CONTENTS

1 General Information

1.1 ⚠ Safety Instructions

Wherever you see this sign ⚠ you will find information on potential hazards. Please read these sections with particular care!

⚠ **Warning!** Before opening the instrument disconnect the mains plug!

⚠ **Attention!** If the fuse has to be changed, use only G fuse-link 5 × 20 according to IEC 127 (see 4.1)!

1.2 ⚠ Switching the Operating Voltage 230 V~/115 V~

Your instrument left the factory to 230 V~. Switching to 115 V~ requires the instrument to be opened, which should only be done by trained personnel.

Setting the Operating Voltage 115 V~

1. Disconnect the instrument from the mains.
2. Remove upper caps and loosen the screws below.
3. Identify the mains voltage switch with the following illustration.
4. Switch the voltage mains voltage switch (slide switch) located under the power switch to the indication “115”.
5. Remove safety cover at the mains plug and replace the fuse with the fuse for 115 V supplied with the instrument.
6. Fasten upper caps and put the sticker supplied with the instrument for marking the switch-over to 115 V on to the type label.

Mains Voltage Switch

115 V position

230 V position

1.3 ⚠ Mains Connection

The design of the unit meets the requirements of safety class I according to EN 61010-1, i. e. all metal parts accessible from outside and exposed to contact are connected with the protective conducto of the supply network.
Power is supplied via a mains cable with earthing contact.

1.4 Installing the Power Supply Unit

The unit should not be operated close to equipment that develops heat.

1.5 Switching on

The unit is switched on using the power switch at the front. The power switch separates the unit completely from the primary side of the transformer.
The LED *ON/OFF* serves as an operation indicator.

1.6 EMC

The unit is interference-free according to the EN 50081-1 and EN 50082-1. In order to fulfil the limiting values in line with present standards, it is absolutely necessary that only cables which are in perfect condition be connected to the unit. The following information applies here:

- Metallic or metallized socket cases must be used for interface RS-232C. The socket cases and the braided screen of the cables must be connected at the shortest distance possible. The signal earth must not be connected to the braided screen.
- After opening and closing the unit ensure that if all the fixing parts and contact springs are installed as before that all the screws are fixed and tightly.

1.7 Inspection and Maintenance

If service is needed, due attention should be paid to the regulations according to VDE 0701. The unit should only be repaired by trained personnel.

1.8 Warranty

DIGIMESS guarantees the perfect working order of the unit for 12 months as from delivery.
There is no warranty for faults arising from improper operation or from changes made to the unit or from inappropriate application.
If a fault occurs please contact or send your unit to:

The unit should be sent in appropriate packing - if possible in the original packing. Please enclose a detailed fault report (functions working incorrectly, deviating specifications and so on) including unit type and serial number.
Kindly verify warranty cases by enclosing your supply delivery note. Any repairs carried out without reference to a valid warranty will initially be at the owner's expense.
Should the warranty have expired, we will, of course, be glad to repair the unit as per our General Terms Of Assembly And Service.

1.9 Delivered Accessories

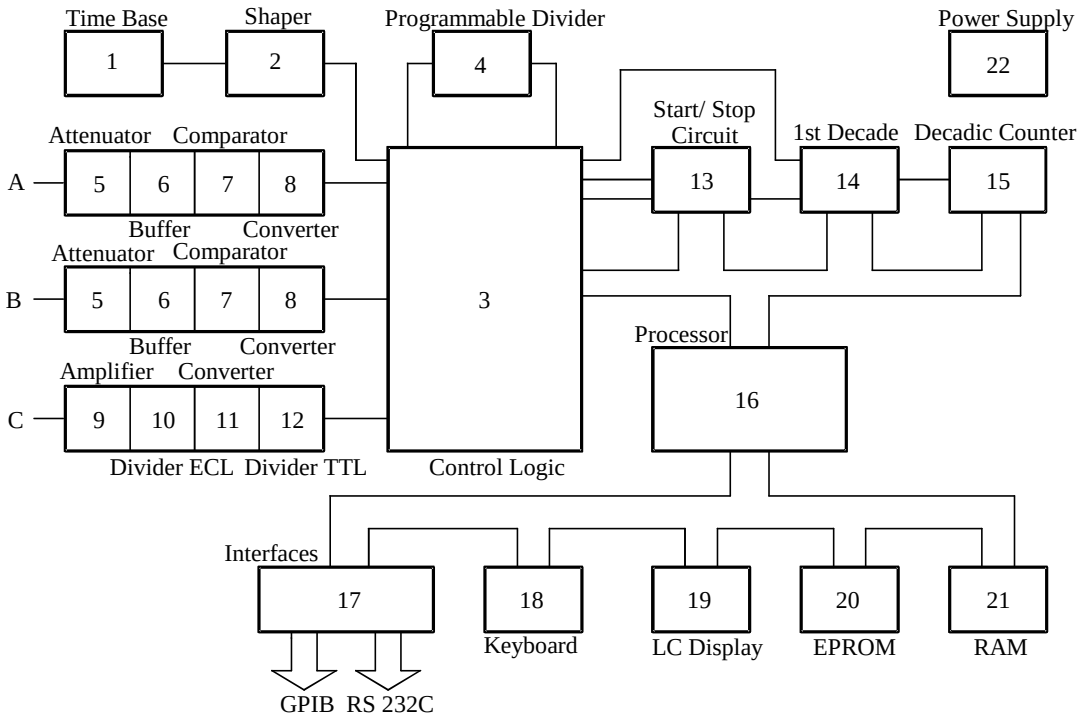
1 mains cable
1 fine-wire fuse (T 200 L/250 V)
2 fine-wire fuses (T 400 L/250 V)
2 coaxial cables
1 operating instructions
1 label for indicating the switch-over to 115 V

2 Application

The desk-top measuring instrument UZ 2500 is a compact three-channel counter controlled by a micro-processor which allows frequency measurements of periodic signals via channels A and B within the range of 10 Hz to 100 MHz and via channel C from 50 MHz to 2.4 GHz. Frequency ratios can be measured between channels A and B or C and B.
Moreover, it is possible to measure the period length of periodic signals from 1 µs to100 ms as well as time intervals from 1 µs to100 s. Pulses from 1 to 10^9 can also be counted via channels A and B.
The trigger level can be set and measuring amplitudes up to $V_{PP} \leq 50$ V can be attenuated at the ratio of 10:1 on channels A and B.
Functions and measuring ranges can be set by means of 8 buttons via a menu and they are clearly displayed on a two-line alphanumeric LC matrix display.
The units standard equipment includes a parallel interface GPIB (IEEE 488.2) for measuring systems and a serial interface RS-232C for communicating with superior systems. With the exception of trigger level settings for channels A and B, all functions and parameters can be set, measurements performed and measured values as well as the states of the unit can be transferred.

3 Configuration and Functional Description

3.1 Block Diagram



3.2 Description

The internal measuring operation of the unit is controlled by a one-chip microprocessor MCS-51 (16) with the help of additional circuits. The time base (1), which is supplied with the frequency standard of 10 MHz (1), provides precise frequencies for the measuring intervals. This nominal frequency is led to the switch and control logic circuit (3) via the shaper (2).

The structure of channels A and B is identical. First the measuring signal is adapted by attenuator (5) and voltage amplifier (6). The output signal of the voltage amplifier is led to the comparator (7). The input signal is converted into a logic signal at ECL level in response to the setting of the trigger level. This signal is converted from ECL to TTL level in the converter (8), and is led to the input of the switch and control logic (3).

The measuring signal passing through channel C is also adapted (9), and led to a fast ECL divider (10) and converted from ECL to TTL (11). Before passing the switch and control logic the high-frequency signal is divided once more (12).

The input signals are divided in a high-speed predivider 1:10 (14) in response to the condition of the programmable divider (4) and the start/stop circuit (13) which generates measuring intervals. Then the signal is evaluated by a decadic counter (15). The processor (16) organizes the reading of the keyboard (20), the setting of the control logic (3), the resetting of the counting decades (14, 15), the visualization on an alphanumeric LC display (19) and the repetition of the measurement. The processor loads and saves the system parameters with the help of EPROM (20) and RAM (21).

The unit can also communicate with superior systems via parallel interface GPIB and the serial interface RS-232C (17).

4 Technical Data

4.1 General Data

Nominal temperature:	+ 23 °C ± 2 °C
Operating temperature:	+ 5 to + 40 °C
Relative humidity:	20 to 80 %
Atmospheric pressure:	86 to 106 kPa
Operating position:	horizontal or inclined by ± 15 °
Operating voltage:	sinusoidal alternating voltage (distortion factor < 5 %) 115/230 V (+ 10 %/– 15 %), internally switchable, 47 to 63 Hz (± 5 %)
Power consumption:	40 VA (max. 30 W)
Fuses:	T 200 L/250 V (230 V~) T 400 L/250 V (115 V~)
Safety class:	1, according to DIN EN 61010 Part 1
Radio interference suppression:	EN 55011 Class B
Dimensions (L × H × D):	290 mm × 120 mm × 260 mm
Dimensions of packing:	335 mm × 125 mm × 385 mm
Weight of universal counter:	about 3.8 kg
Weight incl. packing and accessories:	about 6.0 kg

4.2 Specifications

4.2.1 Characteristics of Channel A

Frequency range:	10 Hz to 100 MHz
Basic sensitivity:	V_{rms} = 25 mV (sine signal)
(Voltage divider 1:1):	V_{pp} = 75 mV on pulses with minimal width of ≥10 ns
Coupling:	a.c. voltage
Input impedance:	1 MΩ (< 40 pF)
Input divider:	1:1 or 10:1
Dynamic range:	75 mV ≤ V_{pp} ≤ 5 V
(with divider 10:1):	750 mV ≤ V_{pp} ≤ 50 V
Maximum input voltage:	50 V ($V_{=}$ + V_{pp})
	8 V (V_{rms}) with divider 1:1, f > 100 kHz
Trigger edge:	rising or falling
Trigger level setting:	adjustable by potentiometer
(voltage divider 1:1)	– 1.5 to + 1.5 V
(voltage divider 10:1)	– 15 to + 15 V

4.2.2 Characteristics of Channel C

Frequency range:	50 MHz to 2,400 MHz
Dividing ratio:	100:1
Sensitivity	
50 MHz ≤ f≤ 100 MHz	V_{rms} = 50 mV
100 MHz ≤ f ≤ 2 GHz	V_{rms} = 25 mV
2 GHz ≤ f ≤ 2.4 GHz	V_{rms} = 50 mV
Input impedance:	50 Ω
Standing wave ratio:	≤ 2.5
Coupling:	a.c. voltage
Maximum input voltage:	V_{rms} = 2.5 V -sine signal ± 40 V d.c.
Optimum input voltage:	indicated by extinguishing of LEDs *MIN* and *MAX*

4.3 Functions

4.3.1 Diagnostic Unit Function (CHECK)

Measuring range:	10 Mhz (standard frequency)
Measuring times (Gate Time):	t_{Gate} = 10 µs, 100 µs, 1 ms, 10 ms, 100 ms, 1 s, 10 s
Accuracy:	± 1 LSD[1)]
Result display:	MHz with decimal point

4.3.2 Frequency Measurement on Channel A or B (FREQ A, FREQ B)

Measuring range:	10 Hz to 100 MHz
Measuring times (Gate Time):	t_{Gate} = 10 µs, 100 µs, 1 ms, 10 ms, 100 ms, 1 s, 10 s
Frequency resolution:	$f = 1/t_{Gate}$ (max. 9 digits)
Accuracy:	± 1 LSD[1)] ± time base error
Result display:	Hz, kHz, MHz with decimal point

4.3.3 Frequency Measurement on Channel C (FREQ C)

Measuring range:	50 MHz to 2.4 GHz
Measuring times (Gate Time):	t_{Gate} = 10 µs, 100 µs, 1 ms, 10 ms, 100 ms, 1 s, 10 s
Frequency resolution:	$f = 100/t_{Gate}$ (max. 9 digits)
Accuracy:	± 1 LSD[1)] ± time base error
Result display:	MHz, GHz with decimal point

4.3.4 Frequency Ratio Measurement on Channels A and B (RAT A/B)

Inputs:	channels A and B ($V_{rms} \geq 100$ mV for channel B)
Measuring range:	10^{-7} to 10^{7}
Measuring time n:	10^{2}- to 10^{8}-multiple of period length for input signals at channel B
Frequency resolution:	f = 1/n
Accuracy:	± 1 LSD[1)] ± trigger error[2)] of channel B
Result display:	without measuring unit, with decimal point

4.3.5 Frequency Ratio Measurement on Channels C and B (RAT C/B)

Inputs:	channels C and B ($V_{rms} \geq 100$ mV for channel B)
Measuring range:	0.5 to 2.4×10^{8}
Measuring time n:	10^{2}- to 10^{8}-multiple of period length for input signals at channel B
Frequency resolution:	f = 100/n
Accuracy:	± 1 LSD[1)] ± trigger error[2)] of channel B
Result display:	without measuring unit, with decimal point

4.3.6 Period Length Measurement on Channel A or B (PER A, PER B)

Measuring range:	1 µs to 100 ms
Sensitivity:	V_{rms} = 100 mV
Measuring unit (resolution):	100 ns
Accuracy:	± 1 LSD[1)] ± trigger error[2)] ± time base error
Result display:	µs, ms with decimal point

4.3.7 Time Interval Measurement on Channel A or B (TIME AB)

Measuring range:	1 µs to 100 s
Slew rate:	> 6 V/s
Measuring unit (resolution):	100 ns
Accuracy:	± 1 LSD[1)] ± trigger error[2)] ± time base error
Result display:	µs, ms, s with decimal point

4.3.8 Pulse Counting on Channel A or B (TOT A, TOT B)

Measuring range:	1 to 10^9 events
Sensitivity:	V_{rms} = 100 mV
Slew rate:	> 6 V/s
Accuracy for external control	
Counter error:	± 1 LSD[1)]
Measuring interval error:	± trigger error[2)]
Result display:	without measuring unit and decimal point

Note: The setting of the gate time does not influence the functions period length measurement and simple pulse counting. The repetition speed is about 250 ms on automatic operation.

1) LSD: Last significant digit of displayed value; corresponds to the resolution within the respective measuring range.

2) The trigger error

a, is for pulse signals $\Delta T = \frac{V_{noise_{max}}}{S_{START}} + \frac{V_{noise_{max}}}{S_{STOP}}$

$V_{noise_{max}}$ (V)	- peak value of the noise voltage in the signal
S_{START} (V/s)	- slew rate of start edge
S_{STOP} (V/s)	- slew rate of stop edge

b, is ± 0.3 % for sine wave signals at a given signal/noise ratio of 40 dB.

4.4 Time Base

Start-up time:	15 min
Nominal frequency of quartz oscillator:	10 MHz
Accuracy of frequency setting:	$\pm 5 \times 10^{-9}$ (at final setting of the unit)
Frequency deviations after 24 hours:	$\leq \pm 10^{-8}$
Temperature influence:	$< \pm 5 \times 10^{-9}$/°C

4.5 Display

The unit is equipped with two 16-digit alphanumeric LC display lines with back lighting. The first line shows the measuring result, measuring unit and decimal point. In the second line the current measuring function and parameter such as measuring interval length, multiplication exponent and so on are displayed.
During parameter input the name of the function group is indicated in the first line and the name of the function buttons from F1 to F4 is indicated in the second line.

4.6 System Interface

The counter can be fully controlled and can be read out via the parallel interface GPIB and the serial interface RS-232C apart from the setting of the trigger levels.

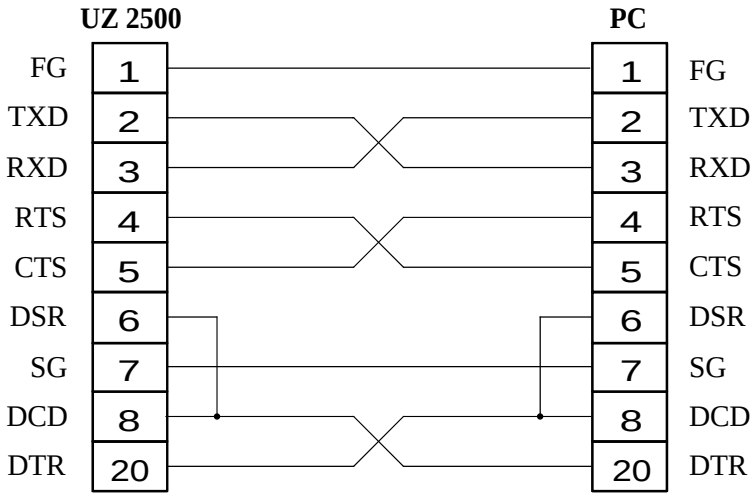
4.6.1 Interface GPIB

Standards of the interface:	ANSI/IEEE 488.1 1987, IEEE 488.2 1992
Functions of the interface:	SH1, AH1, SR1, T5, L4, RL1, PP0, DC1, DT1, E2
Length of input buffer:	64 characters
General instructions and queries:	`*CLS`, `*ESE`, `*ESE?`, `*ESR?`, `*SRE`, `*SRE?`, `*STB?`, `*IDN?`, `*RST`, `*TST?`, `*TRG`, `*OPC`, `*OPC?`, `*WAI`

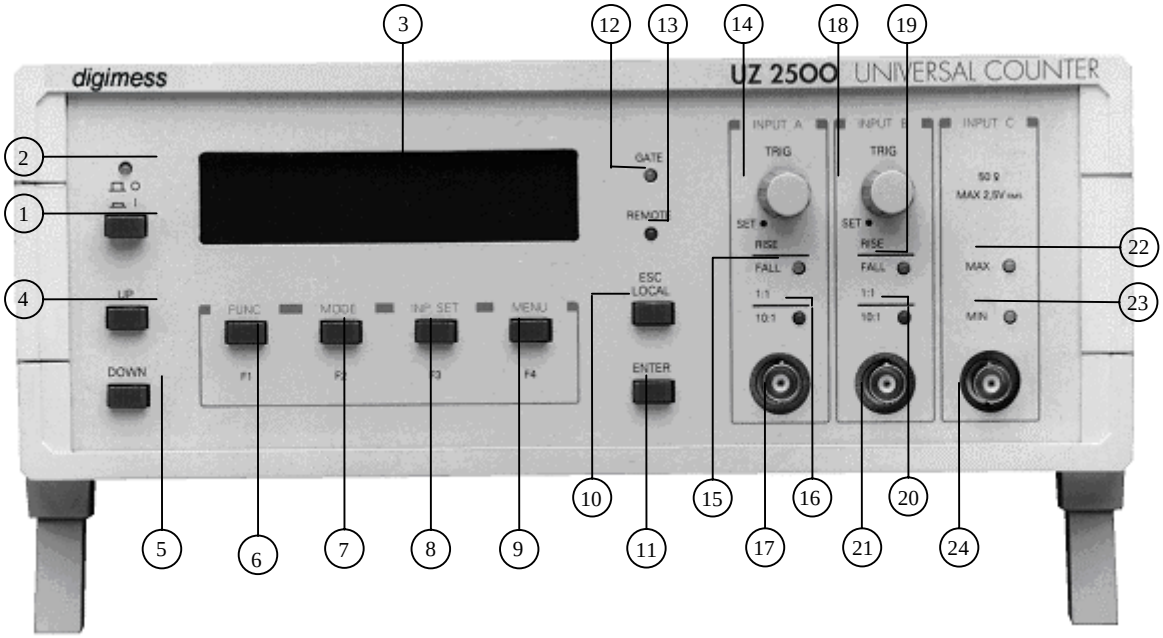
4.6.2 Interface RS-232C

Data transmission rate:	1,200 to 9,600 Bd
Length of data word:	8 bit
Number of STOP bits:	1
Parity:	none
Protocol:	RTS/CTS, without
End characters:	`CR` + `LF` (13 dec. + 10 dec.)
Length of input buffer:	64 characters

Reservation of plug connections:



5 Control Elements



[1] **Power switch**

[2] **Control indication *ON/OFF***
The button indicates whether the unit is ready for operation.

[3] **LC display**
see 4.5

[4] **UP button**
The button is used to scroll up the current menu.

[5] **DOWN button**
The button is used to scroll down the current menu.

[6] **F1 button**
The button sets the measuring functions.

[7] **F2 button**
The button sets the parameter of measuring functions.

[8] **F3 button**
The button sets the parameters for the input amplifier of channels A and B.

[9] **F4 button**
The button sets the measuring mode, chooses and sets the parameters of the interfaces and starts the special functions.

[10] **ESC/LOCAL button**
The button is used to leave the menu and the unit switches from remote control to local control.

[11] **ENTER button**
On pressing this button the function menu is left and the respective measurement is started.

[12] ***GATE* display**
The LED indicates the length of the measuring interval (Gate Time).

[13] ***REMOTE* display**
The LED lights up if the unit is controlled via remote control.

[14] **Potentiometer *TRIG* (A)**
The potentiometer is used for setting the trigger level at channel A.

[15] ***RISE/FALL* display (A)**
The LED lights up if the trigger edge of channel A falls.

[16] ***1:1/10:1* display (A)**
The LED lights up if the input voltage divider was set to the ratio 10:1 at channel A.

[17] **BNC input socket (A)**
see 4.2.1

[18] **Potentiometer *TRIG* (B)**
The potentiometer is used for setting the trigger level of channel B.

[19] ***RISE/FALL* display (B)**
The LED lights up if the trigger edge of channel B falls.

[20] ***1:1/10:1* display (B)**
The LED lights up if the input voltage divider was set to the ratio 10:1 at channel B.

[21] **BNC input socket (B)**
see 4.2.1

[22] ***MAX* display**
The LED indicates an input voltage too high for channel C.

[23] ***MIN* display (C)**
The LED indicates an input voltage too low for channel C.

[24] **BNC input socket (C)**
see 4.2.2

Power is supplied by a **fused plug for non-heating appliances**. The unit is provided with a fuse of T 200 L/250 V for 230 V~ or T 400 L/250 V for 115 V~ net voltage respectively. The **operating voltage indication** shows which operating voltage is to be used.
The **interfaces GPIB** und **RS-232C** serve the purpose of data transmission on remote via external devices.
The mains plug with fuse, the operating voltage indication, the interfaces and the **type plate of the unit** can be found at the back of the counter.

6 Performance of Measurements

6.1 Starting

For external control of the unit the corresponding connecting cable of the system interface GPIB or RS-232C has to be connected before switching on the operating voltage.
After pushing the button Power switch [1] the LED *ON/OFF* [2] lights up and the message appears on the display:

```
COUNTER <UZ25ØØ>
PowerUp SelfTest
```

Internal unit tests are started after switching on. The efficienty proof of the system, of the processor, of the bus, of the RAM-memory, of the display, of the keyboard and the battery or the software of the EPROM memory are tested. If everthing is in order, the message is displayed:

```
COUNTER <UZ25ØØ>
     READY
```

Otherwise the unit displays an error message with a corresponding notice of the reason, e.g.:

```
Testing: EPROM
         ERROR
```

and the unit interrupts the test until the defect is eliminated.
When the test is successfully completed the frequency measurement is carried out on channel A and if no input signal is connected the message appears on the display:

```
          Ø.Ø MHz
FREQ A   [1Ø µs]
```

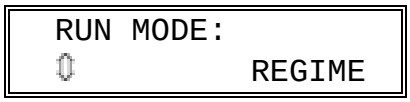
The measuring time is set to 10 µs and the input voltage divider of the channels A and B is set to 1:1. Other settings: Repeat mode, rising edge trigger, potentiometer A and B on. Now the unit is basically ready to start measurements, but the specified parameters for the time base are only fully set 15 minutes after switching the unit on.

6.1.1 Selection of Measuring Mode

The unit can perform single measurements (`Single`) and repeat measurements (`Repeat`). After switching of the F4 button [9] the main menu is called and the message appears on the display [3]:

```
-- MAIN  MENU --
RMD INT SETI AUX
```

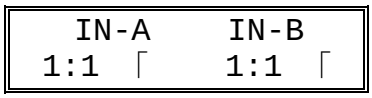
On pressing the F1 button [6] the menu point RMD (Run MoDe) is selected and the following message is displayed:



The variable REGIME has both values Single (single measurement) and Repeat (repeat measurement). On pressing the UP button [4] or DOWN button [5] the desired mode is activated. With the help of the ENTER button [11] the new setting is saved. If the ESC button [10] is pushed the old setting is kept. In both cases the unit reverts to the main menu.
After repeated actuating of the ENTER button [11] the measurement is started. In the case of the single measurement (SINGLE) the unit carries out one measurement, displays the measuring value and is stopped. Any repeated pressing of the ENTER button [11] starts a new measurement. At repeat measurement (REPEAT) the measurement is started automatically. The interval between the single measurement is fixed at about 250 ms.
The measuring time (Gate Time) is indicated by the LED *GATE* [12].

6.1.2 Adjustments of Input Channels

The trigger level of the input amplifier at channels A and B can be set by turning the potentiometers [14] or [18] to the left for negative values (on triggering to falling edge) or to the right for positive values (on triggering to rising edge) (see 4.2.1).
For periodic signals with sampling ratio 1:1 the potentiometer should be adjusted to the position *SET*. The trigger level corresponds to the value 0 V (zero passage).
The signal attenuations and trigger edges at the inputs of channels A and B are set with the function buttons from F1 to F4. After pushing the F3 button [8] the message appears on the display [3]:



and the function buttons receive the meanings:

F1 [6] - change of the dividing ratio at channel A,
F2 [7] - change of the trigger edge at channel A,
F3 [8] - change of the dividing ratio at channel B,
F4 [9] - change of the trigger edge at channel B.

By pressing the appropiate button the desired change is made. With the help of the ENTER button [11] the new settings are saved in the memory of the processor and the unit switches to the measuring state. If the ESC button [10] is pushed the old settings are kept. In both cases the menu operation is finished and the measuring is started.

No settings have to be made for measurements on channel C. The input level can be observed with the help of the LEDs *MIN* [23] and *MAX* [22].

6.2 Frequency Measurement on Channel A or B (FREQ A, FREQ B)

Channels A and B allow frequency measurements of periodic signals within the range of 10 Hz to 100 MHz. The parameters of the input channels are set as described in paragraph 6.1.2. The input signal is led to the selected channel.
With the help of the F1 function [6] the menu point `FUNC` is called to set the measuring function and the following message appears on the display [3]:

```
Function:
0    Description
```

The variable `Description` describes the respective measuring function. On pressing the UP button [4] or DOWN button [5] the desired measuring function `FREQ A` or `FREQ B` is set.
With the help of the F2 button [7] the menu point `MODE` for setting the measuring intervals is activated and the following message appears on the display [3]:

```
Gate Time:
0          Value
```

The variable `Value` corresponds to the measuring intervals `1Ø µs`, `1ØØ µs`, `1 ms`, `1Ø ms`, `1ØØ ms`, `1 s` and `1Ø s`. On pressing the UP button [4] or DOWN button [5] the desired measuring interval is set.
With the help of the ENTER button [11] the new settings are saved in the memory of the processor. If the ESC button [10] button is pushed the old settings are kept. In both cases the menu operation is finished and the measuring is started.

6.3 Frequency Measurement on Channel C (FREQ C)

Channel C allows frequency measurements of periodic signals within the range of 50 MHz to 2.4 GHz.. The input signal is led to channel C.
With the help of the F1 button [6] the menu point `FUNC` is called to set the measuring function and the following message appears on the display [3]:

```
Function:
0    Description
```

The variable `Description` describes the respective measuring function. On pressing the UP button [4] or DOWN button [5] the measuring function `FREQ C` is set.
The measuring intervals are set as described in paragraph 6.2.
With the help of the ENTER button [11] the new settings are saved in the memory of the processor. If the ESC button [10] is pushed the old settings are kept. In both cases the menu operation is finished and the measuring is started.
The input level can be observed with the help of the LED *MIN* [23] and *MAX* [22]. The maximum value is V_{rms} = 2.5 V and should not be exceeded.

6.4 Frequency Ratio Measurement on Channels A and B (RAT A/B)

The result of the measurement is the number of signal periods at channel A in relation to the cycle duration of the signal at channel B. The measuring interval is defined by the decading multiple of the cycle duration of the signal at channel B with the factors from 10^2 to 10^8.
With the help of the F1 button [6] the menu point `FUNC` is called to set the measuring function and the following message appears on the display [3]:

```
Function:
⇕    Description
```

The variable `Description` describes the respective measuring function. On pressing the UP button [4] or DOWN button [5] the measuring function `RAT A/B` is set.
With the help of the F2 button [7] the menu point `MODE` for setting the multiple factor is activated and the following message appears on the display [3]:

```
Multiples:
⇕          Value
```

The variable `Value` describes the exponent `2`, `3`, ... `8` of the basis factor 10. On pressing the UP button [4] or DOWN button [5] the desired exponent is set. The bigger the exponent is the greater the accuracy (resolution) of the frequency ratio and the longer the measuring time.
The parameters of the input channels are set as described in paragraph 6.1.2.
With the help of the ENTER button [11] the new settings are saved in the memory of the processor. If the ESC button [10] is pushed the old settings are kept. In both cases the menu operation is finished and the measuring is started.
The measurement is started when a signal is fed to channel B.

6.5 Frequency Ratio Measurement on Channels C and B (RAT C/B)

The result of the measurement is the number of the signal periods at channel C in relation to the cycle duration of the signal at channel B. The measuring interval is defined by the decading multiple of the cycle duration of the signal at channel B with the factors from 10^2 to 10^8.
With the help of the F1 button [6] the menu point `FUNC` is called to set the measuring function and the following message appears on the display [3]:

```
Function:
⇕    Description
```

The variable `Description` describes the respective measuring function. On pressing the UP button [4] or DOWN button [5] the measuring function `RAT C/B` is set.
With the help of the F2 button [7] the menu point `MODE` for setting the multiple factor is activated and the following message appears on the display [3]:

```
Multiples:
⇕          Value
```

The variable Value describes the exponent 2, 3, ... 8 of the basis factor 10. On pressing the UP button [4] or DOWN button [5] the desired exponent is set. The bigger the exponent is the greater the accuracy (resolution) of the frequency ratio and the longer the measuring time.
The parameters of the input channels are set as described in paragraph 6.1.2.
With the help of the ENTER button [11] the new settings are saved in the memory of the processor. If the ESC button [10] is pushed the old settings are kept. In both cases the menu operation is finished and the measuring is started.
The measurement is started when a signal is fed to channel B.

6.6 Period Length Measurement on Channel A or B (PER A, PER B)

With the help of the F1 button [6] the menu point FUNC is called to set the measuring function and the following message appears on the display [3]:

```
Function:
0    Description
```

The variable Description describes the respective measuring function. On pressing the UP button [4] or DOWN button [5] the measuring function PER A or PER B is set.
The parameters of the input channels are set as described in paragraph 6.1.2.
With the help of the ENTER button [11] the new settings are saved in the memory of the processor. If the ESC button [10] is pushed the old settings are kept. In both cases the menu operation is finished and the measuring is started.

6.7 Time Interval Measurement on Channels A and B (TIME AB)

The result of the two-channel measurement is the time between the beginning of the interval determined by the signal at channel A and the end of the interval determined by the signal at channel B. At this measurement the combination of the trigger edges of the signals at both channels can be used to set the required measuring interval. The setting of the trigger edges is described in paragraph 6.1.2.
With the help of the F1 button [6] the menu point FUNC is called to set the measuring function and the following message appears on the display [3]:

```
Function:
0    Description
```

The variable Description describes the respective measuring function. On pressing the UP button [4] or DOWN button [5] the measuring function TIME AB is set.
The parameters of the input channels are set as described in paragraph 6.1.2.
With the help of the ENTER button [11] the new settings are saved in the memory of the processor. If the ESC button [10] is pushed the old settings are kept. In both cases the menu operation is finished and the measuring is started.
The measurement is started when a signal is fed to channel A.

6.7.1 Pulse Width Measurement

An application example of the time interval measuring is the pulse width definition of the input signal. The sequence of events during the measuring procedure is described in the prevous paragraph 6.7. The decisive feature is the choice of the trigger edges. For positive values a rising trigger edge has to be set at channel A and a falling edge at channel B. For negative values the opposite applies.
For this measurement the channels A and B have to be connected.

6.8 Pulse Counting on Channel A or B (TOT A, TOT B)

The result of the measurements is the number of the pulses at channel A or B during a measuring interval. The interval can be generated in different ways:

1. The user starts the measurements at the keyboard of the unit:
   MANual triggering
2. The measurement interval is controlled by the signal at channel A or B:
   EXTernal triggering

6.8.1 Manual Triggering

The parameters of the input channels are set as described in paragraph 6.1.2. The input signal is fed to channel A or B.
With the help of the F1 button [6] the menu point `FUNC` is called to set the measuring function and the following message appears on the display [3]:

```
Function:
0    Description
```

The variable `Description` describes the respective measuring function. On pressing the UP button [4] or DOWN button [5] the desired measuring function `TOT A` oder `TOT B` is set.
With the help of the F2 button [7] the menu point `MODE` for setting the control mode is activated and the following message appears on the display [3]:

```
Mode:
0          Regime
```

The variable `Regime` has both values `MAN` (manual triggering) and `EXT` (external triggering). On pressing the UP button [4] or DOWN button [5] the manual triggering `MAN` is set.
With the help of the ENTER button [11] the new settings are saved in the memory of the processor. If the ESC button [10] is pushed the old settings are kept. In both cases the menu operation is finished and the measuring is started.

At continuous measurements (Repeat) the counting decades are reset on pressing the ESC button [10].
When the function Single (single measurements) is set and the unit runs, the counting decades are reset on pressing the ENTER button [11]. Now the ESC button [10] is insignificant.

6.8.2 External Triggering

The parameters of the input channels are set as described in paragraph 6.1.2. The input signals are fed to channels A and B.
With the help of the F1 button [6] the menu point FUNC is called to set the measuring function and the following message appears on the display [3]:

```
Function:
0    Description
```

The variable Description describes the respective measuring function. On pressing the UP button [4] or DOWN button [5] the desired measuring function TOT A oder TOT B is set.
With the help of the F2 button [7] the menu point MODE for setting the control mode is activated and the following message appears on the display [3]:

```
Mode:
0          Regime
```

The variable Regime has both values MAN (manual triggering) and EXT (external triggering). On pressing the UP button [4] or DOWN button [5] the external triggering EXT is set.
With the help of the ENTER button [11] the new settings are saved in the memory of the processor and the unit switches to the measuring state. If the ESC button [10] is pushed the old settings are kept.
The unit is ready and waits on a start/stop pulse. At the function „TOT A“ the measuring signal is fed to the input of the channel A and the start/stop pulse fed to the at input of the channel B. With measurements of the function „TOT B“ the functions of the channels are exchanged.

At continuous measurements (Repeat) the counting decades are reset on pressing the ESC button [10].
When the function single measurements (Single) is set and the unit run, the counting decades are reset on pressing the ENTER button [11]. Now the ESC button [10] is insignificant.

6.9 Error Message

The measuring decades can be overflown in some cases due to unfavourable selection of the measuring range (Gate Time). In this case the faulty result is not displayed but the error message is displayed.

```
ERROR: OVERFLOW !
```

6.10 Special Unit Functions

After pressing the F4 button [9] twice the sub-menu is called to set the specific unit functions and the following message appears on the display [3]:

```
--- AUX MENU ---
MEM LOAD TGS TST
```

The **current parameters are saved** with the help of the F1 button (MEM) [6]. This process is displayed with the following message:

```
Memory:
..........SAVING
```

After pressing the ENTER button [11] or ESC button [10] twice the unit switches to the measuring state. After switching on the saved unit configuration is loaded and the parameters are set.

The **basic configuration (FREQ A) is loaded** with the help of the F2 button (LOAD) [7]. Thereby the user-defined settings are deleted. After pressing the ENTER button [11] or ESC button [10] twice the unit switches to the measuring state.

The **trigger levels of the channels A and B are set** after pressing the F3 button (TGS) [8] and the following message appears on the display [3]:

```
Trigger:
0       Parameter
```

The variable Parameter describes the procedure for setting the trigger levels. On pressing the UP button [4] or DOWN button [5] the following settings can be selected.

- P_A & P_B - The trigger levels of channels A and B are set by potentiometers [14] and [18].
- P_A & S_B - The trigger level of channel A is set by potentiometer [14] and the trigger level of channel B is set by SET mode.
- S_A & P_B - The trigger level of channel A is set by SET mode and the trigger level of channel B is set by potentiometer [18].
- S_A & S_B - The trigger levels of channels A and B are set by SET mode.

Note: In the SET mode the trigger level corresponds to the value 0 V (can be set by turning the potentiometers [14, 18] to the left stop).

With the help of the ENTER button [11] the new settings are saved in the memory of the processor. If the ESC button [10] is pushed the old settings are retained. In both cases the menu operation is finished and the measuring is started.
After pressing the ENTER button [11] or ESC button [10] twice the unit switches to the measuring state.

The **self-test is called** (see 6.1) after pressing the F4 button (TST) [9]. The test results are displayed by a message with the corresponding message. After pressing the ENTER button [11] or ESC button [10] twice the unit switches to the measuring state.

7 Remote Control by Program

Remote control of the counter by a personal computer is possible via the interfaces GPIB and RS-232C. The connecting cable must not be longer than 15 m and should be connected when the unit is off. After switching on the counter is in starting position and can receive commands. The remote control is displayed on LED *REMOTE* [13].
All parameter settings, measuring functions and measuring value outputs without trigger level settings of channel A and B can be realized via remote control.

7.1 Preparation on the Counter

7.1.1 Interface GPIB (IEEE 488.2)

7.1.1.1 Communication with Control Unit (Personal Computer)

The connecting cable between counter and computer must correspond to standard IEEE 488.1.
The interface GPIB of the counter is set at the system address 7.
After switching on the unit and when the internal test is successfully completed the operating parameters can be set with the help of a menu.
After pressing the F4 button [9] the main menu is called and the following message appears on the display [3]:

```
-- MAIN  MENU --
RMD INT SETI AUX
```

On pressing the F2 button [7] the menu point INT (Interface) is selected and the following message is displayed:

```
Interface:
⇕      Parameter
```

The variable Parameter means both interface GPIB or RS-232C. On pressing the UP button [4] or DOWN button [5] the interface GPIB is set. With the help of the ENTER button [11] the new setting is saved.
On pressing the F3 button [8] the menu point SETI (Set Interface) is selected and the following message is displayed:

```
--- GPIB SET ---
ADDRESS      TON
```

With the help of the F1 button [6] or F2 button [7] the current system address is called on the display [3]:

```
Address:
⇕          Value
```

The variable Value describes the system address. On pressing the UP button [4] or DOWN button [5] the address can be set from Ø to 3Ø. After pressing the ENTER button [11] twice the menu operation is finished.
After switching off the settings are saved.

7.1.1.2 Communication without Control Unit (Printer)

In the operating mode TON (Talk Only) output units (e.g. printer) which work in the operating mode LON (Listen Only) can be connected the counter. This enables the measuring to be recorded.
After pressing the F4 button [9] the main menu is called and the following message appears on the display [3]:

```
-- MAIN  MENU --
RMD INT SETI AUX
```

On pressing the F2 button [7] the menu point `INT` (Interface) is selected and the following message is displayed:

```
Interface:
⇕      Parameter
```

The variable `Parameter` means both interface `GPIB` or `RS 232`. On pressing the UP button [4] or DOWN button [5] the interface `GPIB` is set.
With the help of the ENTER button [11] the new setting is saved.
On pressing the F3 button [8] the menu point `SETI` (Set Interface) is selected and the following message is displayed:

```
--- GPIB SET ---
ADDRESS      TON
```

With the help of the F3 button [8] or F4 button [9] the choice of the operating mode TON is called on the display [3]:

```
Talk ONly:
⇕           Stand
```

The variable `Stand` describes the state `ON` or `Off`. On pressing the UP button [4] or DOWN button [5] the operating mode TON can be set `ON`. After pressing the ENTER button [11] twice the menu operation is finished. After switching off the settings are saved.

7.1.2 Interface RS-232C

The interface RS-232C of the personal computer has to have the configuration as described in paragraph 4.6.2. After switching on of the unit and when the internal test is successfully completed the operating parameters can be set with the help of a menu.
After pressing the F4 button [9] the main menu is called and the message appears on the display [3]:

```
-- MAIN  MENU --
RMD INT SETI AUX
```

On pressing the F2 button [7] the menu point `INT` (Interface) is selected and the following message is displayed:

```
Interface:
⇕      Parameter
```

The variable Parameter means both interface GPIB or RS 232. On pressing the UP button [4] or DOWN button [5] the interface RS 232 is set.
With the help of the ENTER button [11] the new setting is saved.
On pressing the F3 button [8] the menu point SETI (Set Interface) is selected and the following message is displayed:

```
-- RS 232 SET --
BD-RATE PROTOCOL
```

With the help of the F1 button [6] or F2 button [7] the current baud rate is called on the display [3]:

```
Baud Rate:
                Value
```

The variable Value describes the current baud rate. On pressing the UP button [4] or DOWN button [5] the baud rate can be set from 1200 Bd to 9600 Bd. With the help of the ENTER button [11] the new setting is saved.
With the help of the F3 button [8] or F4 button [9] the current communication protocol is called on the display [3]:

```
Protocol:
                  Typ
```

The variable Typ describes the current choice NONE or RTS/CTS. On pressing the UP button [4] or DOWN button [5] the data exchange can be set with or without protocol. After pressing the ENTER button [11] twice the menu operation is finished.
After switching off the settings are saved.

7.2 Transition: Remote Control ⇔ Local Control

On transmission of the command REN from the personal computer the counter is in the state of REMOTE CONTROL which is indicated by the LED *REMOTE* [13]. Afterwards control of the unit by the local control elements is not possible (except LOCAL button [10]).

There are several ways of switching from remote control to local control of the unit:

- by transmission of the command GTL (Go To Local) from the personal computer,
- by pressing the LOCAL button [10] at the counter if the unit keyboard has not been locked by the command LLO (Local Lock Out),
- by switching off and on the power switch [1].

The following enquires and instructions can also be sent and received from the personal computer by local control of the unit:

*IDN?,*CLS,*ESR?,*ESE,*ESE?,*STB?,*SRE,*SRE?,ERR?,ATTA?,
ATTB?,SLOPA?,SLOPB?,LEVA?,LEVB?,GATE?,NPER?,TOM?.

7.3 Messages of the Counter on Remote Control

7.3.1 Description of the Unit State

The current unit state of the operating conditions can be indicated via the EVENT STATUS REGISTER and the STATUS BYTE REGISTER at any time.

7.3.1.1 ESR - EVENT STATUS REGISTER

The contents of the ESR register are saved in the output buffer and deleted (except bit 7) by transmission of the command `*ESR?` from the personal computer. The ESE register can be also set on `Ø` by switching on the unit, by transmission of the command `*CLS` or after activation of the interface GPIB.

Contents of the ESR register: `ESR xxx`

Bit **7**: (PON) Power On, operating readiness and capitalization of the interfaces are displayed at `1`.
6: (URQ) User Request, isn't used, is always set on `Ø`.
5: (CME) Command Error, is set on `1` at instruction errors.
4: (EXE) Execution Error, is set on `1` at question errors and execution errors.
3: (DDE) Device Dependent Error, unit errors are displayed at `1`.
2: (QYE) Query Error, is set on `1` at question errors.
1: (RQC) Request Control, isn't used, is always set on `Ø`.
Ø: (OPC) Operation Complete, is set on `1` by transmission of the command `*OPC`.

Various states and settings of the unit can be checked. For this the contents of the ESR register are called with the help of the mask (ESE - EVENT STATUS ENABLE REGISTER). The single bits are compared and evaluated by the following logical equation:

$$ESB = (ESR7 \wedge ESE7) \vee (ESR6 \wedge ESE6) \vee (ESR5 \wedge ESE5) \vee (ESR4 \wedge ESE4) \vee (ESR3 \wedge ESE3) \vee (ESR2 \wedge ESE2) \vee (ESR1 \wedge ESE1) \vee (ESRØ \wedge ESEØ)$$

The result ESB (Event Summary Bit) is saved in the STB register.
The command `*ESE xxx` offers the possibility of initializing the ESE register with any masks. The value `xxx` has to be within the range of `Ø` to `255`.
The current contents `ESE xxx` can be queried by transmission of the command `*ESE?`. The contents of the register can set to `Ø` by switching on the unit or after activation of the interace GPIB.

7.3.1.2 STB - STATUS BYTE REGISTER

The contents of the STB register are saved in the output buffer by transmission of the command `*STB?` from the personal computer. The STB register can be set on `Ø` by switching on the unit, by transmission of the command `*CLS` or after activation of the interface GPIB.

Contents of the STB register: STB xxx

Bit **7**: isn't used, is always set on Ø.
6: (MSS) Master Summary Bit, result by checkup of the STB register with a mask.
(RQS) Request service, for GPIB interface only, is derived from the condition of the MSS bit according to IEEE 488.2 and is read as part of the STB register by transmission of the command *STB? in serial operating mode according to IEEE 488.1.
5: (ESB) Event Summary Bit, result by checkup of the ESR register with a mask (ESE register).
4: (MAV) Message Available, is set on 1 if a current massage of the unit is requested at the output buffer.
3: isn't used, is always set on Ø.
2: isn't used, is always set on Ø.
1: isn't used, is always set on Ø.
Ø: isn't used, is always set on Ø.

Note: When the interface GPIB is used in serial operating mode according to IEEE 488.1 the RQS bit is readable as the part of the STB register for the personal computer. This option does not exist when using interface RS-232C.

Various states and settings of the unit can be checked. For this the contents of the ESR register are called with the help of the mask (SRE - SERVICE REQUEST ENABLE REGISTER). The single bits (except SRE bit 6, it is set on Ø always) are compared and evaluated by the following logical equation:

$$MSS = (STB7 \wedge SRE7) \vee (STB5 \wedge SRE5) \vee (STB4 \wedge SRE4) \vee (STB3 \wedge SRE3) \vee (STB2 \wedge SRE2) \vee (STB1 \wedge SRE1) \vee (STBØ \wedge SREØ)$$

The result MSS (Master Summary Status) is saved in the STB register.
The command *SRE xxx offers the possibility of initializing the ESE register with any masks. The value xxx has to be within the range of Ø to 255.
The current contents xxx can be queried by transmission of the command *SRE?. The contents of the register can be set on Ø by switching on the unit, by transmission of the command *CLS or after activation of the interface GPIB.

7.3.2 Description of the Unit Messages

DIGIMESS,UZ25ØØ,x,y - identification of the unit and of the software version
with x - production number or Ø
y - software version or Ø

ATTA_1; ATTA_1Ø - set ratio 1:1(10) of the input divider at channel A
ATTB_1; ATTB_1Ø - set ratio 1:1(10) of the input divider at channel B

SLOPA_RISE;
SLOPA_FALL - set trigger edge at channel A
SLOPB_RISE;
SLOPB_FALL - set trigger edge at channel B

LEVA_SET;LEVA_POT - current choice of trigger level at channel A
LEVB_SET;LEVB_POT - current choice of trigger level at channel B

GATE_1ØUS	- gate times: t =	10 µs
GATE_1ØØUS		100 µs
GATE_1MS		1 ms
GATE_1ØMS		10 ms
GATE_1ØØMS		100 ms
GATE_1S		1 s
GATE_1ØS		10 s

NPER_1Ex - exponent x = 2, 3, 4, 5, 6, 7 and 8 for the decadic multiple of the period length

TOM_EXT - external triggering by pulse counting
TOM_MAN - manual triggering by pulse counting

7.3.3 Description of the Results

The measuring results are sent in the following format:

a) from ZZ X to ZZ XXX

b) from ZZ XEVØY to ZZ XXX.XXXXEVØY

with:

ZZ	· Hz, s, without meaning
XXX.XXXX	· mantisse
E	· symbol for exponent
V	· sign (+/–)
ØY	· exponent

7.3.4 Description of the Errors

When errors occur in the remote-controlled settings and measurements, they are saved with a code in the error register. The contents (error message) of the error register are called and deleted by transmission of the command ERR? from the personal computer.
If several errors arise only the first two error codes are saved. On repeating transmission of the command ERR? the contents of the errror codes can be called and initialized (deleted). The initializing of the error register is also started by transmission of the command *CLS (initializing of the state register).
In the case of error the transmission and receiving of commands or data is still possible.

7.3.4.1 List of Error Messages

error code	text of messages	meaning of text
Ø	-	- faultless operation
	DEVICE DEPENDENT ERROR	**unit error**
	QUERY ERROR	**query error**
1Ø	OVERFLOW	- counting decades are overflown
	INTERFACE ERROR	**interface error**
111	UNDERMINATED	- interface isn't programmed, read operation
114	INTERRUPTED	- interface is programmed, no read operation
117	DEADLOCKED	- interface is programmed, locked
12Ø	BAD USING QUERY	- query is wrong
	EXECUTION ERROR	**execution error**
131	NO EXECUTION	- cannot be executed
132	NOT EX. IN LOCAL	- cannot be executed in local control
133	NO VALID DATA	- data are invalid
134	VAL. OUT OF RANGE	- values are out of range
135	TRIGGER IGNORED	- triggering cannot be executed
	COMMAND ERROR	**command error**
151	ILLEGAL COMMAND	- illegal command
	GPIB error	**error of the GPIB interface**
171	NO LISTENER	- no output unit is connected
	RS 232 error	**error of the RS-232C interface**
181	INP. BUFFER FULL	- input buffer is full

The error messages are dependent on the state of operation and the type of the error.
At local control interface errors are displayed for only a short time. At remote control interface errors are displayed by the message INTERFACE ERROR. The error message is deleted when the contents of the error register is queried or initialized or a unit error occurred. Unit errors are displayed by the message DEVICE DEPENDENT ERROR. The error message is deleted when new commands from the personal computer or new measuring data from the unit are transmitted.

7.4 List of Commands on Remote Control

7.4.1 General Commands

REN (Remote) - transition from local control to remote control
GPIB: - address instruction according to IEEE 488.1
RS-232C: - ASCII: HT = 9 (dec.)

LLO (Locked Local Out) - locking of the LOCAL button
GPIB: - address instruction according to IEEE 488.1
RS-232C: - ASCII: EM = 25 (dec.)

GTL (Go To Local) - transition from remote control to local control
GPIB: - address instruction according to IEEE 488.1
RS-232C: - ASCII: SOH = 1 (dec.)

DCL (Device clear) - initializing of corresponding interface
GPIB: - address instruction according to IEEE 488.1
RS-232C: - ASCII: DC4 = 20 (dec.)

GET
(Group Execute Trigger) - interface instruction for start of measurements and saving of results in the output buffer
GPIB: - address instruction according to IEEE 488.1
RS-232C: - ASCII: BS = 8 (dec.)

Note: This instruction must not be between the first command and the end character of a command line.

*RST (Reset) - initializing of unit settings
input divider: - attenuating 1:1 on channels A and B
trigger edge: - rising edge on channels A and B
trigger level: - use of potentiometers on channels A and B is possible
measuring function: - frequency measurement on channel A
Gate Time: - 10 µs

Note: After switching on the commands *RST and *CLS are executed automatically and the contents of the ESR, STB, ESE and SRE register are reset.

*TST? (Test) - start of unit tests and saving of results
meaning: Ø - test is successful
1 - test isn't successful

*IDN? (Identification) - identification of the unit and of the software version

Note: The command *IDN? should be written at the end of the command line so that the result is saved in the output buffer.

*CLS	
(Clear Status Byte)	- initializing (resetting) of ESR- and STB registers
ERR? (Error)	- reading (output buffer) and resetting of the error register
*WAI (Waiting)	- The following commands are executed after completion of current operation.
*OPC	
(Operation Complete)	- After completion of current operation the bit 7 (OPC) in the ESR register is set on 1.
*OPC?	- After completion of current operation the number 1 is saved in the output buffer.
MEAS (Measurement)	- starting of the measurement after settings of a measuring function and saving of the result in the output buffer
MEAS?	- starting of the measurement after settings of a measuring function and transmission of the result
*TRG (Triggerung)	- general instruction for the starting of the and saving of the result in the output buffer
CONT (Continous)	- starting of the continuous measurement The current measuring value is always saved in the output buffer. Every instruction interrupts the measurement.
READ? (Reading)	- reading of the output buffer and transmission of the result

7.4.2 Commands for Setting the Measuring Parameters

ATTA_1	- ratio 1:1 of the input divider at channel A
ATTA_1Ø	- ratio 1:10 of the input divider at channel A
ATTB_1	- ratio 1:1 of the input divider at channel B
ATTB_1Ø	- ratio 1:10 of the input divider at channel B
SLOPA_RISE	- rising trigger edge at channel A
SLOPA_FALL	- falling trigger edge at channel A
SLOPB_RISE	- rising trigger edge at channel B
SLOPB_FALL	- falling trigger edge at channel B
LEVA_SET	- trigger level V = 0 V at channel A (potentiometer [14] is closed)
LEVA_POT	- trigger level is set via the potentiometer (channel A) at the unit
LEVB_SET	- trigger level V = 0 V at channel B (potentiometer [18] is closed)
LEVB_POT	- trigger level is set via the potentiometer (channel B) at the unit

7.4.3 Commands for Setting the Measuring Functions

Frequency measurement

FREQA	- setting the frequency measurement with channel A
FREQA?	- single frequency measurement with channel A and transmission of the result
FREQB	- setting the frequency measurement with channel B
FREQB?	- single frequency measurement with channel B and transmission of the result
FREQC	- setting the frequency measurement with channel C
FREQC?	- single frequency measurement with channel C and transmission of the result
CHECK	- testing the unit functions
CHECK?	- single test of the unit functions and transmission of the result

GATE_1ØUS	- gate times: t =	10 µs
GATE_1ØØUS		100 µs
GATE_1MS		1 ms
GATE_1ØMS		10 ms
GATE_1ØØMS		100 ms
GATE_1S		1 s
GATE_1ØS		10 s

Frequency Ratio Measurement

RATAB	- setting the frequency ratio measurement A/B
RATAB?	- single frequency ratio measurement A/B and transmission of the result
RATCB	- setting the frequency ratio measurement C/B
RATCB?	- single frequency ratio measurement C/B and transmission of the result
NPER_1Ex	- exponent x = 2 ,3 ,4 ,5 ,6 ,7 and 8 for decadic multiple of the periodic length

Periodic Length Measurement

PERA	- setting the periodic length measurement with channel A
PERA?	- single periodic length measurement with channel A and transmission of the result
PERB	- setting of the periodic length measurement with channel B
PERB?	- single periodic length measurement with channel B and transmission of the result

Time Interval Measurements

TIMEAB	- setting the time interval measurements via channels A and B
TIMEAB?	- single time interval measurements via channels A and B and transmission of the result

Pulse Counting

TOTA	- setting the pulse counting with channel A
TOTB	- setting the pulse counting with channel B
TOM_EXT	- pulse counting by external triggering
TOM_MAN	- pulse counting by manual triggering
TOTA?	- single pulse counting on channel A and transmission of the result
TOTB?	- single pulse counting on channel B and transmission of the result
START	- starting of the pulse counting and saving of the result in the output buffer

7.4.4 Commands for Reading the Unit Settings

ATTA?	- input divider at channel A?
ATTB?	- input divider at channel B?
SLOPA?	- trigger edge at channel A?
SLOPB?	- trigger edge at channel B?
LEVA?	- choice of trigger level at channel A?
LEVB?	- choice of trigger level at channel B?
GATE?	- current gate time?
NPER?	- set coefficient of the periodic length measurement on channel B?
TOM?	- current triggering of the pulse counting?

7.5 Measuring by Remote Control

For external control of the unit the respective connecting cable of the system interface GPIB or RS-232C has to be connected before switching on the operational voltage. After switching on the counter is in starting position and it can receive commands. The remote control is displayed on LED *REMOTE* [13].
It should be noted that single commands or groups of commands have to be separated by semicolon (ASCII: ";" = 59) and ended by the end character. Certain commands or messages can contain parameters or measuring results which are separated by a separation character from the command.
Single commands can be written one after the other in one command line, the length of which may not exceed 64 characters.

Separation and end characters during transmission of commands:

ASCII	GBIP	RS-232C
separation characters	SP = 32 (dec.) NUL to HT = 0 to 9 (dec.) VT to US = 11 to 31 (dec.)	SP = 32 (dec.)
end characters	LF = 10 (dec.) LF = 10 (dec.) + END (EOI true) last sign of the command + END (EOI true)	LF = 10 (dec.)

Separation and end characters during receiving of messages:

ASCII	GBIP	RS-232C
separation characters	SP = 32 (dec.)	SP = 32 (dec.)
end characters	LF = 10 (dec.) + END (EOI true)	CR + LF = 13 + 10 (dec.)

7.6 Program Examples (Q-Basic)

```
100 REM ******************************************************
110 REM     THE EXAMPLE OF USING UZ 2500 WITH GPIB BOARD
120 REM        AT-GPIB/TNT AND SOFTWARE NI-488.2 OF NI
130 REM The UZ 2500 measures frequency of signals via channel B
140 REM               Its GPIB primary address is 7
150 REM        Example program using NI-488.2 subroutines
160 REM   Merge this code with DECL.BAS (when using NI-488.2)
170 REM ******************************************************
180 REM
190 REM            *** SET UP INTERFACE AT-GPIB/TNT ***
200 DIM ADDRLIST%(31) : ADDRLIST%(0)=7: ADDRLIST%(1)=NOADDR%
210     BDINDEX%=0: PAD%=7
220     CALL SENDIFC(BDINDEX%)
230 REM
240 REM       *** SET UP INTERFACE AND STATUS REPORTING ***
250     CALL ENABLEREMOTE (BDINDEX%,ADDRLIST%(0))
260     CALL DEVCLEAR(BDINDEX%,PAD%)
270     WRT$="*RST;*CLS"
280     CALL SEND (BDINDEX%,PAD%,WRT$,NLEND%)
290 REM
300 REM            *** FUNCTION AND MODE SETTING ***
310     WRT$="FREQB;GATE_1S"
320     CALL SEND (BDINDEX%,PAD%,WRT$,NLEND%)
330 REM
340 REM              *** START OF MEASUREMENT ***
350     WRT$="MEAS?"
360     CALL SEND (BDINDEX%,PAD%,WRT$,NLEND%)
370 REM
380 REM             *** RECEIVE RESPONSE MESSAGE ***
390     RD$= SPACE$(20)
400     CALL RECEIVE (BDINDEX%,PAD%,RD$,STOPEND%)
410     CLS:PRINT "Frequency of channel B : ",RD$
420 REM
430 REM        *** SET UP DEVICE AND SET LOCAL MODE ***
440     WRT$="*RST;*OPC?"
450     CALL SEND (BDINDEX%,PAD%,WRT$,NLEND%)
460     RD$= SPACE$(20)
470     CALL RECEIVE (BDINDEX%,PAD%,RD$,STOPEND%)
480 REM
490     CALL ENABLELOCAL (BDINDEX%,ADDRLIST%(0))
500 REM
510 REM       *** DISABLE THE SOFTWARE AND HARDWARE ***
520     V% = 0
530     CALL IBONL (BDIDEX%,V%)
540     END
```

```
5   REM ******************************************************
1Ø  REM    THE EXAMPLE OF USING UZ 25ØØ with RS-232C board
2Ø  REM The UZ 25ØØ measures frequency of signals via input B.
25  REM ******************************************************
3Ø      CLS
4Ø  REM           *** SET UP INTERFACE COMMANDS ***
5Ø      IDCL$=CHR$(2Ø):IREN$=CHR$(9):ILLO$=CHR$(25):IGTL$=CHR$(1)
6Ø  REM
7Ø  REM           *** OPENING COMMUNICATION FILE ***
8Ø      OPEN "com2:12ØØ,n,8,1,CS25ØØØ,FOR RANDOM LF" AS #1
9Ø  REM
1ØØ REM        *** SET UP DEVICE AND STATUS REPORTING ***
11Ø     PRINT #1,IDCL$;IREN$;ILLO$;"*RST;*CLS"
12Ø REM
13Ø REM            *** FUNCTION AND MODE SETTING ***
14Ø     PRINT #1,"FREQB;GATE_1S"
15Ø REM
16Ø REM              *** START OF MEASUREMENT ***
17Ø     PRINT #1, "MEAS?"
18Ø REM
19Ø REM           *** RECEIVE RESPONSE MESSAGE ***
2ØØ     INPUT #1 ,A$
21Ø     PRINT "Frequency of channel B : ";A$
22Ø REM
23Ø REM       *** SET UP DEVICE AND SET LOCAL MODE ***
24Ø     PRINT #1,"*RST;*OPC?"
25Ø     INPUT #1 ,A$
26Ø     PRINT #1,IGTL$
27Ø REM
28Ø REM               *** CLOSE STATEMENT ***
29Ø     CLOSE #1
3ØØ     END
```

8 Maintenance

The unit does not require special maintenance if it is used and handled correctly. Only use a soft wet rag with some soap-suds or a soft rinse liquid for cleaning. Avoid acrid cleanser and solvents.

Service work should only be done by trained personnel.

In case of repairs it is vital to ensure that the design characteristics of the unit are not changed thus reducing the safety and that replacement parts match the original ones and are installed properly (original state).

⚠ **Warning!** The unit must be separated from all power sources before maintenance work is carried out and before parts or fuses are repaired or replaced.

9 Appendix

9.1 Declaration of Conformity

digimess	**Konformitätserklärung** **Declaration of Conformity / Déclaration de Conformité** 129/**95**	CE

Der Hersteller/Importeur
The manufacturer/importer
Le producteur/importateur

digimess
Professional Electronics GmbH

Anschrift / Address / Adresse

Würzburger Straße 150
90766 Fürth
Germany

erklärt hiermit eigenverantwortlich, daß das Produkt:
declare under their sole responsibility that the product: / déclare, que le produit:

Bezeichnung / Name / Description

Universal Zähler
Universal-Counter
Compteur universel

Type / Model / Type

UZ 2500

Bestell-Nr. / Order-No. / Nº de réf.

H.UC 15-00

folgenden Normen entspricht:
is in accordance with the following specifications: / correspond aux normes suivantes:

EN 61010-1 (1994)

DIN EN 50081-1 (1993)

DIN EN 50082-1 (1992)

EN 55022 (1987) Class B

IEC 801-2 (1991) / prEN 55024-2 (1992)

IEC 801-4 (1988) / prEN 55024-4 (1993)

IEC 801-3 (1984)

Das Produkt erfüllt somit die Forderungen folgender EG-Richtlinien:
Therefore the product fulfils the demands of the following EC-Directives:
Le produit satisfait ainsi aux conditions ces directives suivantes de la CE:

73/23/EWG	**Richtlinie betreffend elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen** **Directive relating to electrical equipment designed for use within certain voltage limits** **Directive relatives au matériel électrique destiné à être employé dans certaines limites de tension**
89/336/EWG	**Richtlinie über die elektromagnetische Verträglichkeit** **Directive relating to electromagnetic compatibility** **Directive relatives à la compatibilité électromagnétique**

Fürth, 7.8.1995

Henninger
Leiter Qualitätsmanagement
Q-Manager / Directeur Contrôle de Qualité