# *Operation manual*

# *Tensile test machine*

# *TH 2730*

# *12/2002*

# Tensile test machine

*General:*

*Caution! The load cell can be destroyed easily!*

*Specially if the clamps collide or if there is a transversal force
the load cell might be destroyed quickly*

*Carefully mount load cells.
No torque may be put on the load cell!*

## *Caution: danger of injury!*

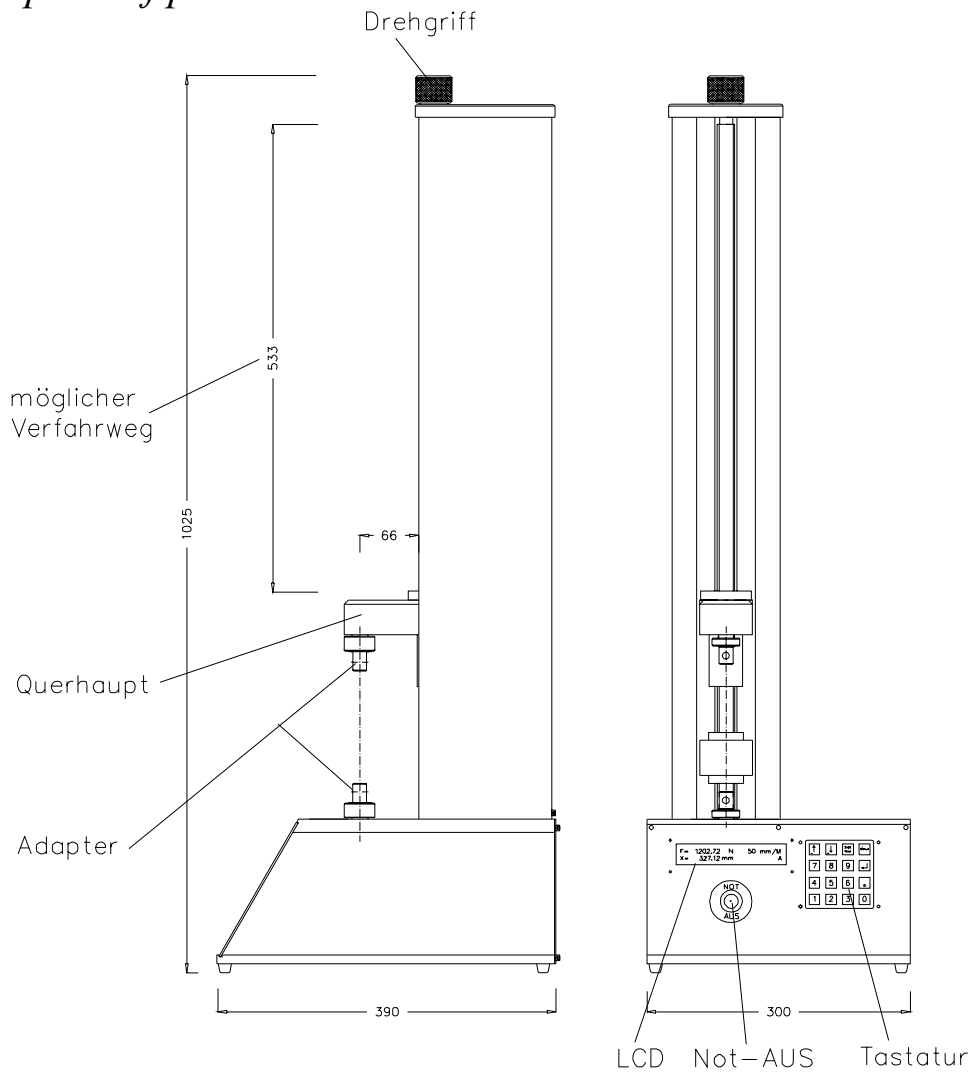*because of the fully accessible construction there is a danger of injury.*

*be aware that nobody is hit in the operation area!*

*Qualified craftsmen may only operate the machine*
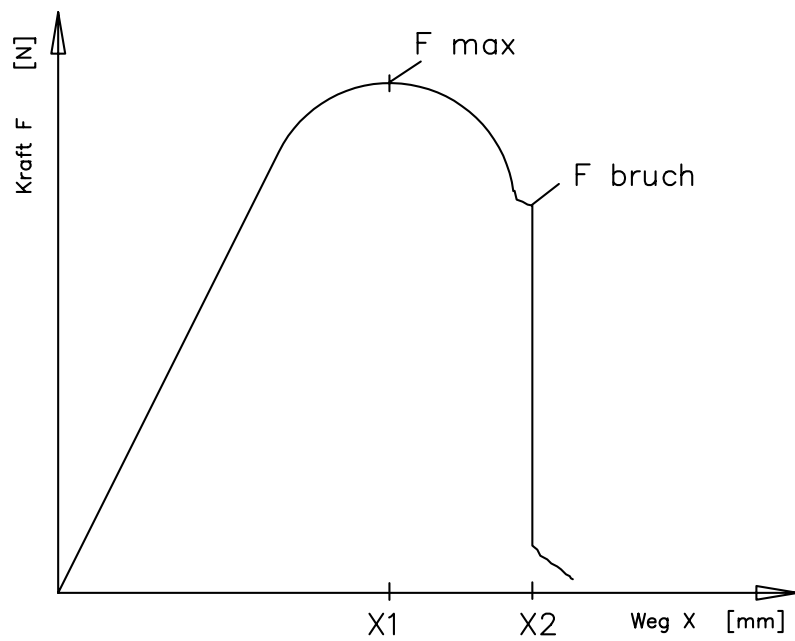
*Index*

## 1) Description of parts

Drehgriff

533

möglicher
Verfahrweg

1025

66

Querhaupt

Adapter

LCD   Not—AUS   Tastatur

390

300

## Kraft — Weg Diagramm

F max

F bruch

Kraft F   [N]

X1    X2    Weg X   [mm]

## 2) Control panel: 4 x 4 Block

```
  ○                                           ○
    ┌─────────────────────────────────────┐
    │  ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐ │
    │  │  ↓   │ │  ↑   │ │Start │ │Menue │ │
    │  │ _∇_+ │ │      │ │Stop  │ │      │ │
    │  └──────┘ └──────┘ └──────┘ └──────┘ │
    │  ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐ │
    │  │  7   │ │  8   │ │  9   │ │Return│ │
    │  │      │ │      │ │      │ │  ↵   │ │
    │  └──────┘ └──────┘ └──────┘ └──────┘ │
    │  ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐ │
    │  │  4   │ │  5   │ │  6   │ │  ○   │ │
    │  └──────┘ └──────┘ └──────┘ └──────┘ │
    │  ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐ │
    │  │  1   │ │  2   │ │  3   │ │  0   │ │
    │  └──────┘ └──────┘ └──────┘ └──────┘ │
    └─────────────────────────────────────┘
  ○                                           ○
```
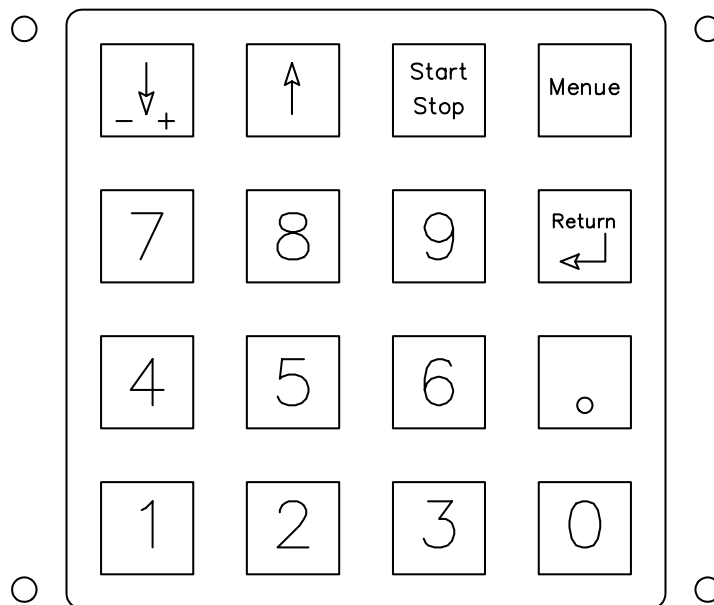
*"↓" (down arrow )*
*in Menu a fast positioning: Crosshead runs down*
*Caution: Danger of squeezing fingers between the clamps*
*Caution Load cell may be destroyed by collision!*
*in Menu (C,D,E,F):  + / - change*

*The positioning speed can be adjusted. Range between: 1-700 mm/min*
*during positioning with this key the max. Force is limited to 33 % of the nominal force of load cell to protect the load-cell from damage.*
*Nevertheless, the load cell might get damaged if the speed is to high and the collision is between two hard surfaces, because the machine can't stop quickly enough.*

*"↑" (up Arrow)*
*in Menu "A" fast positioning: machine travels up*
*speed can be adjusted in menu*
*during positioning with this key the max. force is limited to 33% of nominal force to protect the load-cell from damage.*

*"S" (Start/Stop)*
*only active in Menu A*
*this key starts the test*

*As soon as a change of force in 0.02 seconds is bigger than delta-F the machine stops and displays Fmax res. Xmax.*

*If the Start-Stop key is pressed during a test the procedure is interrupted. Pressing the Start-Stop key again continues the test.*
*Any other key stops test totally.*

*Menu-key*

*This key enables access to the current settings:*

*V   traveling speed in Menu*
*Range: from 1 mm /min to   700 mm/min   (positive values only)*

*X distance for a test*
*Range: from 1 mm to 540 mm (=smallest version of machine)*
*(minus the length of testing equipment)*
*(positive values mean tensile test)*
*(negative values mean compression test)*
*change +  to -  by pressing "⬇" changes sign*

*ΔF [N] sensitivity for detecting rupture of specimen.*
*i.e. value of 200N means: if in tensile mode load decreases more than*
*200N/50ms rupture is detected and test is finished.*

*FlimitS*
*Maximum force in Menu F (Software Limit of Load cell)*
*Exceeding this load cancels the test*

*F man:*
 *Manual speed from 1 to 700 mm/Min for operation with Arrow- Keys*
 *(⬆ ⬇ ) during manual positioning*

*(Enter) Return or Enter key*
*this key is used in multiple ways*

*in main menu (A) it is used to reposition the Crosshead in starting*
*position in setting menu  it is used to validate the new values*

*"0"             Key "0" ( lower right )*
*                this key is used in multiple ways*

*                in main menu (A) it does the zero adjustment*
*                which means by pressing "0" - Key the  A - D-interface sets and the*
*                distance is set to zero.*

*                in the sub menus this Key is used for numeric input*

*"1"             Key 1*
*                this key is used in multiple ways*

*                in main menu (A) it is use to show the Fmax. and the referring distance*
*                after finishing the test.*

*in the  sub menus  ( C,D,E,F) this Key is used for numeric input*

*" 2 "*            *Key 2*
                 *after finished test: the key shows F-break and X-break*
                 *(breaking force and breaking distance.*

*" 5 "*            *check Password for config menu (see chapter 4)*
                 *( also checked at power on when holding a key pressed)*

                 *in the  sub menus  ( C,D,E,F) this Key is used for numeric input*

*" 8 "*            *Key 8 toggle to force regulation*

                 *This key activates the force regulation menu.*
                 *after switching to force regulation menu and pressing that key the*
                 *parameters for the requested force are expected.*

                 *by pressing the Start/Stop Key force regulation is activated*
                 *the machine will slowly approach the requested force.*

                 *a second hit on this key "8" deactivates force regulation*

*" 9 "*            *Key 9 (Option - not in  Standard program*
                 *if in main menu this key brings up a Program which enables the*
                 *automatic mode  or force regulation*
                 *If automatic  mode is active the machine returns to zero position after*
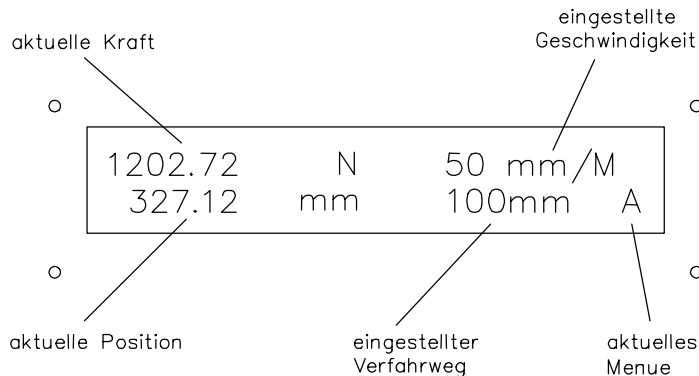                 *finishing the test*

*"3".."9"," ." )*   *the keys "3,4,5,6,7,8,9"  and*
                 *in the  sub menus  ( C,D,E,F) this Keys are used for numeric input*
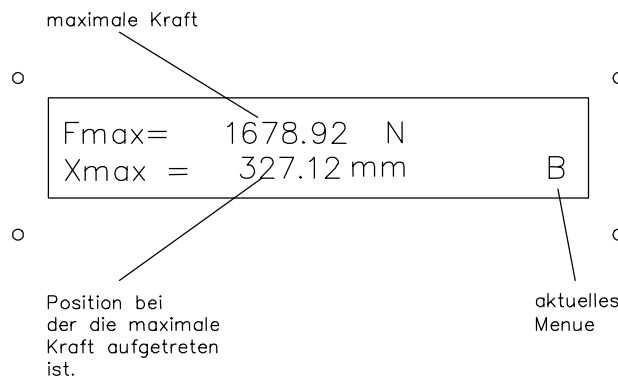
# 3) LCD   Display

*When you switch on the machine you get a message about the size of the mounted load cell. After the processor finishes the zero adjustment procedure you see the main menu A as follows:*
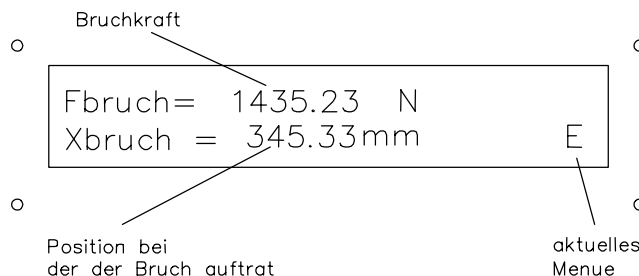
```
                      eingestellte
                      Geschwindigkeit
aktuelle Kraft

 ┌─────────────────────────────────────┐
 │  1202.72      N      50 mm/M         │
 │   327.12      mm     100mm    A      │
 └─────────────────────────────────────┘


aktuelle Position    eingestellter      aktuelles
                     Verfahrweg         Menue
```

*After the testing is finished the display holds  the maximum force reached respective the force at breaking point.*
*You also see the maximum force in case of an irregular end of the test e.g.: exceeding max. distance, exceeding max. force etc.*

```
              maximale Kraft

 ┌─────────────────────────────────────┐
 │  Fmax=     1678.92   N               │
 │  Xmax  =    327.12 mm          B     │
 └─────────────────────────────────────┘


Position bei                      aktuelles
der die maximale                  Menue
Kraft aufgetreten
ist.
```

*by pressing key  "2"  you see the rupture load.*

```
          Bruchkraft

 ┌─────────────────────────────────────┐
 │  Fbruch=   1435.23   N               │
 │  Xbruch  =  345.33mm           E     │
 └─────────────────────────────────────┘


Position bei                      aktuelles
der der Bruch auftrat             Menue
```

*by pressing "1"   your re-establish the max.-load display from menu B*
*by pressing "M" you return to Menu "A"*
*by pressing " Return " the testing machine returns to start position.*
*in case the measured load during positioning reaches 1% of F - limit the positioning is stopped to protect  the load cell against collision.*

_____


*The LCD's contrast can be adjusted with the adjustable resistor on the main PCB!*


## 4)        Change of configuration


*by pressing "Menu" during power on or "5" key  you call the config menu.
to prevent accidental change of configuration it is necessary to key  in the
Code.*

*proceed as follows:*

*after pressing  "5" key  the display shows:  " Password ? "
now key  in the number "09122" if you entered the code correctly  you can
either load the pre-set values or change them.
display shows:   Factory settings ?
Yes=0*

*by pressing "0"  the machine load the following values:
by pressing "Return" you skip the defaults.*

*Default values:
Language (Sprache)        1=deutsch 2= english 3= italian 4=french*

*UNITS          1/2                          mm N / in lbf* ( 1lbf = 4.44822 N   / 1 in = 25.4 mm )

*LOADCELL                                          [N]          2000
load cell Sensitivity (Lastzellenempfindlichkeit)    [mV/V]        3.165   (example)
Calibration factor (Kalibrierfaktor)              [FAK]        1.000
by pressing "0" you start a Calibration program
F limit H (maximum force for Hardware)             [N]          1500 [N]
return speed (Rücklaufgeschwindigkeit)             [VR]         500mm/min
F(0)                                              [N]          (preload) .*


*these settings are stored in a non-volatile ROM and are re-established after every power
on.*

*We recommend noting all changes on a piece of paper.*


<u>Machine type</u>


*'Machine type' can be set to 1..6 value with following meaning:*

*'1' for small engine (40W), short machine (up to 500mm)   TH 2730  3kN
'2' for small engine (40W), long machine (up to 1200 mm)  TH 2730  3kN  1000mm Verfahrweg*

*'3' for big engine (80W), short machine (up to 500mm)        TH 2730  5kN*
*'4' for big engine (80W), long machine (up to 1200 mm)      TH 2730 5kN <1000mm Verfahrweg*
*'5' for two big engines (80W -10kN), short machine (up to 500mm)  TH 3630  10 kN*
*'6' for two big engines (80W -10kN), long machine (up to 1200 mm). TH 3630 10 kN <1000 mm*

*After update parameter is '0' and **must be set to value between 1 and 6 ( '0' and '7' is not
allowed).***
*In machine without program (empty) this parameter is automatic set to '1'.*

*For more information see info-hex-3-74.txt file.*

# 5)        *Load Cell*

## 5.1)            *Limits of the Load Cell*

*The Load Cell mustn't be deformed  more than max.  0.2 mm in pulling direction!*

*Doing pressure tests ensure that the Load Cell does not bend out to the side!*
*Specially using low force Load Cells there is a high risk of damage by permanent bending
of the Load Cell which is due to the Load Cells construction principle*
*In case there is a danger of Load Cell overload we recommend using special protection
equipment, which we also provide. (www.grip-engineering.com)*

*After overload damage the Load Cell may still show measurements, but is not linear
anymore.*
*This is why we recommend the use of pneumatic grips for low force tests to avoid
accidentally destruction of load cells when tightening the clamps.*
*To ensure the accuracy of a Load Cell a calibration test should be done with multiple
different weights. If necessary adjust the calibration factor .*
*We only can provide the Load Cell Function as guaranteed by the manufacturer
Interface/Huppert.  Any warranty claims, which are due to mal -operation or overload will
not be accepted.*

### 5.2)        *Zero adjustment*

*By pressing " 0 " before testing a **Zero adjustment is done.***

*As already the clamping of probes does produce forces a **Zero adjustment**
should always be done before testing.*

### 5.3)            *change of load cells*

*Switch off power on the machine*

- *loosen the screw at the cross bar*
- *mount new load cell with the screw at the cross bar*
- *put load cell plug into the connector at the back side of the machine*

- *Switch on the machine again and wait to end of self test procedure*
- *press  "5"*
- *type Password: "09122"*
- *save old parameters on a piece of paper and type the new values*

> ➢ *set new parameter for 'Load cell' e.g.:  2000 [N]*
> ➢ *set new parameter for 'mV/V'*
>    *(load cell sensitivity) e.g.:  3.165 [ mV/N]*
> ➢ *set new parameter for 'Cal' (calibration factor) to "1"*

      *set calibration factor with weight*
      *put a calibration weight at the load cell, e.g. : 10 kg = 98.0665 N (***

      *the display should show a similar value*
      *E.g. the display shows 95.6 N the calibration factor must be increased:*
      *from 1 to  1.03745 (use calculator)*

      *check the changes with the weight again!*
      *** (this is dependent to your location and valid for 45° northern / e.g. at the*
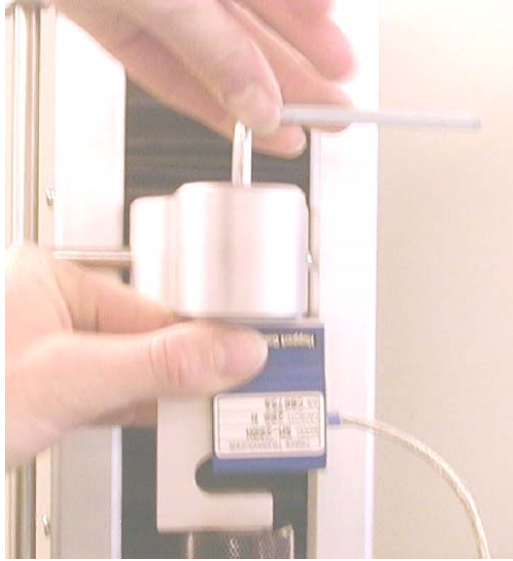      *North pole it would be 98.32 N /  at the Equator 97.80 N )*

      *Mounting procedure of Load Cell*

      ***Caution!***
      *Small type of load cells (200 N Stage can easily be deformed permanently by torsion forces.*


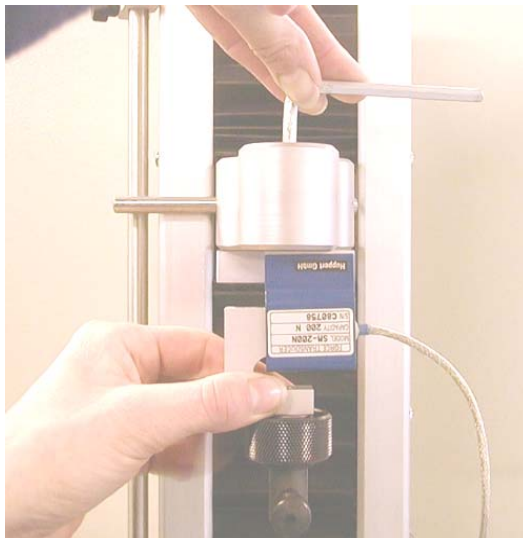      *Never put torsion forces on the Load cell while tightening or loosing probes and clamps*

*only hold the load cell at the upper part!-------------------------------*
*right* ↓



✓ OK.

-------------------------------------------------------------------------------
*wrong*↓
*do not mount like this! Load cell is likely to be destroyed .*



✗ never

-------------------------------------------------------------------------------

*Load cell have a fragile area with tiny parts and adjusted DMS strips inside.*
*Torsion forces can easily deform these thin Stages permanently.*
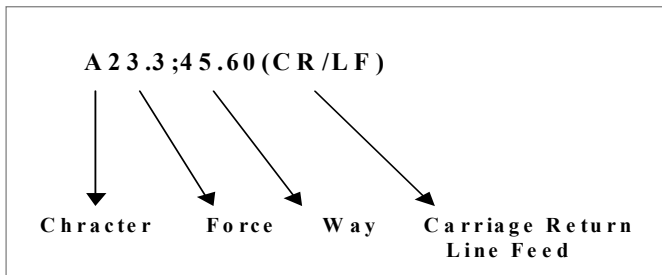
# 6) Interface RS232

## Table of orders for TH 2730

| ORDER | FUNCTION | EXAMPLE | RESULT |
|---|---|---|---|
|  | End of commands is always $ <br> * Decimal separator is '. ' |  |  |
| 'A' | Actual readings | A$ | Force ;Way |
| 'B' | Last readings (rupt. value) | B$ | Frupt    Xrupt |
| 'C' | Write configuration data block | C$ | Receive Conf. Data |
| 'Dxxx' | Set F delta | D20$ | F delta=20N |
| 'E' | Return to zero position | E$ | Return button (to 0,00mm) |
| 'Fxxx' | Set limit of force in test (F limitS) | F200$ | F limitS=200N |
| 'G' | Read configuration data block | G$ | Send Confg. data to comp. |
| 'H' | Stop machine | H$ | Stop button |
| 'H?' | Ask for listing command set | H?$ | Command set listing |
| 'Jxxx' | Set return speed | J200$ | VR=200 mm/min |
| 'K0' | Set normal mode | K0$ | Machine in Normal mode |
| 'K1' | Set Constant Force Regulation mode | K1$ | Machine in CFR mode |
| 'Lxxx' | Set end position for test | L100$ | X=100mm |
| 'M' | Last readings (max. value) | M$ | Fmax    Xmax |
| 'N' | Read nominal load | N$ | 2000 (Load cell = 2000N) |
| 'O' | Reset Load cell and position counter | O$ | 0,0N   0,00mm ("0" button) |
| 'O1' | Reset position counter only | O1$ | 2,0N   0,00mm |
| 'O2' | Reset Load cell only | O2$ | 0,0N   7,34mm |
| 'Pxxx' | Set preforce (F0) | P0.4$ * | F0=0.4N |
| 'Qxxx' | Set constant force to keep (in CFM) | Q200$ | Force to keep = 200N |
| 'R' | Begin test | R$ | Start button |
| 'RESET' | Hard reset | RESET$ | Reset of system |
| 'S' | Ask for Status | S$ | Condition of machine |
| 'SER?' | Ask for serial number of machine | SER?$ | 0001 (max 20char.) |
| 'SER:' | Set serial number in machine | SER:0001$ | Set ser.# 0001 (max 20char.) |
| 'T' | Read software ver. nr. in Flash mem. | T$ | " HEX-3.35  5. 2000 " |
| 'U' | Ask for actual units (US or SI) | U$ | 1-SI system, 0-Us system |
| 'Vxxx' | Set speed testing speed | V100$ | V=100mm/min |
| 'Xxxx' | Move to position | X20$ | 20mm to up |

*Serial communication port :*

Pin 1=DCD
Pin2=RxD
Pin3=TxD
Pin4=DTR
Pin5=GND
Pin6=DSR
Pin7=RTS
Pin8=CTS
Pin9=RI

## Data format:

| Bit per second | 38400 |
|---|---|
| Data bits | 8 |
| Parity | None |
| Stop bits | 1 |
| Protocol | Hardware (RTS/CTS) |

*Transmission example:*

*Character possibility:*

A 2 3 .3 ;4 5 .6 0 ( C R /L F )

Chracter     Force     Way     Carriage Return
                                Line Feed

„A"    -actual readings
„M"    -last readings of max. value(Fmax ; Xmax)
„B"    -last readings of break(Fbreak ; Xbreak)
„S"    -status of machine
„E"    -machine return to zero position
„R"    -test is running
„OK" -reset of Load cell and position is done
EOF (ASCII=26)-end of data, end of test

Force          =  23.3N
Way            =  45.60mm

# C 251 Compiler    Communication procedure.

```
…
switch(combuffer[0])
    {
    case 'R':versuch(0);
                    break;
    case 'E':moveto(wegoffset,Tconfig.VR);
                    printf("E\n\r");
          break;
    case 'H':mstop();
          break;
    case 'O':adnullen();
                    printf("OK\n\r");
                    break;
    case 'A':printf("A% 6.*F;% 6.2F\n\r",Tconfig.nachkomma,getkraft(),getweg());
                    break;
    case 'M':printf("M% 6.*F;% 6.2F\n\r",Tconfig.nachkomma,fmax,xmax);
                    break;
    case 'B':printf("B% 6.*F;% 6.2F\n\r",Tconfig.nachkomma,frupt,xrupt);
                    break;
    case '$':resetproc();
                    break;
    case 'V':combuffer[0]=' ';
                    T=atof(combuffer);
                    if ((T>1)&&(T<1000)) Tparablock.SPEED=T;
                    break;
    case 'L':combuffer[0]=' ';
                    T=atof(combuffer);
                    Tparablock.endpos=T;
                    break;
    case 'X':combuffer[0]=' ';
                    T=atof(combuffer);
                    moveto(T,Tconfig.VR);
                    break;

    case 'S':printf("S%d\n\r",status);
```

# Delphi 3.0   Receive procedure (for exp.)

```
procedure Tform1.receive(s:string);
 const status:word=0;
 var    s1,s2:string;
        index1,index2:word;
         y:tvaluesx;
 begin
    case s[1] of
     'A':      Begin
               index1:=pos(';',s);
                    s1:=copy(s,2,index1-2);
                    index2:=pos(#10,s);
                    s2:=copy(s,index1+1,index2-index1-1);
                    panel2.caption:=s2+'mm';
                    panel3.caption:=s1+' N';
               end;
     'R':      Begin
                    if status=0 then
                         begin
                         xychart1.clear;
                         timer1.enabled:=false;
                         inc(status);
                    end;
                    index1:=pos(';',s);
                    s1:=copy(s,2,index1-2);
                    index2:=pos(#10,s);
                    s2:=copy(s,index1+1,index2-index1-1);
                    panel2.caption:=s2+'mm';
                    panel3.caption:=s1+' N';
                    Y[0]:=strtofloat(s2);
                    Y[1]:=strtofloat(s1);
                    Y[2]:=0;
                    Y[3]:=0;
                    y[4]:=0;
                    xychart1.add(y);
               end;
     #26:   begin
                    status:=0;
                    timer1.enabled:=true;
                    speichern1click(self);
               end;
    end;
 end;
```

## C 251 Compiler    Communication procedure.

```c
switch(combuffer[0])
    {
    case 'R':versuch(0);
                  break;
    case 'E':moveto(wegoffset,Tconfig.VR);
                  printf("E\n\r");
          break;
    case 'H':mstop();
          break;
    case 'O':adnullen();
                  printf("OK\n\r");
                  break;
    case 'A':printf("A% 6.*F;% 6.2F\n\r",Tconfig.nachkomma,getkraft(),getweg());
                  break;
    case 'M':printf("M% 6.*F;% 6.2F\n\r",Tconfig.nachkomma,fmax,xmax);
                  break;
    case 'B':printf("B% 6.*F;% 6.2F\n\r",Tconfig.nachkomma,frupt,xrupt);
                  break;
    case '$':resetproc();
                  break;
    case 'V':combuffer[0]=' ';
                  T=atof(combuffer);
                  if ((T>1)&&(T<1000)) Tparablock.SPEED=T;
                  break;
    case 'L':combuffer[0]=' ';
                  T=atof(combuffer);
                  Tparablock.endpos=T;
                  break;
    case 'X':combuffer[0]=' ';
                  T=atof(combuffer);
                  moveto(T,Tconfig.VR);
                  break;

    case 'S':printf("S%d\n\r",status);
                  break;
    case 'F':combuffer[0]=' ';
                  T=atof(combuffer);
                  if (fabs(T)<CONFIG.GRENZLAST) Tparablock.LIMIT=fabs(T);

    case 'D':combuffer[0]=' ';
                  T=atof(combuffer);
                  Tparablock.DELTA_F=fabs(T);
    case 'P':combuffer[0]=' ';
                  T=atof(combuffer);
                  Tparablock.F0=fabs(T);

              }
```

# Delphi 3.0   Receive procedure ( for example )

```
procedure Tform1.receive(s:string);
 const status:word=0;
 var s1,s2:string;
    index1,index2:word;
    y:tvaluesx;
 begin
 case s[1] of
 'A': Begin
    index1:=pos(';',s);
    s1:=copy(s,2,index1-2);
    index2:=pos(#10,s);
    s2:=copy(s,index1+1,index2-index1-1);
    panel2.caption:=s2+'mm';
    panel3.caption:=s1+' N';
    end;
 'R': Begin
    if status=0 then  begin
                xychart1.clear;
                timer1.enabled:=false;
                inc(status);
                end;
    index1:=pos(';',s);
    s1:=copy(s,2,index1-2);
    index2:=pos(#10,s);
    s2:=copy(s,index1+1,index2-index1-1);
    panel2.caption:=s2+'mm';
    panel3.caption:=s1+' N';
    Y[0]:=strtofloat(s2);
    Y[1]:=strtofloat(s1);
    Y[2]:=0;
    Y[3]:=0;
    y[4]:=0;
    xychart1.add(y);
    end;
 #26:begin
    status:=0;
    timer1.enabled:=true;
    speichern1click(self);
    end;

 end;
 end;
```

## 7) Special programs for test machine

### F (0) Mode

*if F(0) Mode is set to " 1 "  x will automatically be set to 0*
*if load will come to a special value (after touching the sample )*
*used for compression tests*

*constant force regulation*

*with key 8 you can switch to force regulation*

*with key Menu you can set force*

*for example  5 N makes tension 5 N*
*for example –5N makes compression 5 N*

*if you press Start key force regulation will be activated*
*machine drives slowly to this force*

*if you press again on key 8 you come back to normal constant speed regulation*
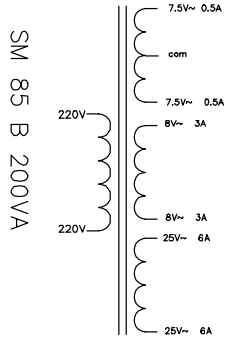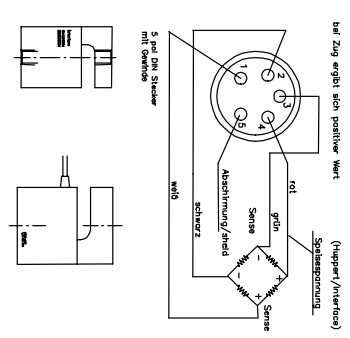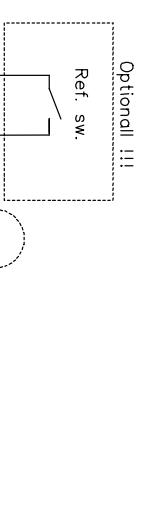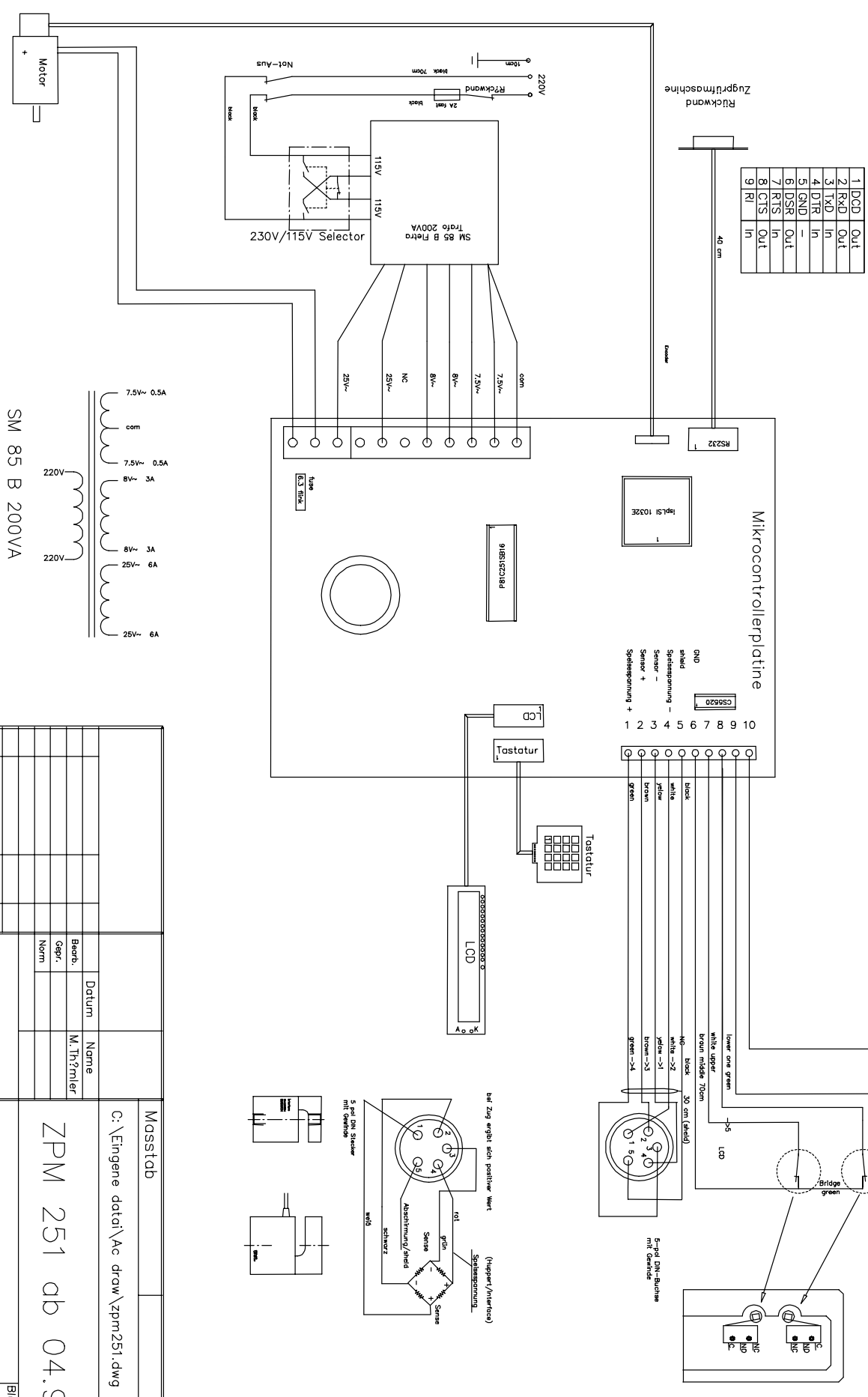
## 8) Number of machine

*On backside of machine you can find this number*
*please use it if you have questions*

## 9) Accessories

*1 RS 232 cable*
*1 110/220V cable*
*2 pins 8 mm for adapter*
*1 certification of load cell*

*Grips like ordered see also    http://www.grip-engineering.com*

110V VERSION (USA)

Motor +

Not-Aus
black 70cm
black
2A fast
black
Rückwand
220V
10cm

230V/115V Selector
115V
115V
SM 85 B Rietro Trafo 200VA

Rückwand Zugprüfmaschine
Encoder
40 cm

| 1 | DCD | Out |
| 2 | RxD | Out |
| 3 | TxD | In |
| 4 | DTR | In |
| 5 | GND | - |
| 6 | DSR | Out |
| 7 | RTS | In |
| 8 | CTS | Out |
| 9 | RI | In |

SM 85 B 200VA
7.5V~ 0.5A
com
7.5V~ 0.5A
8V~ 3A
8V~ 3A
25V~ 6A
25V~ 6A
220V
220V

25V~  25V~  NC  8V~  8V~  7.5V~  7.5V~  com

fuse 6.3 flink
PB84SIC2018B
fuse 6.3 flink

RS232
isp151 1032E
CS5620

Mikrocontrollerplatine

GND 1
shield 2
Speisespannung - 3
Sensor - 4
Sensor + 5
Speisespannung + 6
7 8 9 10

LCD
Tastatur

green
brown
yellow
white
black

LCD
A o oK

Tastatur

lower one green
white upper
braun middle 70cm
black
yellow ->1
brown ->3
green ->4
white ->2
NC

5-pol DIN-Buchse mit Gewinde
1 2 3 4 5
30 cm (shield)
LCD
->5

Optionall !!!
Ref. sw.

Bridge green

NC  NO  C
NC  NO  C

bei Zug ergibt sich positiver Wert
(Hupper/Interface)
Speisespannung

weiß
rot
grün
schwarz
Abschirmung/shield
Sense
Sense

5-pol DIN Stecker mit Gewinde

| Zust | Änderung | Datum | Name |
| --- | --- | --- | --- |
| | | | |

Bearb.
Gepr.
Norm
Datum  Name
M.Th?mier

Masstab
C:\Eingene data\Ac draw\zpm251.dwg

ZPM 251 ab 04.99

Andrze i27.04.99 16:15zpm251.dwg

Blatt 1
1 Bl.

## Thümler GmbH
*grip - engineering*

*Spannzeuge und Zubehör für Zugprüfmaschinen*
*Sonderprüfgeräte - Entwicklung und Bau*

Hans Traut Str. 25          90455 Nürnberg              Germany
Tel.:  09122-78711      Fax.: 09122-73127      e-mail: grip@osc.de

# EG-Konformitätserklärung

Name und
Anschrift des Herstellers:   Thümler GmbH   90455 Nürnberg   Hans Traut Str. 25

Beschreibung
der Maschine                 kleine Zugprüfmaschine TH 2730

Bestimmungen
denen die Maschine
entspricht                   EG Maschinenrichtlinie 89/392
                             und EWG 91/368, EWG 93/44
                             VDE 0100, VDE 0106, VDE 0113, DIN 57113 / EN 60204
                             VDE 0160, VDE 0660
                             VBG1, VBG4, VBG5, VBG7A, ZH1/456 und ZH1/597

Stellung
des Verantwortlichen         M. Thümler  Dipl. Ing. (Univ.) Maschinenbauing.

Funktion                     Leitung, Entwicklung, Konzeption, Konstruktion
                             eingetragen in folgende Handwerksrollen
                             - Elektromechanikerhandwerk  Lfd. Nr. 92/09/132 BNR 0052159
                             -  Maschinenbauerhandwerk    Lfd. Nr. 87/13/062 BNR 0052159

Nürnberg, den 16. 6. 99

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# *10) Windows software*

*You can download actual software, manual and hex file from our software homepage*

*http://www.grip-soft.de*