

The instrument shall be used only when mounted firmly, and the supply line shall contain a switch or another adequate means for disconnection from mains.

Before switching on the apparatus, make sure that it is set to the voltage of the power supply.

The shield of the sensor cable should be connected to terminal Sh for reasons of electromagnetic compatibility. This is internally connected to protective earth PE and to the negative pole of power supply.

Dimensions: drawing No. 4-111.699 on page 20
Connection diagram: drawing No. 4-111.701 on page 21

When using a speed sensor with a npn-output connected to V-, before connecting the power supply, an internal DIL-switch according to diagram 4-111.701 has to be set in position “pull-up“. When using a speed sensor with a pnp-output connected to V+, before connecting the power supply, an internal DIL-switch according to diagram 4-111.701 has to be set in position "pull-down". For this purpose the instrument is to be disassembled.

Warning: Disassembly must only take place with power supply disconnected! Capacitors inside the apparatus may still be charged, even if the apparatus has been disconnected from all voltage sources.

Both sides of the housing have to be pushed outward by means of a thin screwdriver or similar, thereby loosening the walls from the black terminal blocks. Then both catches on both sides of the housing are also to be pushed outward, whilst pulling the terminal blocks out of the housing. Thereby the whole electronics are lifted out of the housing.

For remounting the instrument the steps are reversed. When pushing the electronics into the housing mind the printed circuit to slide in the slot of the housing. After the catches have snapped in, both side walls of the housing have to be pressed against the terminal blocks in order to snap in.

7 Parametrization and Operation

7.1 Software Conception

Parameters are entered from a personal computer (PC) via the serial RS 232 - interface by means of a self-explaining, user friendly menue. Several forms and tables allow for the easy selection among a choice of functions or parameters.

7.1.1 List of Parameters and Text Displays

Originally activated parameters respectively their values are indicated in bold letters.

Instrument type
Manufacturing code
Software version
Date of calibration

Configuration < System >

Machine factor	1.0000E-07 ... **1.0000** ... 1.0000E+07
Minimum measuring time	2 / **5** / 10 / 20 / 50/ 100 / 200 / 500 **ms** / 1/ 2 / 5 s
Minimum indicated measured value	1.0000E-07 ... **0.0200** ... 1.0000E+07
Alarm definition	**ONLY system error/** System error OR Sensor monitoring

Configuration < Sensor >

Sensor supply	**12.00 V (fix)**
Trigger level	**0.00 V (fix)**
Minimum sensor current	**0.5** ... 25,0 mA
Maximum sensor current	0.5 ... **25.0** mA

Configuration < Analog output >

Measuring range starting value	**0.0000** Hz ... max. 90% of measuring range end value
Measuring range end value	0.99999 Hz ... **1000.0** Hz ... 34.999 kHz
Output range	**0 ... 20mA** / 4 ... 20mA resp. 0 ... 10V / 2 ... 10V resp. 0 ... 5mA / 1 ... 5mA
Time constant	**0.0** ... 9.9s

Configuration < Limits >

Status of operation	**On:** relay status depends on the corresponding limit Off: limit is inactive resp. the relay is deenergized
Mode of operation	**Normal /** Invers
Lower setpoint of limit 1	(e.g.) **200.00** Hz
Upper setpoint of limit 1	(e.g.) **300.00** Hz

Configuration < Relay selection >

Switch-over of selection A/B (start activation)	**None** (always selection A) / Binary input (only with FTF 123)
Delay	**0** ... 2'000 s
Selection A	Alarm / Sensor monitoring / **Limit 1** / Limit 2 / Window / On / Off
Selection B	Alarm / Sensor monitoring / **Limit 1** / Limit 2 / Window / On / Off
Alarm	the relay depends **only** on alarm defined under < System >
Sensor monitoring	the relay depends **also** on sensor current limits defined under <Sensor>
Limit	the relay depends on setpoints defined under <Limit >
Window	the relay depends on the measured value within or out of the window defined by limits 1 and 2
On	the relay is always energized
Off	the relay is always deenergized
Acknowledge A resp. B	**without (no hold-function) /** relay is hold if control is active / relay is hold if control is inactive

7.2 Parametrization

The mutation of parameters is possible via the RS232 interface by selecting the required menue and changing the proper parameters.

Warning: Every mutation becomes effective only when the parameters finally are stored by the PC via the interface and the EEPROM of the FT 100 instrument in the working memory.

7.2.1 Machine Factor

After the input of a Machine Factor M = f/n

- with f (Hz) = signal frequency of the speed transmitter at a determined machine speed
- and n (rpm) = machine speed

the limits for the frequency relay and the measuring range for the frequency/current-converter can be entered directly in rpm.

7.2.2 Minimum Measuring Time

The minimum measuring time determines the minimum time, during which the input frequency is measured. By choosing a longer minimum measuring time, frequency jitter is filtered out, but there results also a delyed step response for the output.

7.2.3 Minimum displayed Measured Value

For an input frequency below the minimum displayed measured value, the measured value displayed on the PC shows „0000“.

7.2.4 Definition of the Alarm

This function allows for the selection, whether only a system error or also a sensor current outside the defined limits of I min. and I max. switches off the „OK“-LED and shows the alarm on the PC as active.

7.2.5 Sensor Current Minimum

As long as the sensor current consumption is above the value I min. , the sensor is considered working properly.

7.2.6 Sensor Current Maximum

As long as the sensor current consumption is below the value I max. , the sensor is considered working properly.

7.2.7 Measuring Range Starting Value

The measuring range starting value („Zero“) means for the FTW 113 the value corresponding to the starting value of the output range, e.g. 0 mA.

7.2.8 Measuring Range End Value

The measuring range end value („Full Scale“) means for the FTW 113 the value corresponding to the full scale value of the output range, e.g. 20 mA.

For a falling transfer function the measuring range end value has to be choosen smaller than the measuring range starting value.

7.2.9 Output Range

For standard converters FTW 113 this range is normally set to "0...20 mA". A different output range may be selected out of the menue, according to the option of the instrument.

7.2.10 Time Constant

At the time of delivery the time constant for the FTW 113 is set to „0“.

In order to smooth out variations on the analog output signal, the selection of a larger time constant allows the activation of a software lowpass filter with the selected time constant.

7.2.11 Status of the Setpoints (Limits)

The frequency relay FTF 123 has a relay output, which can be assigned to one of the two setpoints resp. Limits 1 or 2. For test purposes the Limits can also be deactivated.

7.2.12 Mode of Operation of the Setpoints (Limits 1 and 2)

Each setpoint is defined by an upper and a lower threshold value.

With the mode of operation set to „normal“, an input frequency rising above the upper threshold value activates the Limit and energizes the assigned relay. With the input frequency falling below the lower threshold valu, the Limit is deactivated and the assigned relay is deenergized.

With the mode of operation set to „inverse“, an input frequency rising above the upper threshold value deactivates the Limit and deenergizes the assigned relay. With the input frequency falling below the lower threshold value, the Limit is activated and the assigned relay is energized.

7.2.13 Relay Control

The setpoints and the relay on the FTF 123 are normally controlled by set „A“ of parameters. For testing purpouses or for control purposes of an additional setpoint, a set „B“ may be activated via the binary input. Dependent on the status of the binary input, either connected to 0V (=low) or left open (=high) the control set „B“ or „A“ gets activated.

For reasons of safety the switching over from parameter set „B“ to set „A“ can be delayed by a selectable 0 to 2 000 seconds.

All the functions in set „A“ and „B“ may be defined independent of each other.

With the modes of operation for Limits 1 and 2 identical (e.g. both „normal“ or both „inverse“), the relay control function „Window“ lets the relay get energized only when the measured value lies between the two Limits 1 and 2. With different modes of operation for Limits 1 and 2 (e.g. one „normal“ and the other „inverse“) the relay is deenergized, if the measured value lies between the two Limits 1 and 2.

7.2.14 Acknowledge (only with frequency relays with SW-Version 1.06 or higher)

The binary input on the frequency relay is used for selecting between parameter set „A“ and „B“ (2.7.13) but it may also be used for resetting the relay if a hold-function is selected. Once the relay control was activated, the relay status does no longer change, independent of the input frequency. The relay may be reset by shortly opening resp. closing the binary input (for 0.1 to 0.3 s).
As soon as there is an alarm active, measurements are stopped and the relay gets deenergized, independent of the selected acknowledge function. After the disappearance of the error resp. alarm status the acknowledge function only considers the last correct measured value. Any violation of limit values during alarm are not considered.

7.2.15 Selection of the Display Intervall

The refresh cycle for the display of measured values and states on the PC can be selected in the range of ¼ to 10 seconds.

7.3 Operating Characteristics

7.3.1 Power-on

Analog Output:

After power-on, the output corresponds until the first measurement has been finished to the value determined as measuring range starting value.

Relay outputs with binary input **not activated**

After power-on, the relays stay deenergized or they go in the position defined under „Relay selection“.

- The first positive edge of the input signal starts the first measurement interval.
- After accomplishment of the first measurement, those relays which are related to Limits, switch into their corresponding position.
- If there is no input frequency, after a time of 100 sec (2*period of 0.02 Hz) the relays switch into the position corresponding to "below setpoint low".

Relay outputs with binary input **originally activated** (not yet implemented):

After power-on, the relays stay deenergized or they go in the position defined under relay selection, parameter function B.

- An eventually defined bridge-over time is only starting when the binary input is deactivated, e.g. is opened.

  During all this time the relays are still controlled by the parameter function „B".
- After this time has elapsed, the relays go in the position defined under the parameter function „A“.
- The first positive edge of the input signal starts the first measurement interval.
- After accomplishment of the first measurement, those relays which are related to Limits, switch into the position corresponding to the measured value.
- If there is no input frequency, after a time of 100 sec (2*period of 0.02 Hz) the relays switch into the position corresponding to "measured value below Limit low".
- The delay time is zero, if there is no binary input selected or if the selected binary input is not activated. In these cases the relays get instantly under control of parameter function „A“.

7.3.2 Measuring

- Each measurement starts with a positive edge of the frequency input signal. After elapse of the selected Fix-Time, the next positive edge of the input signal finishes the actual measurement and simultaneously starts the next measurement.
- The total resulting measurement time is computed with a resolution of ± 0.4 µs.
- The calculation and control of the outputs immediately takes place at the beginning of the next measurement.
- Transmission and display of the measured values and states on the screen of the PC are accomplished once during each display interval.
- For input frequencies out of range, the analog output goes to the corresponding extreme value.

7.3.3 Behaviour with activated Hold-Function (Acknowledge)

- Hold-Function with relay function „normal“ and with simultaneous selection of „Relay is hold if active (inactive)“: If the input frequency goes above the upper limit value (or below the lower limit value) the relay changes its state and will be hold in this state, unless it is reset, even if the input frequency goes again below the lower (resp. the upper) limit value.
  The LED displays only, whether the instrument is working correctly (LED bright) or is in error (LED dark)
- The relay is reset by shortly opening and closing again of the binary input (if rela control parameter set „B“ is activated) resp. by shortly closing and opening again of the binary input (if relay control parameter set „A“ is activated) for a time between 0.1 ... 0.3 s.

If the binary input is opened (resp. closed) for a time longer than 0.3 s , the relay control parameter set „A“ (resp. „B“) will get active and the communicated (on the PC displayed) values and the relay and the LED will go without further resetting via the binary input or by power-on-reset to the actual states corresponding to the relay control parameter set „A“ (resp. „B“)

7.3.4 Sensor Failure

The FT100 fault behaviour is in part a function of the software configuration.

- If the input signal suddenly fails, the resultant conditions are as follows:

  FTW 113

Output range		Alarm =		Status with no sensor signal	
0..20mA	4..20mA	System	System or Sensor	LED	Output current/voltage
X		X		On	0mA/0V
	X	X		On	4mA/2V
X			X	On	0mA/0V
	X		X	On	4mA/2V

  The transition to final condition follows an approximate exponential function.

  FTF 123

Alarm =		Status with Sensor Fault	
System	System or Sensor	LED	Relay
X		On	De-energised
	X	Off	De-energised

- With Alarm = System or Sensor and sensor failure determined by the sensor current being outside of the configured Imin, Imax values, the resultant conditions are:

  FTW 113

Output range		Alarm =		Status with no sensor signal	
0..20mA	4..20mA	System	System or Sensor	LED	Output current/voltage
X		X		On	0mA/0V
	X	X		On	4mA/2V
X			X	Off	0mA/0V
	X		X	Off	0mA/0V

  An output of 0mA with configured range of 4..20mA is thereby a clearly detectable fault condition.

  FTF 123

Alarm =		Status with Sensor Fault	
System	System or Sensor	LED	Relay
X		On	De-energised
	X	Off	De-energised

7.3.5 System Alarm

- If the microprocessor detects a RAM, ROM or EEPROM Checksum error, the measured value is set to 0 rpm and the output goes to its lowest level (0mA, or 4mA, or 0V, or 2V), and the relays get deenergized .

7.3.6 Power Failure

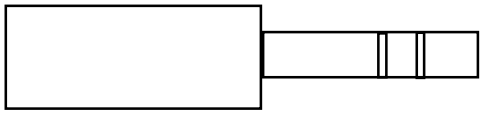
- For power supply interruptions longer than the maximum allowable time, the analog output will go to 0mA resp. 0V and the relays get deenergized. When the supply voltage returns above the specified minimum level, the instrument will go through its initialization routines according to paragraph „Power-on“.
- A break-down of the internal supply-voltage due to a power supply voltage below the specified minimum level will be detected as a power-failure.

7.4 Communikation with the PC

Any communication via the serial RS 232 - interface is initiated by the PC.

Transmission speed:	2400 Baud
Parity - Bit:	keines
Data - Bits:	8
Stop-Bits:	2
Connector Type:	3,5 mm stereo headphone

Connection Diagram: GND RXD TXD



The connection diagram of the ear phone connector on the instrument displays the names with respect to the instrument port. The instrument's RXD has to be connected with the PC's TXD and vice versa.

The FT 100 instrument does not generate the standard RS 232 signal (-5V ... +5V). Instead RXD has a 5V - CMOS level, which is compatible with most Pcs, as long as the cable length is below 2 m.

A detailed documentation (**article number 376A-72662**, drawing number 4-111.522) is available, where the syntax and the commands are fully explained.

7.5 Calibration of Frequency Measurement

The instrument was adjusted at the manufacturing site, and the calibration data are stored within the EEPROM.

The instrument does not have any manually adjustable components; erraneaous measurement values can get readjusted only at the manufacturing site.

7.5.1 Calibration Instrument

- Source of frequency:

  Highprecision-Frequency-Generator or LF-Generator with Digital tachometer with accuracy class 0.05% or better, with respect to the output frequency. For reduced requirements with respect to the accuracy, the calibration can also take place with the speed sensor mounted at the machine and its output frequency supervised by a Digital tachometer. In any case **The Machine Factor M** is to be considered, i.e. the relation between the frequency f and and the corresponding measuring value (e.g. rotational speed n).

- Measurement of the output current or voltage with the converter FTW 113:

  Highprecision Multimeter with accuracy class 0.05%. or better, or the definite instrument used for indicating the measured value. In this way measuring range errors of the definitive instrument are automatically compensated, and the accuracy of the measuring chain depends only on the precision of the frequency source.

7.5.2 Components influencing the Measuring Precision

- Quartz Crystal (X1):

Temperature tolerance	± 10 ppm over the whole temperature range
Longterm drift	± 5 ppm/year
Failure rate	< 15 fit

- Reference voltage source (U11, SR 25 D):

Temperature drift	± 50 ppm/Grad K
Longterm drift typ.	1 ppm/1´000 Std
Failure rate	< 4,5 fit

- Precision resistor (.....):

Temperature drift	± 50 ppm/Grad K
Longterm drift	< + 500 ppm/Jahr
Failure rate	< 0,7 fit

7.5.3 Calibration Procedure

Before starting the calibration, the instruments are connected to the specified frequency source and the multimeter according to the connection diagram 4-111.701.

Compare the displayed values with the theoretical values and record any differences.

- Calibration of the analog output:

  Set input frequency according to the configured starting value (zero):
  Actual measured value = starting value
  Analog output value = 0.00% (display only with FTW 113)
  Input frequency **below** the value configured under " Minimum displayed Measured Value" will be displayed as "0000".
  The analog output with FTW 113 should correspond to the defined starting value.

  Set input frequency according to the configured end value (full scale):
  Actual measured value = end value
  Analog output value = 100.00% (display only with FTW 113)
  The analog output with FTW 113 should correspond to the defined end value.

  Set input frequency **in the middle between** the configured starting and end values:
  Actual value = mean value
  Analog output value = 50.00% (display only with FTW 113)
  The analog output with FTW 113 should correspond to the defined mean value.

  Differing displays or output values can only be readjusted at the manufacturing site.

- Calibration of the setpoints:

  Set status "on". When slowly changing the input frequency from lower to higher values, relays with "normal" function should get energized and relays with "inverse" function should get deenergized.

  When slowly changing the input frequency from higher to lower values, relays with "normal" function should get deenergized and relays with "inverse" function should get energized.

  Actual display fo the end values resp. relay status: "active" when energized
  "inactive" when deenergized

  Differing setpoints can only be readjusted at the manufacturing site.

7.6 Calibration of Sensor Monitoring Functions

The instrument was calibrated at the manufacturing site, and the calibration data are stored within the EEPROM.

The instruments do not have any manually adjustable components; erraneous measurement values can get readjusted only at the manufacturing site.

7.5.1 Calibration Instruments

- Measurement of the sensor limits for the sensor current monitor
  Digital Multimeter with accuracy class better than 0.1%:
- Load resistor, 470 Ohm/0.5 W
- Variable load resistor, 1 kOhm/ 100 mA/ 0.5 W

  The 470 Ohm resistor is wired in series to the 1 kOhm resistor and thus limits the current to max. 25 mA.
- Variable load resistor, 50 kOhm/ 15 mA/ 0.5 W

  The 1 kOhm resistor is wired in series to the 50 kOhm resistor and thus limits the current to max. 12 mA.

7.5.2 Components influencing the Measuring Precision

- A/D Converter (within µController U6, 68HC11A1):

Resolution	1/256	= 8 bit
Non-linearity		± ½ bit
Zero point error		± ½ bit
End value error		± ½ bit
max. cumulated error		± 1 bit over the whole temperature range

- Reference voltage source (78L05):

Precision	± 10% over the whole temperature range
Longterm drift	< ± 12 mV/ 1'000 hours
Failure rate	< 200 fit

- Precision resistor (.....):

Temperature drift	± 50 ppm/degree K
Longterm drift	< + 500 ppm/year
Failure rate	< 0,7 fit

7.6.3 Calibration Procedure

Compare the measured values with the defined values and record any differences:

- The sensor supply voltage (+V) is measured unloaded and with a load of 25 mA.

  A differing supply voltage can be readjusted only at the manufacturing site.

  With a supply current exceeding 25 mA, the output voltage gets reduced:
- The sensor supply current is measured for different loads:

  If the load current exceeds Imax or if it falls short of Imin, the display "alarm messages" shows sensor monitoring activated.

Differing limits can only be readjusted at the manufacturing site

8 Mechanical Construction

The housing consists in front of a frame with terminals and a protective cover with fixing elements for mounting rails.

Internally the terminals are directly connected to the board. This board is fixed by guide strips of the protective cover.

9 Description of the Electronic Circuitry

Schematic 4-111. .... Page 1/2

- Input filter and stabilization for the +15V power supply:
  noise filter
  protection against overvoltage and false polarity
  bypass capacitor
  switched mode regulator for 150 mA
- +12 V power supply:
  linear regulator for 100 mA
- +5V power supply:
  linear regulator for 50 mA

Watchdog and sensor current monitor:
CPU reset is generated if the +5V supply voltage goes below 4.4V (output RES low)
CPU reset is stopped 200ms after the +5V supply voltage is above 4.4V (output RES high)
Interrupt request XIRQ is generated, if signal WDI does not switch over at least once per second (output WDO low)
Interrupt request IRQ is generated, if the +12V power supply goes below 11.7V (output PWF low)

- Micro-Controller:
  internal 256 bytes RAM and 512 bytes EEPROM
  8-channel 8 bit A/D-converter
  serial interface
  input capture-pulse accumulator
  PWM output
  running in the extended multiplex-mode
  quarz frequency 12 MHz
  clock cycle 333,3ns
  adress-demultiplexer
  8 kByte EPROM
- RS 232 serial interface:
  with protective circuit
  5V CMOS - level
- Binary input:
  with pull-up resistor
  with protective circuit
- PWM-enhance:
  only with FTW 113
  see PWM-output on schematic page 2
- Relay output:
  only with FTF 123

Schematic 4-111. .... Page 2/2

- Sensor power supply and Signal input:
  input filter
  protection against false polarity and overvoltage
  shunt and difference amplifier for sensor current monitoring
  current limiter
  code switch for selection of input options
  schmitt-trigger
- PWM-output:
  mean value on the output of the PWM-enhance circuit = 0 ... +2.5V
  12 bit resolution
  Micro-Controller PWM-output: 10 bit with 3 MHz/4096 = 732 Hz PWM-frequency
  PWM-enhance output: 12 bit with 12 MHz/4096 = 2928 Hz PWM-frequency
  Bessel lowpass filter of sixth order
- Current output:
  unipolar current transmitter
  zero adjustment via P1
  full scale adjustment via P2
  noise suppression
  protection against false polarity and over voltage
- Option Voltage Output:
  Source-follower
  zero adjustment via P3
  full scale adjustment via P1
  noise suppression
  protection against false polarity and over voltage

10 Maintenance

These instruments don´t need any maintenance since thye have very low driftrates and they contain neither batteries nor other components subject to wear.

When cleaning the instruments mind the limited protection against accidental electrical shock! Whenever possible the power supply should be interrupted during cleaning.

For cleaning the surfaces use only spirit, pure alcohol or soap-suds. Other solvents must not be used.

11 Repair

Warning: Disassembly must only take place with power supply disconnected!
Capacitors inside the apparatus may still be charged, even if the apparatus has been disconnected from all voltage sources.

Based on the description in section 9 errors may be assigned to the functional blocks in the schematic. Normally an error may only be repaired by exchanging the defective electronic component. In the field for this reason preferably the whole instrument is exchanged instead of trying to repair the instrument.

Both sides of the housing have to be pushed outward by means of a thin screwdriver or similar, thereby loosening the walls from the black terminal blocks. Then both catches on both sides of the housing are also to be pushed outward, whilst pulling the terminal blocks out of the housing. Thereby the whole electronics are lifted out of the housing.

Warning: The printed circuit of the instrument has mainly SMD comonents. These are hard to exchange without special tools, therefore preferably the printed circuit board or even the whole instrument is exchanged by a good one. Besides, due to the SMD components and the partially complex electronic functions the fixing of the defective component on the printed circuit board is rather tedious.

For remounting the instrument the steps are reversed. When pushing the electronics into the housing mind the printed circuit to slide in the slot of the housing. After the catches have snapped in, both side walls of the housing have to be pressed against the terminal blocks in order to snap in.

When connecting the mains, mind the safety instructions according to paragraphs 1 and 6 !

The converters FTW 113 have only at the output manually adjustable components for the zero point and the end value; erraneous measurement values can get readjusted only at the manufacturing site.

The frequency relays FTF 123 don´t have any manually adjustable components; erraneous measurement values can get readjusted only at the manufacturing site.

12 Storage

The storage temperature of -25 ... +70 degrees C applies for long-term storage.

For short intervals of at maximum one day, the instrument may be exposed to a temperature within the range of -40 ... +90 degrees C. At excess temperatures any mechanical stress is absolutely prohibited.

When quickly cooling the instrument, dew may considerably reduce the the isolation between the galvanically separated circuits.

13 Warranty

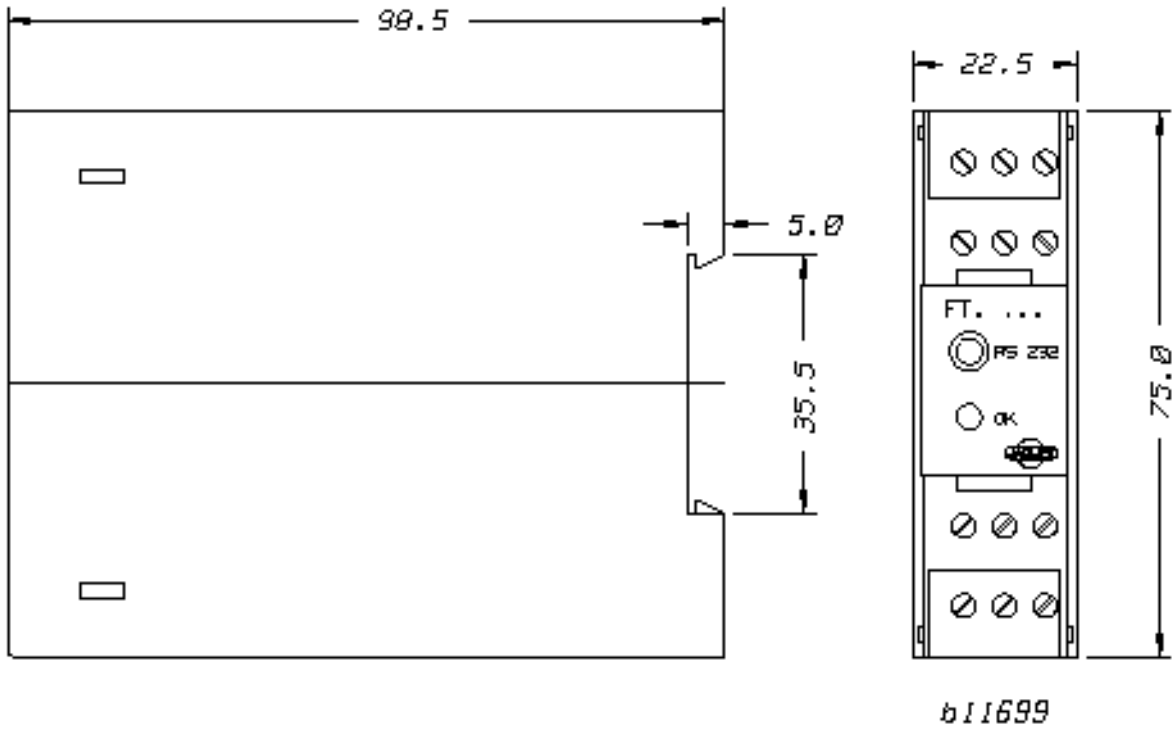
The guarantee for a careful and perfect execution of the delivered products includes the replacement or repair of instruments showing a manufacturing defect, agreed upon by JAQUET, within a period of 12 (twelve) months from date of delivery.

Travelling and labour costs are excluded from the guarantee. The garantee also does not cover any damage due to misuse or to improper handling.

Complaints due to visible defects are only accepted if adressed to JAQUET within 14 days after receipt of the goods.

14 Drawings

Dimensions



Connection diagrams and layout