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Operating Instructions No. 492 E
Speed measuring and switching instruments Type Series FT 1600

General
Rotational speed measuring and switching instruments FT 1600 are microprocessor-controlled and operate on the period measurement principle, with subsequent reciprocal formation (the computing principle). The number of periods involved in a measurement depends on the level of the input frequency (see Diagram 4-110.336) The advantage of the computing principle is that a high input frequency is not required, even for fine resolution of the measured value.

Safety note
Rotational speed measuring and switching instruments FT 1600 comply with Class of Protection I; they require that a protective ground conductor be connected without fail. They were developed and tested according to IEC Publication 348 and have left the factory in perfect condition. These Operating Instructions contain information and hazard warnings which, when observed, will ensure safety of the relevant instrument and safe operation. If the condition of an instrument is in doubt as a result of electrical, climatic or mechanical overload the instrument must be taken out of service immediately and handed over to the manufacturer or his representative for repair.

General technical data (applies to all instruments)

Housing: Plastic housing for optional mounting on rails in accordance with DIN 46277/3 or 50022, or on mounting plate in accordance with DIN 43660 and 46121, Type of Protection IP 50 to DIN 40050. Terminals with self-lifting connection plates for 2,5 mm2 or 2 x 1.5 mm2 stranded conductor; type of protection for terminals: IP 10.

Supply voltages:
AC 230: 230 V +15 %/-20 %, 47 to 63 Hz
AC 115: 115 V +15 %/-20 %, 47 to 63 Hz
DC 24: 18 to 33 V DC

Supply voltage interruptions of 50 ms at a max.undervoltage of 20 % AC or 5 ms at minimum DC voltage can be withstood without instrument malfunction.

Power consumption: AC approx. 6 VA, DC approx. 3 Watts.

Electromagnetic compatibility		mains	frequency entry
according to IEC 255-4	common mode	2,5 kVs	2,8 kVs
	series mode	1,0 kVs	---
according to IEC 801-4	common mode	2,0 kVs	1,0 kVs

Pulse transmitter connection (frequency input):
Floating, for connection of NAMUR transmitters in accordance with DIN 19234, switching threshold at I_{th} 1.6 mA or (jumper-program-

mable) proximity switches with npn transistor output or pulse transmitters with amplifier, trigger level U_{LO} = -60 to +0.8 V, U_{HI} = +3.6 to +60 V.
Built-in transmitter power supply: +12 V, rated at 25 mA (up to 35 mA at max. ambient temperature of + 50° C).
Option: Intrinsically safe frequency input (EEX ia) II C (without +12 V transmitter supply)

Pulse output: Floating open-collector output with U_{LO} = 0.4 V max. at 2.5 mA sink current, U_{max} = +24 V. Further speed measuring and switching instruments may be connected to this output (cascade connection). The frequency entry of the instruments to be connected must meet the following specifications:
-NAMUR entry or
-AC-coupled entry with pull-up resistor = 680 Ohm or
-DC-coupled entry with pull-up resistor = 4,7 kOhm and trigger level U_{LO} = 0,8 V.
Reset input (RES, for startup bridging, only in frequency relay and in speed monitor): Same electrical data as for the frequency input.

Climatic conditions
KVE in accordance with DIN 40040, storage temperature -25 to +65°C relative air humidity 75 % yearly average, up to 95% during a maximum of 30 days.
Ambient temperature: 0 to 55°C with 25mA max.load on transmitter power supply, 0 to 50°C at 35 mA.
Temperature drift: **FTF 1623/FTR 1643:** max. of 150 ppm/°K
FTW 1613: typ. 150 ppm/°K, max. of 300 ppm/°K but not greater than +/- 0.5 % between 0 and 50°C.

Installation
The instrument should be installed at a chemically and physically neutral location. It must not be subjected to direct solar radiation. Any mounting position is permissible.

Connections
The AC line and pulse transmitter are connected at screw terminals as shown in Diagram 4-110.335 The protective ground conductor should be connected to Terminal 3 before the phase and neutral conductor are connected. The instrument may only be operated in the permanently installed state, and the AC power cable must be fitted with a suitable switch. Before switching on, check that the AC line voltage is the same as the instrument voltage.
Caution: Any open-circuit in the protective ground conductor, outside or inside the instrument, will impair safety and can place persons and objects at risk. Deliberate interruption of the protective ground conductor is prohibited.
Test voltages: Between ground/AC line: 2000 V/50 Hz/1 min.
between ground/current output 500 V/50 Hz/1 min.
For interference rejection, the transmitter cable shield must be connected to the reference potential of the input amplifier via Terminal 12.

Programming the parameters (Diagram 4-110.334)
Unless otherwise specified, the instruments of type series FT 1600 are supplied with standard setting parameters:
Pulse transmitter connection and reset input for connecting NAMUR* transmitters

End-of-range frequency FTW 1613: 0 to 1000 Hz/4* to 20mA
Switching point FTF 1623: 500 Hz
Switching point FTR 1643: 50 p/0.1 s
Hysteresis FTF 1623/FTR 1643: 1 %
Relay function FTF 1623/FTR 1643: Normal*
Startup bridging FTF 1623/FTR 1643: 1 s, relay OFF
Power-on-reset FTF1623/FTR1643: ON*
Variables marked * can only be changed after unscrewing the screw at the front and lifting off the front panel.

Dismantling the instruments
All parameters and functions can be set with the front panel lifted off. Further dismantling is only necessary to replace a fault fuse.
Caution: The instrument may only be dismantled with power supply removed. Inside the instrument there are capacitors which remain live even when the supply has been removed. The two Phillips screws at the corners of the housing should be unscrewed. The two snap-on seats on the side of the housing can then be released with a screwdriver and the housing cover can be lifted off forwards. The entire electronics assembly can then be lifted out.

Instrument-related technical data

Frequency-current converter FTW 1613
Programmable parameters:
- End-of-range frequency: Lowest 0.999 Hz, highest 29.9 kHz
  Set at the front by means of 4 coding switches (mantissa, 3-decade and exponent)
- Output current range: Optionally 0 to 20 or 4 to 20 mA
- Pulse transmitter connection.

Current output: Floating, maximum load 500 ohms, maximum load voltage 10 V, maximum no-load voltage 20 V. Maximum linearity error 0.2 %, programming by means of OUTPUT jumper according to drawing No. 4-110.334.
Response time (reaction time): This is the sum of the measuring time (Zmax) and computing time (5 ms). If the input frequency is suddenly and fully removed, the output current goes to scale zero in steps, approximating an e function, as soon as the measuring time for the new measured value becomes longer than 2, 4, 8 -... times the last measuring time.

Frequency relay FTF 1623
Programmable parameters:
- Switching point between 0.002 Hz and 29.9kHz
  Set at the front by means of 4 coding switches (mantissa, 3-decade and exponent).
- Hysteresis 1% or 5 % referred to the set value. Set at the front by means of the coding switches. The hysteresis is only effective when the input frequency is increasing.
- Normal or inverse relay function
- Startup bridging: Time 1 s to 1800 s, relay function ON/OFF
- Power-on reset: ON/OFF
- Pulse transmitter connection

Accuracy of switchingpoint: 0.5 % referred to the set value.
Switching contact: 1 changeover, max.of 250 V, 1A, 50 W.
With an inductive load, an external spark suppressor must be fitted. An LED at the front indicates the control state (active

when the switching point has been exceeded). The relay is a monostable device and picks up when the set switching point is exceeded. The inverse function can be programmed by means of an internal RELAY jumper, i.e. the relay drops out when the switching point is exceeded.
Switching delay (reaction time): This is the sum of measuring time (Zmax), computing time and switching delay of the relay (13 ms). If the input frequency is suddenly and fully removed, an indication is given that the frequency has dropped below the switching point after one period of the switching frequency.
Startup bridging and relay function: A startup bridging time and the relay position during this time can be selected by means of coding switches. The relay position is independent of the programmed normal/inverse function. The startup bridging time begins with the enable signal, i.e. opening of the reset input. Additionally, the time can be started by applying auxiliary power (power-on reset ON, programmable via jumper P.O.R in accordance with drawing No. 4-110.334).

When the bridging time has elapsed, the first positive-going edge at the frequency input starts the first measurement. The relay only goes to the appropriate setting when this measurement is completed.

Speed monitor FTR 1643
Programmable parameters:
- Switching point: Number of pulses (=ZZ) range 1 to 100 (=00) per time division (T=0.1/0.3/1/4/20/120/600/3600 s), settable on 3 coding switches.
- Hysteresis 1 % or 5 %; set by means of coding switches for the time division of pulse rate ZZ/T. The hysteresis is only effective, when the input frequency is increasing.
- Startup bridging 1 s to 1800 s, relay function ON/OFF.
- Power-on reset ON/OFF.
- Relay function normal/inverse.
- Pulse transmitter connection.

The remaining technical data are the same as for frequency relay FTF 1623.

Calculating the values for setting parameters
End-of-range frequency (frequency-current converter FTW 1613) or frequency-dependent switching point (frequency relay FTF 1623):

$$f = \frac{n \cdot p}{60} \text{ (Hz)}$$

where n = End-of-range speed of rotor in rpm
p = Number of poles of rotor or number of pulses per revolution.

Frequency f (Hz)	Coding switch settings Mantissa	Exponent
0.100 to 0.999		$-3 = 10^{3}$
1.00 to 9.99	100 to 999 according	$-2 = 10^{2}$
10.0 to 99.9	to desired frequency	$-1 = 10^{1}$
100 to 999		$0 = 10^{0}=1$
1000 to 9990		$1 = 10^{1}$
10000 to 29900		$2 = 10^{2}$

Switching point for speed monitor FTR 1643

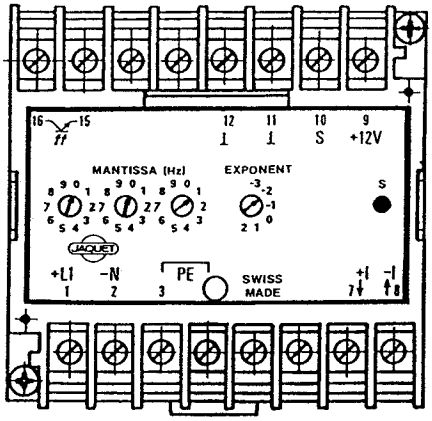
$$\frac{ZZ}{T} = \frac{ns \cdot p}{60}$$

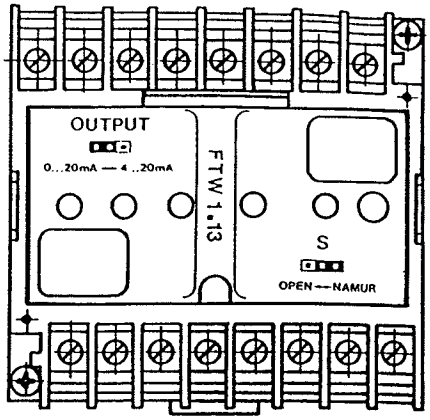
Where ZZ = Number of pulses per time division.
T = Time division
ns = Speed in rpm to be monitored
p = Number of poles of rotor or pulses per revolution

Optimum measuring accuracy is achieved with the greatest possible mantissa or ZZ.

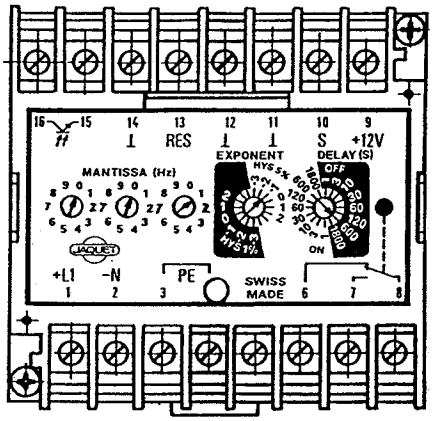
7.10.92 HB

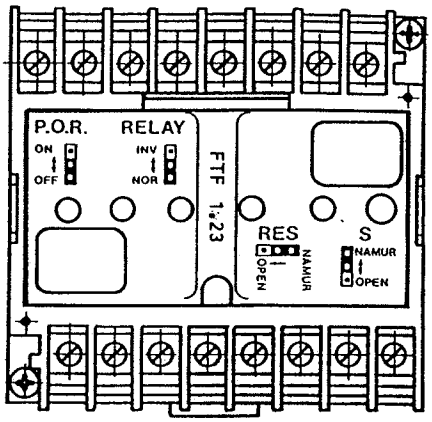
FTW 1613



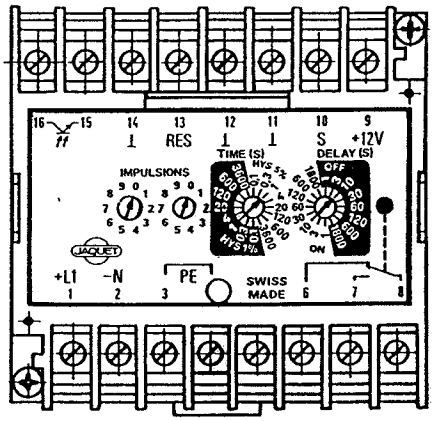


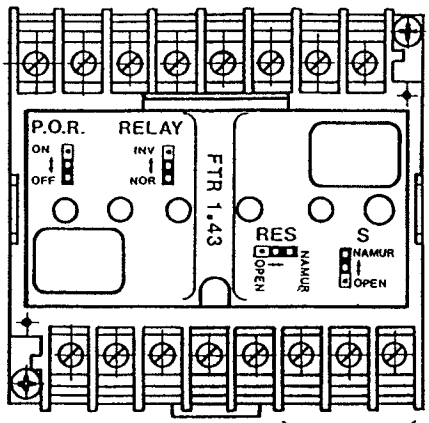
FTF 1623





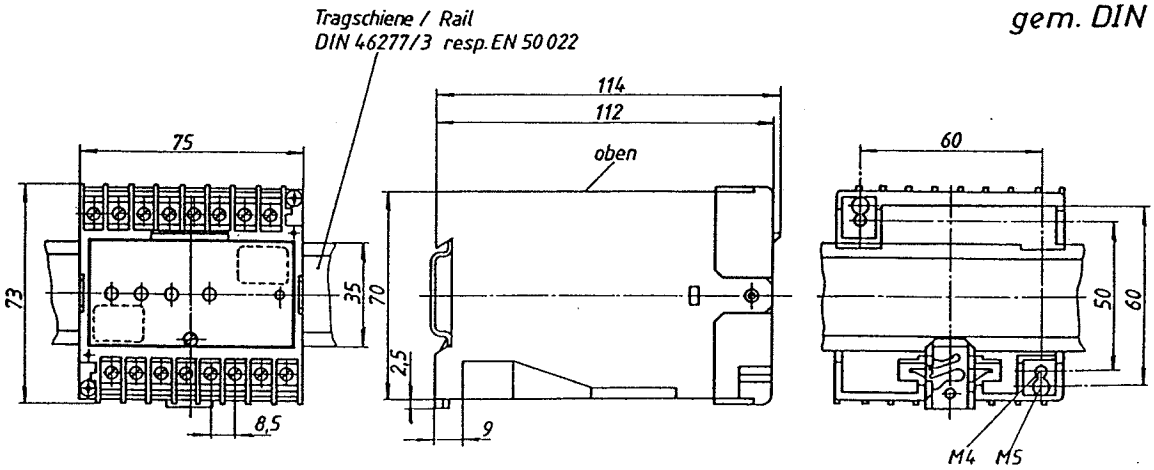
FTR 1643





bei Ex-Option festprogrammiert zum Anschluss von NAMUR-Gebern gem. DIN 19234

Massbild / Dimensions FT 1600

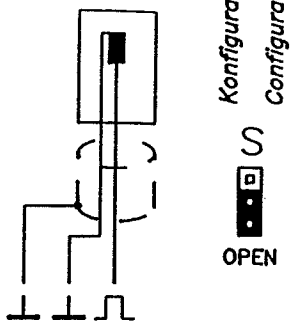


ANSCHLUSS DER IMPULSGEBER
TRANSMITTER CONNECTIONS
RACCORDEMENT DES TRANSMETTEURS

ZUSAMMENSCHALTUNG MEHRERER GERAETE
CONNECTION OF SEVERAL UNITS
RACCORDEMENT DE PLUSIEURS APPAREILS

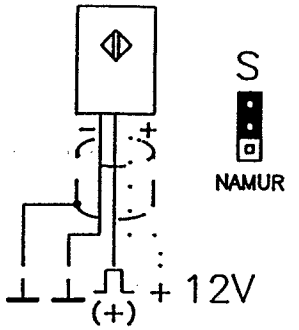
Elektromagnetischer Geber bei
Electromagnetic transmitter with
Transmetteur électromagnetique avec

n ≥ ...RPM ≙ U >4Vs resp. >8Vss

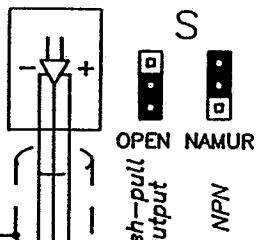


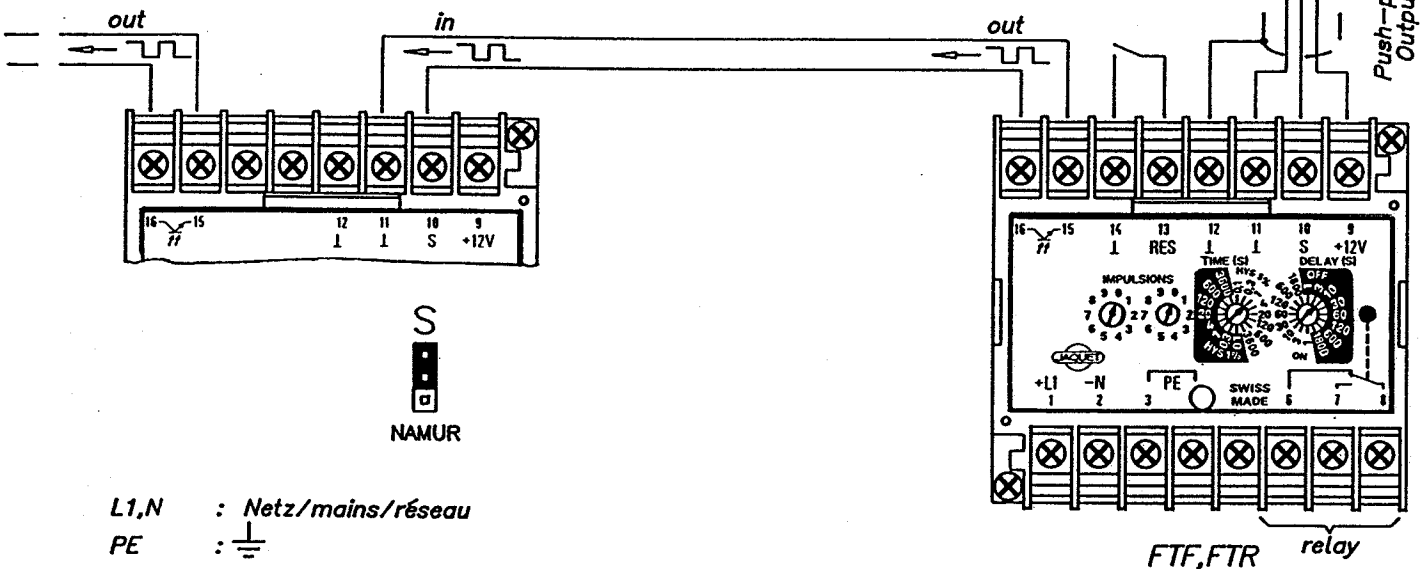
Zweidraht-,HF-,NAMUR-Geber
Two-wire-,HF-,NAMUR-transmitter
transmetteur à deux fils,HF,NAMUR

Näherungsinitiator mit NPN - Ausgang
Proximity switch with NPN - output
Détecteur de proximité avec sortie NPN

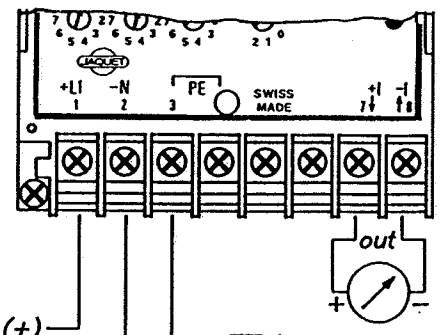


Geber mit Verstärker
Transmitter with amplifier
transmetteur avec amplificateur





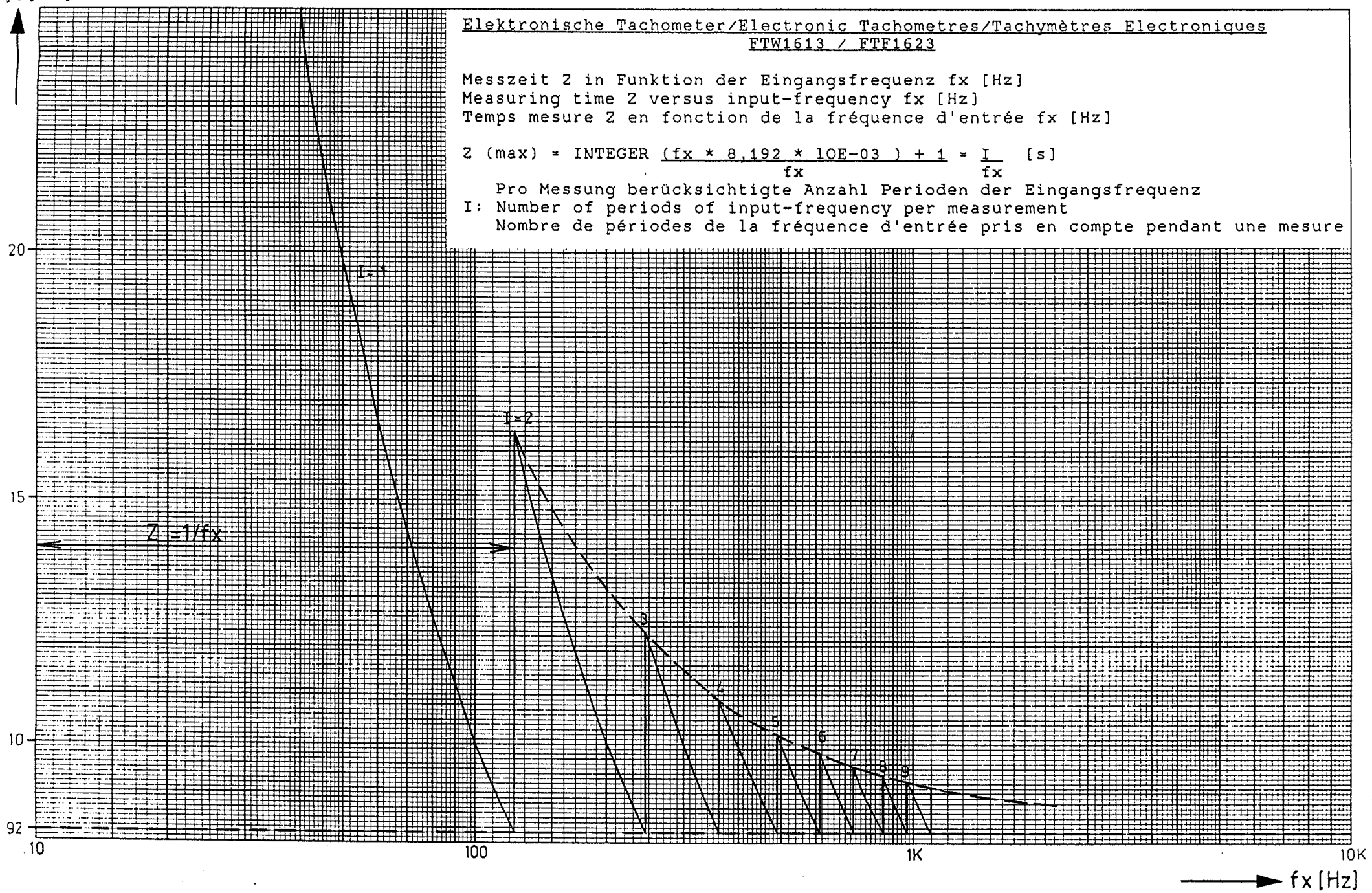
L1,N : Netz/mains/réseau
PE : ⏚
S ⊓⊔ : } Geber
⊥ 0V : } Transmitter
+12V : } Transmetteur
RES : Reset
// : ⊓⊔ out



Sicherung	*AC 230V*	*T 32mA*	
Fuse	*AC 115V*	*T 63mA*	
Fusible	*DC 24V*	*T 500mA*	

Netz mains réseau
Phase (+)
Null/neutral/neutre (-)
Erde/ground/terre ⏚

FTW



Elektronische Tachometer/Electronic Tachometres/Tachymètres Electroniques
FTW1613 / FTF1623

Messzeit Z in Funktion der Eingangsfrequenz fx [Hz]
Measuring time Z versus input-frequency fx [Hz]
Temps mesure Z en fonction de la fréquence d'entrée fx [Hz]

$$Z\ (max) = \text{INTEGER}\ \frac{(fx * 8{,}192 * 10E\text{-}03) + 1}{fx} = \frac{I}{fx}\ [s]$$

I: Pro Messung berücksichtigte Anzahl Perioden der Eingangsfrequenz
Number of periods of input-frequency per measurement
Nombre de périodes de la fréquence d'entrée pris en compte pendant une mesure

Sach.Nr. 354

4-110.336