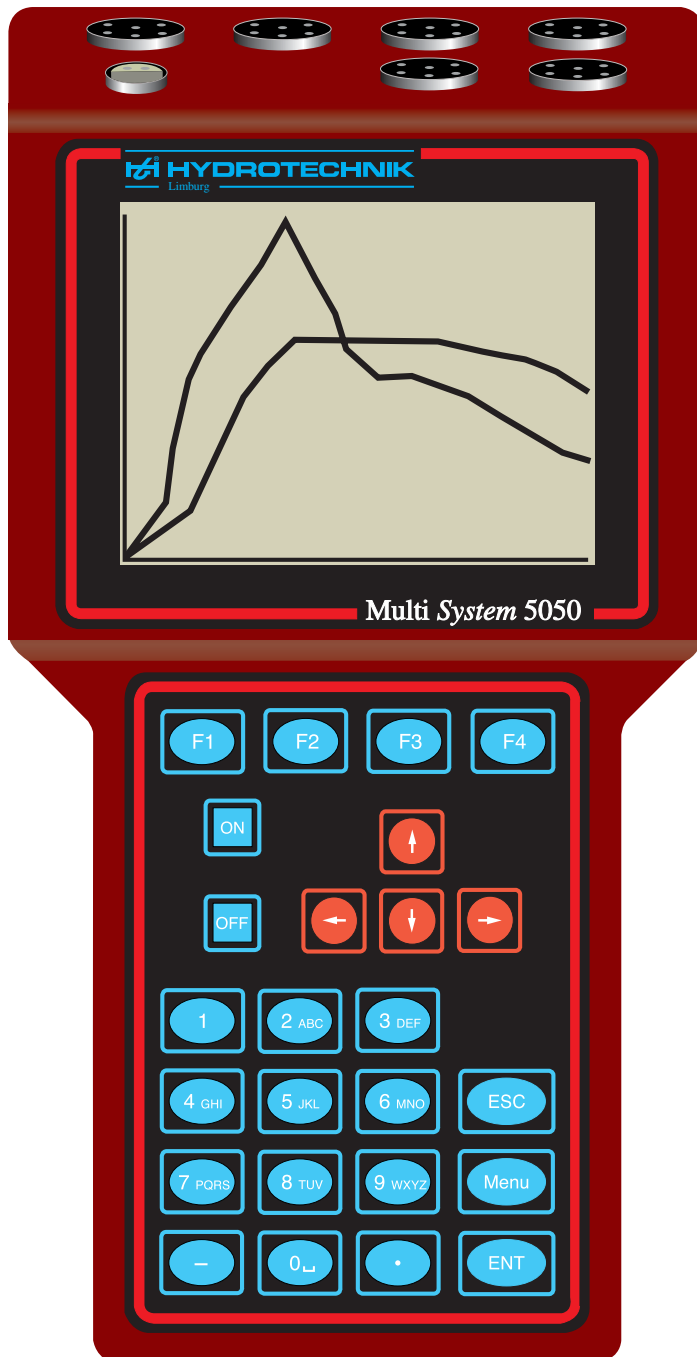*Test with confidence*

HYDROTECHNIK
Limburg

Messen mit System

Multi-System 5050

User Manual

L3160-00-62.00E

ISDS **Intelligent Sensor Detection System**

USB

UNIVERSAL SERIAL BUS

Please take the time to read this manual carefully so as to get the most out of your Multi-System 5050 and to ensure optimum performance and realiability.

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Foreword

This user manual describes the hand-held measuring device Multi-System 5050.

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Modification to reflect technical progress are reserved.

Thank you very much for your confidence

You have purchased a powerful, state-of-the-art measuring device that will serve you well in your daily measuring activities.

The use of the Multi-System 5050 should not provide any problems for you but you can make only full use of its features if you acquaint yourself fully with the device.

We will be happy to assist you in the unlikely case of difficulties.

We wish you success in the use of our hand-held measuring device Multi-System 5050

List of contents

General

With the Multi-System 5050, Hydrotechnik sets new standards for present and future hand-held measuring devices. Each hand-held device contains components of the latest, highly integrated technology, in a compact casing with oil-resitant keyboard and a clear and optimal-dimensioned graphics display. The device has been optimised with the needs of daily use in mind, it facilitates ease of use and offers new technical refinements.

With regards to sensors, Hydrotechnik has set another milestone by offering the new ISDS (Intelligent Sensor Detection System) as an introduction to automatic recognition of sensors connected to the measuring device. All relevant parameters are stored in an EPROM and are serially read upon activation.
When the measuring device is switched on the sensor recognition is activated, displaying all connected ISDS-compatible devices.
The entry of sensors, as required in the past, are no longer necessary; the measuring may be started immediately.

Hydrotechnik's measuring device Multi-System 5050 is a powerful, batter-driven hand-held measuring device for all types of physical values.

It offers 2 frequency inputs and 4 analogue inputs, freely selectable by the user. The frequency sockets may be used for sensors with an output signal between 3.5 and 30 V, the analogue socket may be used for sensors with a standardised output signal between 0 and 20 mA, or 4 and 20 mA or a voltage signal between 0 and 10 VDC.

In addition, the measuring device offers two independent memories: a min/max memory continuously monitoring and storing the minmal/maximal values of the 6 measuring channels and another memory with a capacity of 1 MB (max. 500,000 measures), allowing the storage of a maximum of 36 different series of readings.

A special function enables the user to analyse measured values (max. 3) either as discrepancy or sum, or to carry out a hydraulic performance evaluation and a primary derivation (e.g., speed from distance). The result will be displayed and may also be stored.

The stored measuring series are automatically assigned their relevant date and time and may be displayed graphically or in tables or, alternatively, printed out. This applies to the complete measuring series or only parts of it.

- a zoom function may be used to enlarge particular sections
- simultaneous to the current values measured the display shows also all extreme values (min./max.)
- of course, the display of the extreme values may be suppressed, resulting in the physical size being displayed and, provided there is enough space, even the time will be shown
- data may be transmitted at max. 57600 Baud via RS 232 interface to a PC
- via the USB interface the stored data may be transmitted extremely fast (4x faster than via the RS 232 interface)

The data evaluation software „HYDROcomsys/WIN32" provided free of charge by HYDROTECHNIK manages large data volumes either in graphical or tabular form and statistical data analysis.
A text editor for the compilation of useful comments regarding the individual measuring series and an optional multi-windows technology for presentation using a PC should provide an extremely useful tool.
The integration of the data into standard programs like WORD and EXCEL is possible.

The operating software for the Multi-System 5050 has been developed with the greatest care and thoroughly tested. Should you, therefore, detect an error we would appreciate it if you would inform Hydrotechnik in a sufficiently documented form (see also the notes in chapter 1.9). Please refer, if necessary, to your local dealer from whom you purchased the system. We shall provide you with an updated program version free of charge within the warranty period.

The stored values may be displayed directly as curves on the measuring device. The user thus has the characteristic curves of his measured values immediately available and may alter his measuring tasks appropriately and change the measuring parameters as he requires, to achieve the measuring results desired.

This type of visual pictorial display is more explicit than a simple table. We are convinced that you will not want to miss this option in future.

Additionally, the user may select from various internal trigger options, or use an external trigger to start the storage function. The measuring device may also be used to access external devices, e.g., a PLC.

If, for special measuring tasks, more than 6 measuring channels are required, this number may be increased to, for example, 12 via a parallel connection with another measuring device. Several measuring devices may thus be coupled.

All stored measures may be documented in printed tables or graphics. A large number of commonly available printers are supported.

We hope to have opened the path for you to simplified measuring processes.

Notes on the correct charging of the internal battery

Before using the measuring device make sure that the internal NiCd-batteries are sufficiently charged. If in doubt use the Hydrotechnik mains unit.

Whilst using the Hydrotechnik mains units (primary 230 VAC, secondary 24 VDC) a continuous charging of the battery is assured.

Please be aware that the batteries are only partially charged ex works. It is advisable to connect the mains adapter and charge the batteries for approx. 14 - 16 hours.

The re-charging of the batteries should be always done with the mains adapter.

An empty battery should be recharged for 16 hours with the device switched off.

The life cycle of NiCd-batteries may be very long, but it depends, however, on the intensity of use. 100% discharging, overcharging or immediate re-charging after every use should be avoided.

A discharge to under 50% and a subsequent re-charging has a positive effect on the life cycle of the NiCd batteries. A re-charging after only short usage of the measuring device is inadvisable since the memory effect known in connection with NiCd batteries causes a reduction of the battery capacity. If the battery is frequently only partly discharged and subsequently reloaded, the battery will soon reduce its capacity. If this should be repeated over a long period, the battery may be permanently damaged. However, with a few discharging and re-charging cycles, i.e., by long-term use of the measuring device and subsequent complete re-charging, the battery may be regenerated.

We recommend regular batter maintenance by re-charging
Following a prolonged non-use of the measuring device, i.e., as a rule a monthly discharging and subsequent recharging of the battery should be done.

The self-discharge of NiCd batteries is a known fact and can be counteracted only by regualr maintenance on the part of the user. This saves time and inconvenience, since it assures the functionality of your measuring device at all times.

General notes on safety, concerning your safety and the functionality of the measuring device:

- never subject your device to extreme heat or humidity, observe the technical specifications of the device
- never open the device yourself

When operating with the mains adapter unplug the mains adapter:
- during a thunder storm
- if you observe odour or smoke

Please protect your sensors against:
- exceeding the permitted voltage range
- mechanically overloading the permitted measuring range
- wrongly connecting sensors, especially third party sensors

Responsibilities:
When using our measuring devices and the sensors connected to them you should only employ operators who are trained, instructed and authorised in connection with your systems, devices and test equipment, to reduce to a minimum the safety risk, e.g., in case of operational erros, wrong connections, total system failure, environmental pollution, Thus a clear distinction between the responsibilities between the manufacturer Hydrotechnik and the user (operator) may be defined.

Proper use:
If the measuring device Multi-System 5050 is to be used for external control purposes in order to simulate an intervention in the process of a system it must only be done under supervision and only for measuring purposes. Leaving the device in the system for control purposes should be avoided since it might provide an opportunity of manipulation by third parties. Please consider the high security risks that could result from improper operation.

Cleaning
If the casing is dirty, clean it with a soft cloth, slightly moistened with a normal household cleaner (please observe directions by the manufacturer of the cleaning fluid). Strong chemical solutions should not be used since they would damage the casing.

Battery disposal
You are legally required to return all used batteries.
Their disposal via the domestic waste disposal is illegal.
Please dispose of the batteries in accordance with the regulations for hazardous waste.
All recycling centres are obliges to accept batteries.
Of course, you may return your old measuring device batteries to HYDROTECHNIK.

Please make your contribution to conserving the environment!
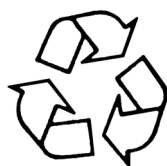
Recycling for the sake of our environment

Connectivity specifications for the Multi-System 5050

Measuring input
Ch2
analogue

Measuring input Ch3
analogue

Measuring input Ch4
analogue

Measuring input
Ch1
analogue

Measruing input
Ch 6
for frequencies

External trigger in / out

Measuring input
Ch 5
for frequencies

External power supply
230 VAC/24 VDC

USB-interface

Serial PC-interface

16 lines
graphics
display

Centronics interface
parallel for printers

On/Off-switch

Foil-covered keyboard

Connectivity of the Multi-System 5050

The most diverse sensors may be connected
max. 6 to the measuring inputs
ISDS-compatible sensors are automatically
recognised by the measuring device

Sensors for
measuring volume
throughput with or
without ISDS

Sensors for pressure and
temperature with or without
ISDS

Temp.-Sensor

Connectivity for various
b/w or colour printers

Turbine

Pressure sensor

Gearwheel
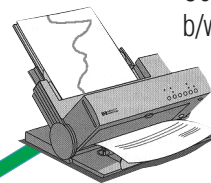
Software HYDROcomsys/WIN32
for data presentation on a PC

p1	= 185.2	bar
p2	= 168.4	bar
p3	= 48.9	bar
Q1	= 85.34	l/min
n1	= 1225	U/min
T1	= 64.7	°C
dp1	= 16.8	bar

MINMAX

USB

RS232

Revolution sensor
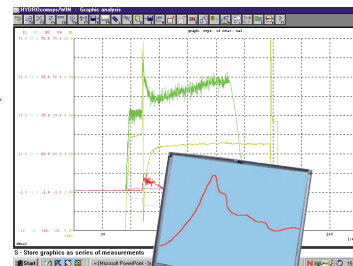
Measuring device Multi-System5050:
Presentation of measured values

Other sensors, e.g., power,
distance, torque, etc. are
possible

external trigger/controlling
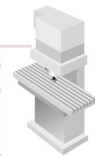
Measuring device used to
control an external system.

parallel connection

External digital addressing
to trigger the storage of
measured values in the
measuring device.
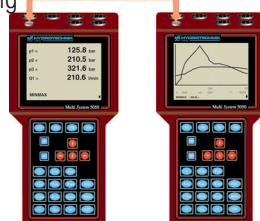
Paralled connection of several
measuring devices to increase
the number of input channels.
Synchronous storage in both
measuring devices.

Description of the function keys

On / Off switch
These two keays are designed for a secure activation / deactivation of the device with mechanical switches located behind the foil keyboard.

Softkeys F1 to F4
Depending on the active menu, the keys F1 to F4 have different functions. These selection mode always appear at the display bottom and are activated by the keys F1 to F4.
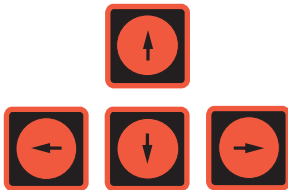
Arrow keys

Four arrow directions are available:

- arrow up or down select from the menu
- arrow left or right page through the display

Alphanumeric keyboard
Input of data from non-ISDS compatible sensors, text inputs, blanks, minus, e.g. for temperatures, comma as decimal point.

Escape-function
Return to the previous program section without saving any parameter alterations or aborting the entry into a field. Repeated pressing leads to a return to the measuring menu.

Menu
Activation of the main menu.

Enter
Confirms an entry or selects a function.

Description of the display symbols

Example: approximate location of symbols in the display
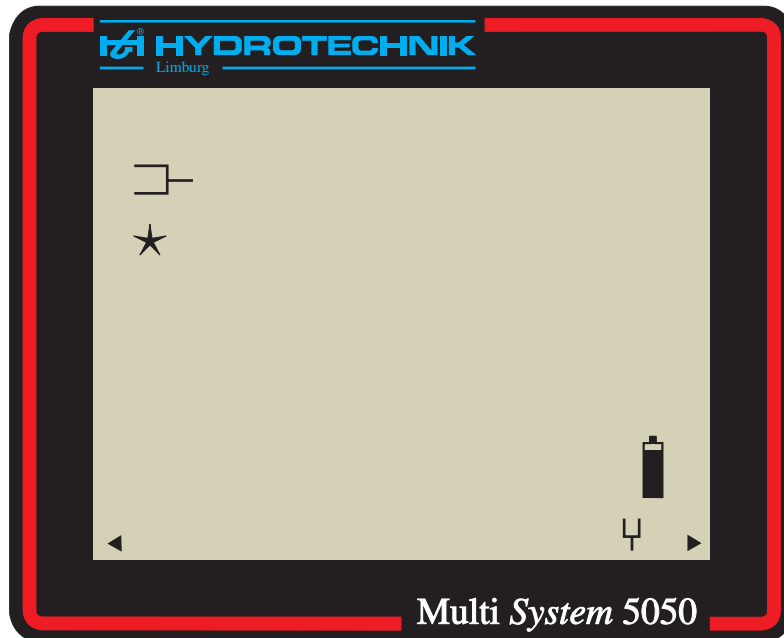
Symbol battery
Fully charged.

Symbol battery
Battery almost empty.
If this symbol is blinking, activate the mains adapter for recharging of the battery.

Symbol mains adapter
Recharges the internal battery. Appears upon plugging-in of the mains adapter whilst at the same time deactivating the battery symbol. If the symbol is blinking, the wrong mains adapter is being used.
Please use only the „Original mains adapter from HYDROTECHNIK".

Symbol arrow
Arrow pointing left: paging to the previous page
Arrow pointing right: paging to the following page

Symbol ISDS
When this symbol appears in front of the channel of a measuring display an ISDS-sensor has been detected on this channel. All parameters of the sensor will be set automatically.

Symbol USB
This symbol appears when the USB-interface is active (connection between measuring device and PC).

Symbol asterisk*
This symbol appears during storage. If it is blinking it indicates an impending trigger event.

1. Switching-on the measuring device.

Before we start the description of the measuring device we would like to point out, that it was our intention to create a practice-oriented user manual that enables you, with clearly structured paragraphs and simple overviews, to understand the program logic and to introduce you in the easiest possible way to the operation of the Multi-System 5050 so that, after a short learning phase, you will have to refer to this manual only in special cases.

For certain measuring tasks that are not very often used, the list of contents should be consulted to recall the necessary operating steps.

After activation of the measuring device **[ON]** a display appears, showing for approx. 4 seconds the initialisation, current program version, data and time.

In the case of queries always quote the current program version.

Initialisation

```
******* Multi-System 5050 *******


                initialisation
                version 3.x
                13.06.2001
                   01:48


                S/N : xxx

    F1        F2        F3        F4
```
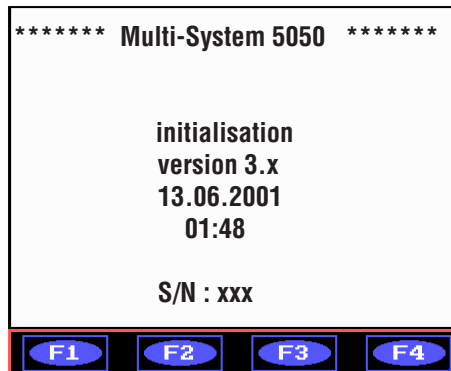
Following the display of the current program version the measured value is automatically displayed (the example shows a sample display).

Measured value

```
 ⌐ p1=-6.006     -6.515
                  -6.003
    p2= 110.9      97.5
                  110.9
    Q1= 183.7     183.7
                  187.4
 ⌐ Q2= 19.81     19.81
                  19.95
    E1=   OFF      OFF
                    ON
    A1=   OFF      OFF
                   OFF
   dp1=-116.8    -116.8
                 -103.9
MEAS.u DELETE

    F1        F2        F3        F4
```
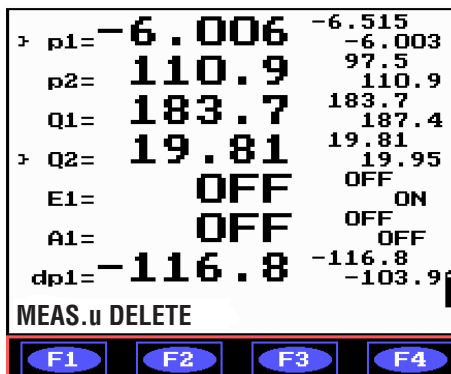
With the **[Menu]** key the main menu with its five sub-menus is activated.

The program steps are provided in the form of menus by the device and you only need to make your selection, an entry or confirm.
As soon as all required steps have been selected or programmed it is extremely easy to commence measuring.

Operating structure

The following illustrations explain the operating structure and the design of the program menus. After switching-on first the initialisation and then the measuring menu appear. By pressing the menu-key the main menu appears. From here you may select all the submenus required for measure analysis or presentation.

Initialisation

```
******* Multi-System 5050 *******

      initialisation
      version 3.x
      13.06.2001
        01:48

       S/N : xxx
```
F1 F2 F3 F4

Measuring menu

```
→ p1= -6.006   -6.515
              -6.003
  p2=  110.9    97.5
              110.9
  Q1=  183.7   183.7
              187.4
→ Q2=  19.81   19.81
              19.95
  E1=   OFF     OFF
               ON
  A1=   OFF     OFF
               OFF
 dp1= -116.8  -116.8
             -103.9

MEAS.V   DELETE
```
F1 F2 F3 F4

Main menu

```
*******  MAIN-MENU  *******

Channel menu

Display menu
Memory menu
Device menu
Project menu

------------- Memory -------------
  Start    SHOW    DELETE
```
F1 F2 F3 F4

ON   **Menu**

Using either of the arrow keys or the hotkeys 1 to 5 you can select the appropriate submenu (black bar)

1

```
*****  CHANNEL MENU  ******
→K1: p1 0/10 L     -1/6
 K2: p2 0/20      0/200
 K3: T1 0/20    -50/200
→K4: p3 4/20 L      0/0
 K5: Q1 o.R.      1000
→K6: Q2 o.R. L     75.5
 K7: Trigger Input
 K8: Trigger Output
 K9: K1-K2
 K10: -
 K11: -
```
F1 F2 F3 F4

Measuring channel menu

2 ABC

```
******  DISPLAY MENU  ******
Channels    :  p1    p2
               Q1    Q2
               E1    A1
               dp

Display rate : 1.00 sec
Contrast     : 50%
Presentation : TEXT

                        OK
```
F1 F2 F3 F4

Display menu

3 DEF

```
*****  MEMORY MENU  ******
Channels     :  p1  p2

Storage time :      5 sec
Scann. rate  :      1 ms
Ind. rate    : NO
Trigger 1    : NO


                        OK
```
F1 F2 F3 F4

Storage menu

4 GHI

```
******  DEVICE MENU  *******
**** S/N:990202  V.xx  ****
Language    :  ENGLISH

Date        : 13.06.2001
Time        : 11:32
ISDS        : YES
Unit        : SI
Printer     : HP mono
              (HP 350C)
Format      : A4
                        ▶
                       OK
```
F1 F2 F3 F4

Device menu

5 JKL

```
******  PROJECT MENU  ******

 Project    :   -

< Channels >:
  p1   0/10 L    -1/6
  p2   0/20     0/200
  T1   0/20   -50/200
  p3   4/20 L     0/0

  Q1   n.D        1000
  Q2   n.D  L     75.5
                        ▶
SELECT   SAVE  LOAD  DELETE
```
F1 F2 F3 F4

Project menu

1.1 Language selection

Take the following steps in order to select your preferred language for the Multi-System 5050, since it is shipped with the default language GERMAN.

```
******* Multi-System 5050 *******


         initialisation
          version 3.x
          13.06.2001
            01:48

          S/N : xxx

 [F1]    [F2]    [F3]    [F4]
```

Switch on with the **ON** key.

```
→ p1= -6.006   -6.515
                -6.003
  p2= 110.9      97.5
                110.9
  Q1= 183.7     183.7
                187.4
→ Q2= 19.81     19.81
                19.95
  E1=    OFF     OFF
                 ON
  A1=    OFF     OFF
                OFF
 dp1=-116.8    -116.8
               -103.9
 MEAS.V  DELETE
 [F1]    [F2]    [F3]    [F4]
```

Temporarily the initialisation appears, followed by a display of the measured value.

Now you may select your preferred language by following the steps described below.

```
*******   MAIN-MENU   *******

Channel menu
Display menu
Memory menu
Device menu
Project menu

-------- Memory --------
 Start   SHOW   DELETE
 [F1]    [F2]    [F3]    [F4]
```

Select the main menu by pressing **Menu**

By pressing **4 GHI** the fourth item of the device menu is selected

(not shown on the display).

```
****** DEVICE MENU ********
**** S/N:990202  V3.xx ****
Language :  DEUTSCH
            ENGLISH
Date     :  FRANCAIS
Time     :  ESPANOL
            ITALIANO
ISDS     :  NEDERLANDS
Unit     :  SVENSKA
Printer  :  HP mono
            (HP 350C)
Format   :  A 4
 [F1]    [F2]    [F3]    [F4]
```
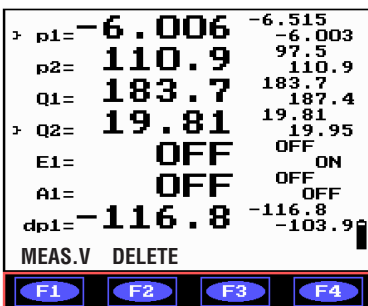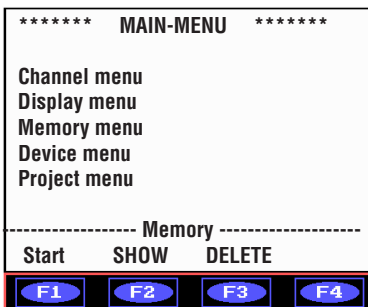
Pressing **1** selects German.

Use the arrow keys **↑** **↓** to select your preferred language.

In our example we select „German", confirm our selection (highlighted black bar)

with **ENT** and confirm with **F4** (OK in the display).

The selected language stays active even after switching-off the device.

```
****** DEVICE MENU ********
**** S/N:990202  V3.xx ****
Language :  English
Date     :  19.06.2001
Time     :  11:33
ISDS     :  YES
Unit     :  SI
Printer  :  HP mono
            (HP 350C)
Format   :  A4
                      OK
 [F1]    [F2]    [F3]    [F4]
```

It is advisable for the user now to check all other program steps and make the selections appropriate for him. In this way he can set his personal defaults which then would not have to be altered.

The following program steps are activated by pressing **ENT**
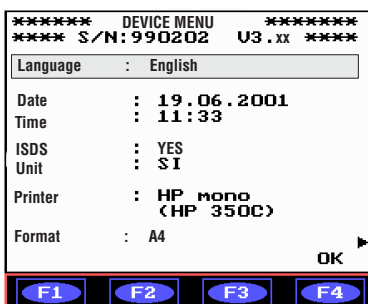
1.2   Setting date and time

You may set date and time with the arrow keys. With the [ENT] key the desired line (highlighted black bar) may be activated. Entries are made via the numeric block. Since the figures are to be entered in the sequence:

Day- Month- Year   or   Hours- Minutes

Each entry of a figure must be confirmed by [ENT] . The cursor will then automatically move to the next entry field.

**1.3   ISDS-setting
        with SI and US units**

This line should display „YES" if ISDS-compatible sensors are used.

Use [ENT] to move between „YES" and „NO"

In another line you may choose between SI or US units.

Here, too, you select with [ENT]

**SI- units are: °C, bar, l/min etc.
US-units are: °F, psi, gal/min etc.**

If an ISDS sensor for SI-units is connected (e.g. pressure sensor 600 bar), it will automatically be convertred to psi, if US-units had been selected before.

1.4 Printer selection

Select your preferred printer from the line „Printer".
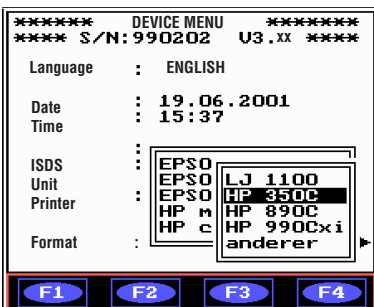
You can choose between HP colour and b/w printers and other makes.
The available printers have been tested by HYDROTECHNIK.

1.5 Company address

In the line „Company" the company adress may be changed to that of the user with the arrow key.

The entry is done with the numeric keys as known from mobile phones.

With **F1** you switch between upper and lower case.

Delete, insert or erase is done by **F2** or **F3** or **F4**

The text entered appears later in all hard copy protocols.

1.6 Transmission speed
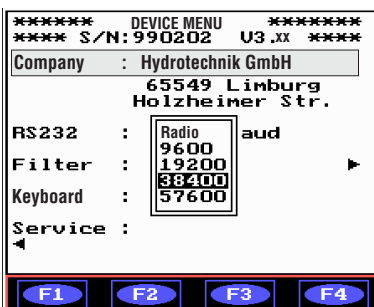
The line „RS 232" lets you select the Baud rate. The desired Baud rate* is selected with the arrow keys.

*)**Baud (Bd) means bit/s and represents the speed of transmission.**

We recommend a Baud rate of: **38400**

When you wish to transmit data from the measuring device to the PC make sure, that the HYDROcomsys/WIN32 software has the same Baud rate as the measuring device, e.g., 38400 baud.

1.7 Channel filter

```
******   DEVICE MENU   *******
******   Channel Filter   *******
AD Channels
   Channel    1  :   1  ms
   Channel    2  :   1  ms
   Channel    3  :   1  ms
   Channel    4  :   1  ms
Frequency Channels
 Min. Frequence     :  1 Hz
 Gate Time    f1    :  001
                       (10.9ms)
 Gate Time    f2    :  001
                       (10.9ms)
                            OK
```
```
  F1      F2      F3      F4
```

1.8 Keyboard selection

```
******   DEVICE MENU   *******
****  S/N:990202  V3.xx  ****
Company   : Hydrotechnik GmbH
             65549 Limburg
             Holzheimer Str.
RS232   :  38400 Baud
Filter  :                    ▶
Keyboard   :  COMFORT
Service : Overview
◀
                           OK
```
```
  F1      F2      F3      F4
```

```
******   DEVICE MENU   *******
***  S/N:990202  V3.xx   ****
Company   : Hydrotechnik GmbH
             65549 Limburg
             Holzheimer Str.
RS232   :  38400 Baud
Filter  :                    ▶
Keyboard   :  STANDARD
Service : Overview
◀
                           OK
```
```
  F1      F2      F3      F4
```

1.9 Service

```
******   DEVICE MENU   *******
***  S/N:990202  V3.xx   ****
Company   : Hydrotechnik GmbH
             65549 Limburg
             Holzheimer Str.
RS232   :  38400 Baud
Filter  :                    ▶
Keyboard   :  COMFORT
Service    :  Overview
       PRINT            OK
```
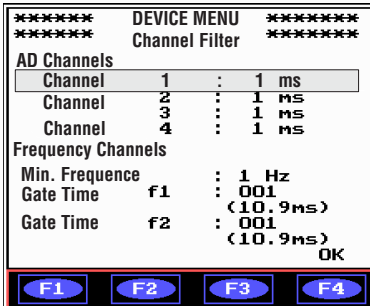```
  F1   F2   F3   F4
```

```
******   DEVICE MENU   *******
*** S/N:990202 V3.xx   ****
Company   : Hydrotechnik GmbH
             65549 Limburg
             Holzheimer Str.
RS232   : 38400 Baud
Filter :   ▶
Keyboard   : COMFORT
Service   : Detail
       PRINT   OK
```
```
  F1   F2   F3   F4
```

In the line „Channel filter" a software filter may be activated. The analogue inputs are scanned at 1 ms (1 kHz). Via an adjustable software filter (1-2-4-8-16 ms) the measured values may be smoothed through averaging from 2, 4, 8 or 16 values. As a standard frequencies as low as 1 Hz are captured. This means that the frequency of 1 Hz is recognised and displayed only after a period measurement of 1s.

When storing, the recording between the last frequency and the decline to zero (no frequency) will always be displayed in the protocol with a delay of 1 second.

Frequencies of below 1 Hz will be displayed as zero. By changing the parameter to „min frequency" the measuring range may be set to between 0,25 Hz and 100 Hz. When setting the minimum frequency to, e.g., 100 Hz, the measuring device will display a measuring value „zero" already after 10 ms.

The frequency inputs may be smoothed by the Time gate. The greater the time gate, the greater the smooting of the signal.
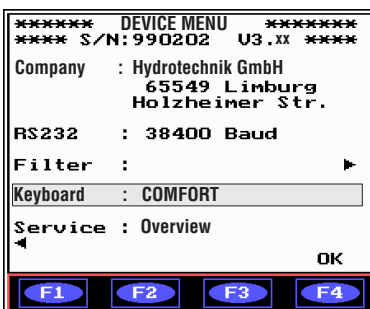
The line „keyboard selection" allows you to select between comfort and standard. The default value is comfort and German language. With our international customers in mind, the comfort setting allows the language selection directly by entering a specific number sequence; see example on page 15. Here, a maximum of 5 keys need to be pressed in succession. The individual numbers represent the line selected in a menu (number 4 = fourth menu line).

In comparision, the standard procedure requires 9 keys to be pressed.

You can change from comfort to standard with the key    ENT
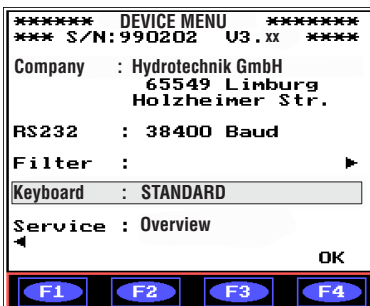
The standard setting requires the use of the arrow keys. A selection by entering numbers is not possible. Our description refers to the standard setting so that you may get acquainted with the complete program structure.

In the „Service" line you may choose between overview and detail. The line „Overview" is of primary interest to the user since here all device parameters set by him may be printed out as a protocol.

In the case of complaints about hard- or software errors it is advisable to use the detailed printout option which enables the HYDROTECHNIK service team to carry out a better diagnosis. If necessary send us a brief error description together with this detailed printout. In both cases the printout is activated with    F2
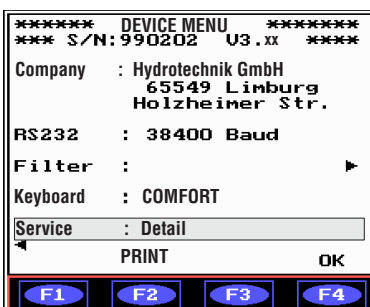
**After all settings or modifications in the „Device menu" have been completed press**    F4    **(OK in the display) to confirm.**

**If you fail to do this, the old settings remain valid.**

## 2.0 Settings in the measuring channel menu

**To start with there follows a brief explanations of the terms K1 to K11**

**Active measuring channels are:**

> K1 = Ch1 = input analogue, rear
> K2 = Ch2 = input analogue, rear
> K3 = Ch3 = input analogue, rear
> K4 = Ch4 = input analogue, rear
> K5 = Ch5 = input frequencies, rear
> K6 = Ch6 = input frequencies, rear

**Trigger „in/out":**

> K7 (IN) displayed as trigger in
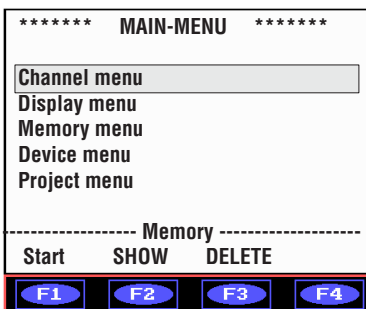> K8 (OUT) displayed as trigger out.

**The socket „in/out" is located at the rear of the measuring device.**
The trigger input is used for external trigger activation from a system to activate the measuring device in storage mode. The trigger output is used for external control, e.g., in a system whereby a direct addressing from the measuring device is not possible. For safety reasons and load control a relay should be provided.

**Internally calculated values:**
K9, K10 and K11 are three additional channels used by the software to compute discrepancies, sums derivations and for the calculation of hydraullic performance.
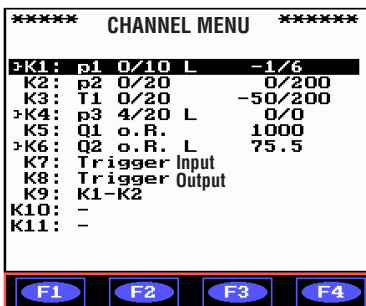The computation of a discrepancy is, for example: K9 = K1-K2.

## 2.1 Activating the measuring channel menu

```
******* MAIN-MENU *******

Channel menu
Display menu
Memory menu
Device menu
Project menu

------------------ Memory -------------------
 Start      SHOW      DELETE

  F1       F2        F3        F4
```

The measuring channel menu is activated from the main menu with [ENT]

In our example the measuring channel menu appears, from which all measuring channels, trigger inputs or outputs and internally calculated values may be selected.
If ISDS had been activated in the device menu, all connected ISDS compatible sensors will be automatically recognised.

2.2 Display of sensors with or without ISDS

```
***** CHANNEL MENU ******

⊐K1: p1 0/10 L      -1/6
 K2: p2 0/20        0/200
 K3: T1 0/20      -50/200
⊐K4: p3 4/20 L       0/0
 K5: Q1 o.R.        1000
⊐K6: Q2 o.R. L      75.5
 K7: Trigger Input
 K8: Trigger Output
 K9: K1-K2
K10: –
K11: –

  F1       F2        F3        F4
```

In our example, the symbol ⊐— shows that for channels 1, 4 and 6, – ISDS sensors have been detected.
The measuring device stores the sensor characteristics, e.g., for a pressure sensor: unit (bar), signal type (4-20/0-20 mA or 0-10V), range (0 to 600) and the linearization (characteristic curve of the sensor). This characteristic curve, specified as **L** is used for linearization by the measuring device, resulting in a more precise analysis.

The ISDS compatible sensor provides extra measuring comfort since the user no longer needs to enter the sensor characteristics. In additionm, the measuring device offers improved accuracy of values by the internal error curve compensation (linearization).
When connecting a sensor (ISDS-compatible or not) always switch off the measuring device first, then connect the sensor and then switch-on the measuring device again. Only in this way will the sensor be correctly detected by the measuring device.
Please check for the symbol ⊐— for ISDS-compatible sensors in the display.

```
*****    CHANNEL MENU    ******

⇥K1: p1 0/10 L     -1/6
 K2: p2 0/20         0/200
 K3: T1 0/20      -50/200
⇥K4: p3 4/20 L       0/0
 K5: Q1 o.R.        1000
⇥K6: Q2 o.R. L      75.5
 K7: Trigger Input
 K8: Trigger Output
 K9: K1-K2
K10: -
K11: -


   F1      F2      F3      F4
```
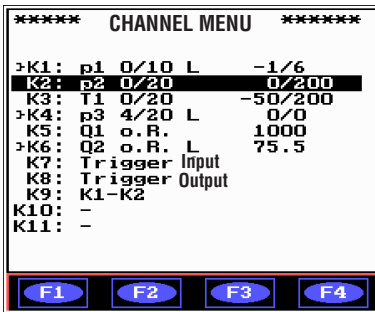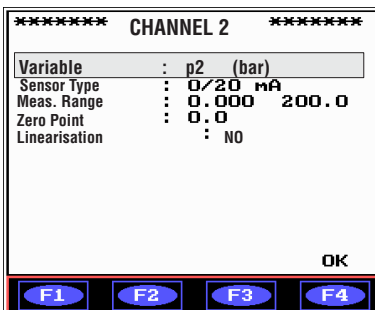
In contrast, for a non ISDS compatible sensor all sensor specific data must be entered into the device.
In a further example we shall describe a sensor without ISDS.

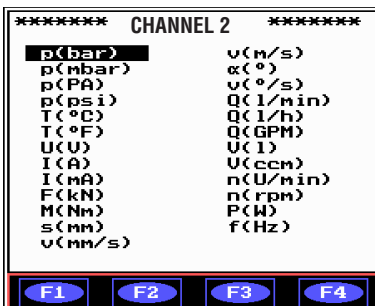We locate the black bar over the arrow key [↕] on K2 and confirm with [ENT].

2.3 Entry of the measuring unit

```
*******    CHANNEL 2    *******

Variable       :  p2   (bar)
 Sensor Type   :  0/20  mA
 Meas. Range   :  0.000   200.0
 Zero Point    :  0.0
 Linearisation      :  NO




                          OK

   F1      F2      F3      F4
```

Now the **measuring unit, signal type, range, the zero (base) value and the linearization** must be entered.

The measuring unit is selected with [ENT]

The following menu is displayed.

```
*******    CHANNEL 2    *******

 p(bar)          v(m/s)
 p(mbar)         α(°)
 p(PA)           v(°/s)
 p(psi)          Q(l/min)
 T(°C)           Q(l/h)
 T(°F)           Q(GPM)
 U(V)            V(l)
 I(A)            V(ccm)
 I(mA)           n(U/min)
 F(kN)           n(rpm)
 M(Nm)           P(W)
 s(mm)           f(Hz)
 v(mm/s)

   F1      F2      F3      F4
```

The measuring type is selected with the arrow keys [↕] [↕] . In our example we select p (bar).

Confirm with [ENT]

2.4 Entering the singal type
(power or voltage)

```
*******    CHANNEL 2    *******

 Variable      :  ┌─────────┐
 Sensor Type   :  │0/20  mA │
 Meas. Range   :  │4/20  mA │ 00.0
 Zero Point    :  │0/10  V  │
 Linearisation    └─────────┘ NO




   F1      F2      F3      F4
```
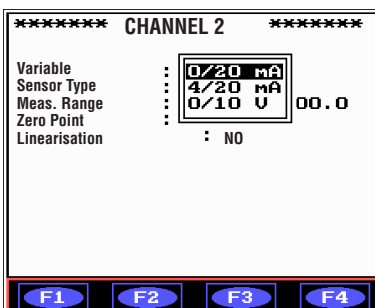
Select „signal type" with [ENT]. You can only select from 0 to 20 mA, 4 to 20 mA or 0 to 10 V

2.5 Entering the range

```
******* CHANNEL 2 *******

Variable      : p2 (bar)
Sensor Type   : 4/20 mA
Meas. Range   : 0        600
Zero Point    : 0.0
Linearisation :     NO




           ENTF  EINFG   LOE
   F1      F2      F3      F4
```
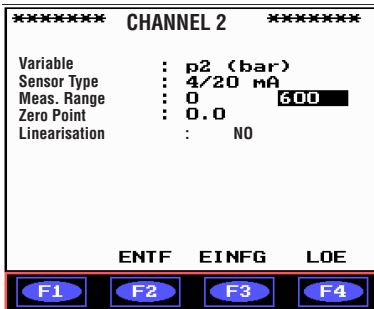
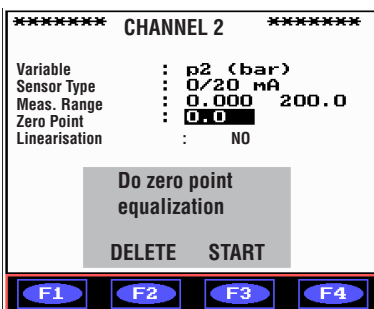Select with [ENT] . Now you can enter the start and end values with the numeric keys.

In our example we set the start value to 0 and the end value to 600.

Please note, that the range consists of the two input fields „measuring start" and „measuring end" and that each input must be confirmed with [ENT] .
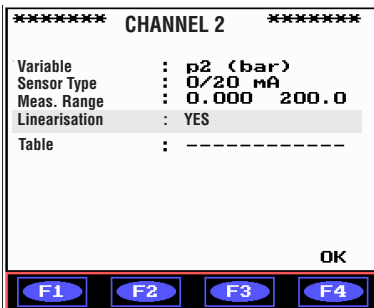
2.6 Zero point alignment

```
******* CHANNEL 2 *******

Variable      : p2 (bar)
Sensor Type   : 0/20 mA
Meas. Range   : 0.000   200.0
Zero Point    : 0.0
Linearisation :     NO

       Do zero point
       equalization

       DELETE  START
   F1      F2      F3      F4
```

The zero point alignment is set through the option „zero value" with [ENT]
Should, for example, the pressure sensor show a zero value discrepancy although no pressure exists, press [F3] (start) to reset the zero value. The zero value discrepancy is stored by the device and later taken into consideration by the software when the actual measure is displayed.

The setting of the zero value for the pressure sensor should be done without pressure.
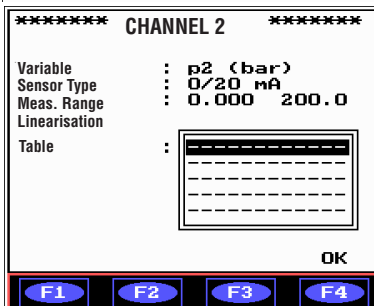
2.7 Selecting linearization

```
******* CHANNEL 2 *******

Variable      : p2 (bar)
Sensor Type   : 0/20 mA
Meas. Range   : 0.000   200.0
Linearisation :   YES
Table         : -----------



                           OK
   F1      F2      F3      F4
```

„Linearization" is selected via [ENT] At the same time the display shows:

„Linearization: YES"
„Table: - - - - -"

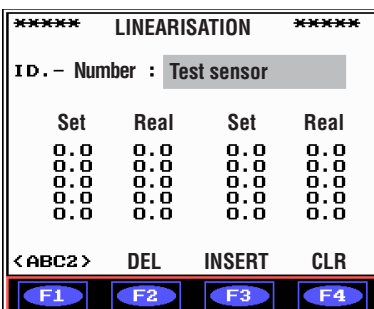Select the line „table" using the down arrow [↓] (black bar) and confirm with [ENT] .

For very precise pressure measuring the entry of a linearization table is recommended.

```
******* CHANNEL 2 *******

Variable      : p2 (bar)
Sensor Type   : 0/20 mA
Meas. Range   : 0.000   200.0
Linearisation :
Table         : ┌───────────┐
                │═══════════│
                │-----------│
                │-----------│
                │-----------│
                └───────────┘
                           OK
   F1      F2      F3      F4
```

This display is shown 5 linearization tables are available to the user per measuring channel. Enter the values manually in accordance with the calibration protocol of the sensor.
In our example, theoretically, 5 pressure sensors with identical range but different linearization values may be connected sequentially in channel 2 (ch 2). From this example you can gather the comfort provided by an ISDS-compatible sensor. Here no linearization values need to be entered.
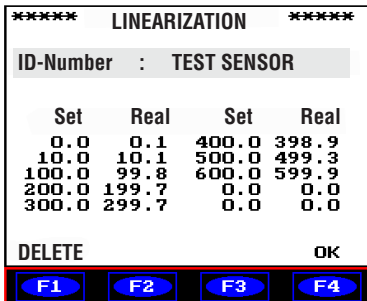
2.8 Entering a linearization

```
*****  LINEARISATION  *****

ID.- Number : Test sensor

   Set   Real    Set   Real
   0.0   0.0     0.0   0.0
   0.0   0.0     0.0   0.0
   0.0   0.0     0.0   0.0
   0.0   0.0     0.0   0.0
   0.0   0.0     0.0   0.0

<ABC2>    DEL  INSERT   CLR
   F1      F2      F3      F4
```

The linearization function is selected with [ENT] . The linearization table may be given an identification by entering a name under „ID-NUMBER". In our example we chose „TEST SENSOR".
The entry is made with the numeric block and confirmed with [ENT] .

Standard and actual values are entered with the „Arrow down" key [↓] .

The [ENT] key is used for entering the standard or actual values and for confirmation. With a little practice you shold have no problem.

```
*****    LINEARIZATION    *****

ID-Number   :   TEST SENSOR

   Set    Real     Set    Real
   0.0     0.1   400.0   398.9
  10.0    10.1   500.0   499.3
 100.0    99.8   600.0   599.9
 200.0   199.7     0.0     0.0
 300.0   299.7     0.0     0.0

DELETE                      OK

   F1      F2      F3      F4
```

```
*******  LINEARIZATION  *******

 Variable    :  p2  (bar)
 Sensor Type :  0/20  mA
 Meas. Range :  0.000   600.0

 Linearisation  :   YES
 Table       :  TEST SENSOR
 Set    Real       Set    Real
0.000  0.100   400.0   398.9
10.00  10.10   500.0   499.3
100.0  99.80   600.0   599.9
200.0  199.7   0.000   0.000
300.0  299.7   0.000   0.000
                            OK

  F1      F2      F3      F4
```

```
*****   CHANNEL MENU    ******

↷K1: p1 0/10 L      -1/6
 K2: p2 0/20 L      0/600
 K3: T1 0/20      -50/200
↷K4: p3 4/20 L       0/0
 K5: Q1 o.R.        1000
↷K6: Q2 o.R. L      75.5
 K7: Trigger Input
 K8: Trigger Output
 K9: K1-K2
K10: -
K11: -

  F1      F2      F3      F4
```

The attached calibration protocol for a pressure sensor provides the necessary calibration points that may be entered line by line as standard or actual values. Please note that each entry must be confirmed with [ENT]

In our example the values 0 to 600 bar were entered.

Characters or complete entries may be deleted or inserted with [F2] or [F3] or [F4]

After all values of our example have been entered in the table „Test Sensor" the entry must be concluded by [ENT] in the column **Standard** and confirmed with [F4] (OK)
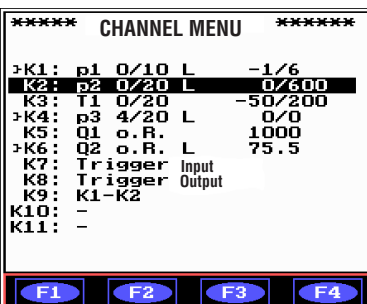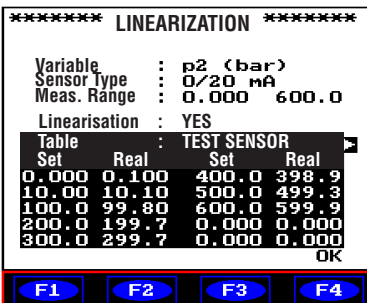
Automatically the menu „measuring channel 2" is highlighted.

Re-press [F4] so that the data are either entered or assigned.

The measuring channel menu is activated.

The measuring channel menu displays „**K2: p2 0/20 L   0/600** "
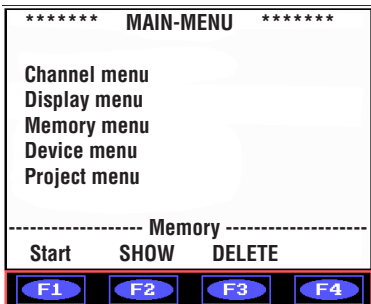which should be interpreted as follows:

K2	**=**	**Ch2 (measuring input)**
p2	**=**	**Pressure, 0/20 = 0 to20 mA**
L	**=**	**Linearization**
0/600	**=**	**0 to600 bar (sensor range)**

The linearization table may be recalled as required, modified and deactivated.
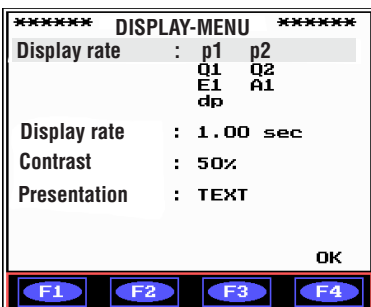
Thus, all pressure sensor parameters, including the linearization table are entered. If further sensors are connected with the measuring device, the input should be done as described above.
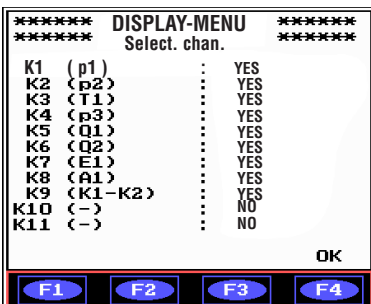
3.0 Activating the display menu

```
*******   MAIN-MENU   *******

Channel menu
Display menu
Memory menu
Device menu
Project menu

------------- Memory -------------
  Start    SHOW    DELETE
   F1       F2       F3      F4
```

After selecting the appropriate line and pressing [ENT] the display menu is shown.

3.1 Channel selection

```
******   DISPLAY-MENU   ******
Display rate    :  p1   p2
                   Q1   Q2
                   E1   A1
                   dp

Display rate    : 1.00 sec
Contrast        : 50%
Presentation    : TEXT

                           OK
   F1       F2       F3      F4
```

Pressing [ENT] again activated the menu „Channel selection".

```
******   DISPLAY-MENU   ******
******   Select. chan.   ******
K1  (p1)       :     YES
K2  (p2)       :     YES
K3  (T1)       :     YES
K4  (p3)       :     YES
K5  (Q1)       :     YES
K6  (Q2)       :     YES
K7  (E1)       :     YES
K8  (A1)       :     YES
K9  (K1-K2)    :     YES
K10 (-)        :     NO
K11 (-)        :     NO
                           OK
   F1       F2       F3      F4
```

With the down/up arrow keys [↓] [↑] select the desired channel and then activate or deactivate with [ENT] .
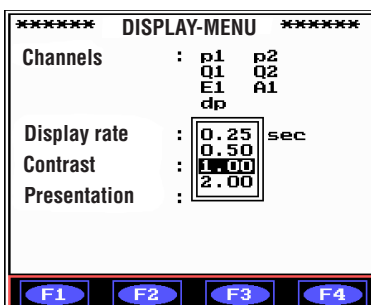
The display shows the status either with „yes" or „no". Using the comfort-display channels may be selected or deselected very fast with the numeric keyboard (**1** = channel 1, **0** = channel 10, **-** = channel 11).

3.2 Selecting display rate

```
******   DISPLAY-MENU   ******
Channels        :  p1   p2
                   Q1   Q2
                   E1   A1
                   dp

Display rate    : 1.00 sec
Contrast        : 50%
Presentation    : TEXT

                           OK
   F1       F2       F3      F4
```
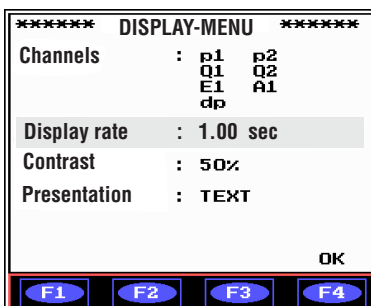
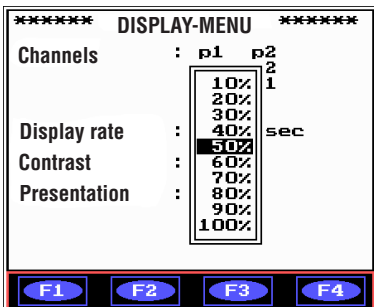Here, too, the display of „display rate" is activated with [ENT] .
The display rate defines the frequency at which the display is updated. The greater the time span, the greater the average values of the display.

```
******   DISPLAY-MENU   ******
Channels        :  p1   p2
                   Q1   Q2
                   E1   A1
                   dp

Display rate    : |0.25| sec
                   0.50
Contrast        : 1.00
Presentation    : 2.00

   F1       F2       F3      F4
```

Select the desired display rate with the up/down arrows [↓] [↑]

and confirm with [ENT]

3.3 Select contrast

```
****** DISPLAY-MENU ******
Channels    : p1  p2
                    2
              10%   1
              20%
              30%
Display rate : 40% sec
              50%
Contrast    : 60%
              70%
Presentation : 80%
              90%
             100%
```
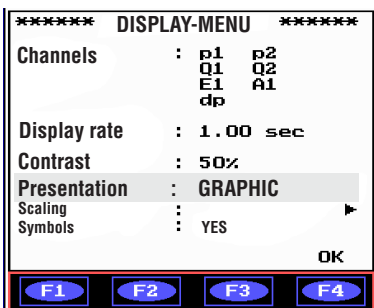F1 F2 F3 F4

The contrast setting may be selected with the up/down arrows within the range of 10% to 100% and confirmed with ENT .
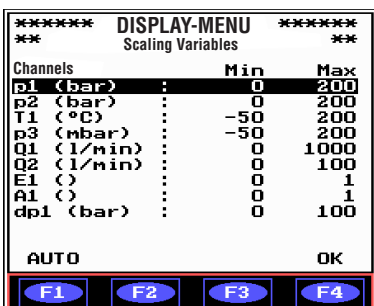
3.4 Select graphics or text display

```
****** DISPLAY-MENU ******
Channels    : p1  p2
              Q1  Q2
              E1  A1
              dp
Display rate : 1.00 sec
Contrast    : 50%
Presentation : GRAPHIC
Scaling     :              ►
Symbols     : YES
                        OK
```
F1 F2 F3 F4

With the up/down arrows the display type is selected.

Select between graphics and text using the ENT key.

When selecting „text" no further action is required.

When selecting graphics further adjustments might be necessary.

3.5 Invoke scaling

```
****** DISPLAY-MENU ******
**    Scaling Variables    **
Channels        Min    Max
p1 (bar)    :     0    200
p2 (bar)    :     0    200
T1 (°C)     :   -50    200
p3 (mbar)   :   -50    200
Q1 (l/min)  :     0   1000
Q2 (l/min)  :     0    100
E1 ()       :     0      1
A1 ()       :     0      1
dp1 (bar)   :     0    100

AUTO                    OK
```
F1 F2 F3 F4

Each channel may be scaled individually.
The channel to be scaled is selected with the up/down arrows and ENT .

With the function key F1 (Auto) the cannels are set automatically in accordance with the measuring ranges of the sensors.

☞ This function (Auto) should be used if the expected values are not yet known in their signal intensity (amplitude).

3.6 Selecting symbolism

```
****** DISPLAY-MENU ******
Channels    : p1  p2
              Q1  Q2
              E1  A1
              dp
Display rate : 1.00 sec
Contrast    : 50%
Presentation : GRAPHIC
Scaling     :              ►
Symbols        YES
                        OK
```
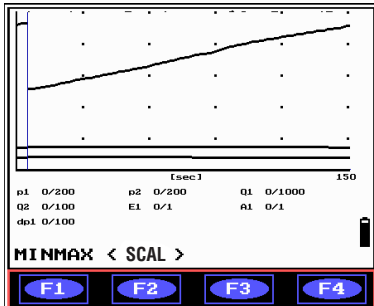F1 F2 F3 F4
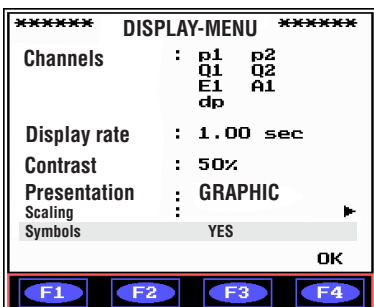
The symbolism is activated/deactived with ENT .
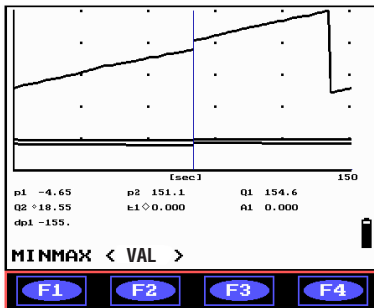The symbols for the channels are assigned automatically by the software and require no additional activities.

☞ After executing all program steps and confirming all parameters with F4 , these settings will become valid for the display.

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3.7 Display type „gaphics"

e

3.8 Display type „text"

Presentation of measured and extreme values

Min.-value
Max.-value

Display of measured values with type

In the example chosen by us, the display shows the current measures of all selected channels.

Using **F1** you can switch between „**MINMAX**" and „**VAL**".

Measured value
The mean value, calculated in accordance with the display rate, is shown.

MINMAX
The minimum and maximum values of the selected siplay rate are displayed (excepted are calculated values, e.g., discrepancies).

<Value>
The graphics legend displays for each channel the current median value, calculated within the selected display rate.

<Scaling>
The graphics legend displays the currently set scalingset for each channel.

The value in brackets (e.g. **< value>**) is the current display, values without brackets refer to the function to be selected, in our example (display of the min/max values) with the **F1** key.

Via the display menu it is possible at any time to change from graphics display to text display.
When changing into the text mode, the following display appears.

Use the **F2** key to set the min/max values to zero.

We recommend to briefly press **F2** after activating the measuring device.

Use the **F1** key to switch to the current measuring display with the current measuring type and units.

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4. Storage menu

4.1 Carrying out an optimal data storage

The programmable storage parameters of the hand-held measuring device Multi-System 5050 offer a large variety of storage settings. Before you start storing data you should acquaint yourself how best to organise the data storage.

The standard measured values memory has a capactiy of up to 500,000 values.

This large storage capacity might tempt you to carry out our extensive storage with a scanning rate of, e.g., 1 ms and a long storage period in order to document even the smallest deviation. This would be wrong, however, since an unnecessary large number of measurements would be taken. A few years ago, when triggering was not possible and a complete measuring cycle had to be recorded, this procedure was unavoidable.
Nowadays a certain section (window) of the measuring cycle should be selected with a specific selection of scanning rate, storage time, type of trigger and pre-trigger setting, since then only a fraction of the measuring need to be done.

The following descriptions should help to achieve an optimal setting of the storage parameters:

4.2 Storage channels

You should only select those channels that you really need for the measuring task.
Please consider that any unneeded measured values active when storing, occupy memory capacity and slow down any analysis considerably. Of course it is possible to correct or to select later unneeded channels either in the measuring device or via the HYDROcomsys/WIN32 software.
By careful selection of the required measuring channels any possible limitations regarding memory capactiy and processing speed will be avoided.

4.3 Storage time

This parameter determines the duration of the storage. In connection with the scanning rate it defines the number series of measurements to be stored in the measuring device. A measure value record may consist of one or more measuring values, assigned to various channels. The measured values of the measure value record are stored at a single scanning time.

For a better understanding, look at the following example:

Pressure p1 and p2 and temperature T are to be stored.
The scanning rate is defined as 1 ms and the storage time 5 seconds.

Therefore, per scanning, three values (p1, p2 and T) will be saved as a single measure record.

After a m   easuring period of 5 seconds 5,000 measure records, i.e., 15,000 measured values will have been stored.

The measured values of a storage procedure are called measuring series.
The Multi-System 5050 is capable of storing a maximum of 36 measuring series, each consisting of several measuring values.

The storage time is comparable to a window, reflecting a certain time period of a measuring procedure. You should select the length of the storage time to ensure that all required results are visible, but not use too much memory space.

4.4 Saving with our without trigger

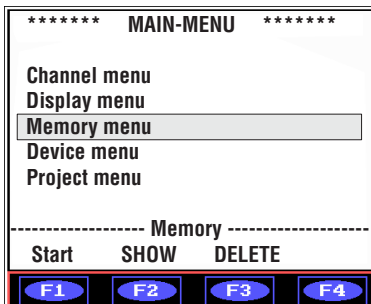Data storage is completely independent from whether it is to be done with or without triggering.
Immediately after storage activation the measuring device begins to store values in the memory. For this, a memory area is reserved the size of which is determined by the scanning rate, the measuring channels and the storage time. When this memory area is full, the measuring without triggering will be automatically ended. In the case of triggered storage, it will be continued at the start of the memory area, i.e., the oldest values will be overwritten (temporary cache). In this case the storage will only be automatically ended when the trigger event occurred and the storage time, as defined in the pre-trigger setting, has expired.
Of course, the storage process may be stopped at any time manually via the keyboard. In such a case, however, the measuring series is not recorded according to the pre-trigger setting. It contains either no trigger event or too many values before a trigger event, since after the trigger event, not enough values were stored.

A maximum of eight values may be stored simultaneously.
The storage capacity is approx. 500,000 values and may be subdivided into 36 individual storage slot assignments. This assignment, i.e., how many values are to be stored in a storage slot, depends on the storage parameters.
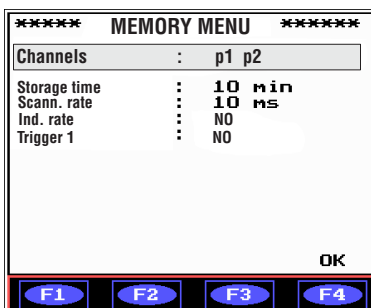
4.5 Activating the storage menu

```
******* MAIN-MENU *******

Channel menu
Display menu
Memory menu
Device menu
Project menu

-------------- Memory --------------
Start    SHOW    DELETE
  F1      F2       F3       F4
```
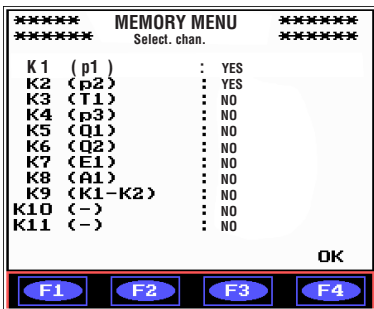
For a better understanding, we describe here a normal storage of values without trigger to make the user familiar with the basic functions.
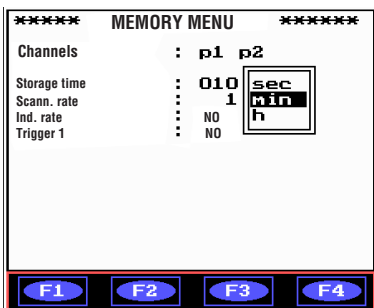
Open the „storage menu" from the main menu with the [ENT] key.

4.6 Calling up all storage parameters
   without trigger

```
*****  MEMORY MENU  ******
Channels        :   p1  p2
Storage time    :   10 min
Scann. rate     :   10 ms
Ind. rate       :   NO
Trigger 1       :   NO




                        OK
  F1      F2       F3       F4
```

This display appears. The channel selection is activated with [ENT] .

```
***** MEMORY MENU ******
******    Select. chan.    ******
  K1  (p1 )        :  YES
  K2  (p2)         :  YES
  K3  (T1)         :  NO
  K4  (p3)         :  NO
  K5  (Q1)         :  NO
  K6  (Q2)         :  NO
  K7  (E1)         :  NO
  K8  (A1)         :  NO
  K9  (K1-K2)      :  NO
 K10  (-)          :  NO
 K11  (-)          :  NO
                        OK
  F1      F2      F3      F4
```

In our example, the two channels K1 (p1) and K2 (p2) were set with [ENT] to „Yes".
Confirm with [F4] .
These two selected channels will be later stored.

```
***** MEMORY MENU ******
 Channels        :  p1 p2
 Storage time    :  010  ┌─────┐
 Scann. rate     :    1  │ sec │
 Ind. rate       :   NO  │ min │
 Trigger 1       :   NO  │ h   │
                         └─────┘



  F1      F2      F3      F4
```
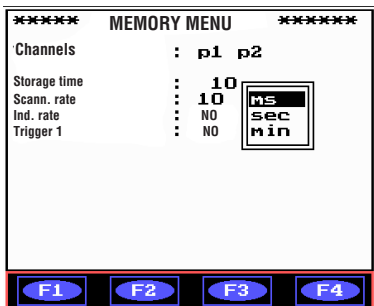
The storage time is selected with arrow down [↓] and activated with [ENT]

Entries are made with the numeric keys. In our example 10 min is entered.

Pressing again the [ENT] key to enter the storage time unit which may be set, using the up/down arrow keys [↑] [↓] , to seconds, minutes and hours.

Confirm with [ENT] .

```
***** MEMORY MENU ******
 Channels        :  p1 p2
 Storage time    :    10
 Scann. rate     :    10  ┌─────┐
 Ind. rate       :   NO   │ ms  │
 Trigger 1       :   NO   │ sec │
                          │ min │
                          └─────┘



  F1      F2      F3      F4
```
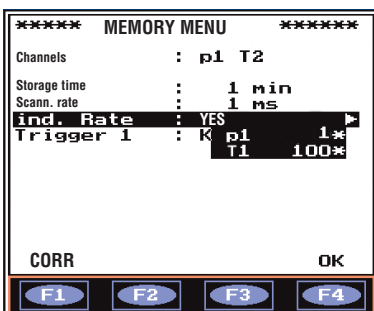
The scanning rate is called up with the down arrow [↓] and selected with [ENT] .

The entry is made with the numeric keys. In our example 10 ms is entered.

Press again [ENT] to enter the unit of the scanning rate, which may be specified with the up/down arrow keys [↑] [↓] in ms, s and min.

Confirm with [ENT] . Then press [F4] to accept all entries.

To save space in the measured value memory it is possible to use the individual sensor rate.
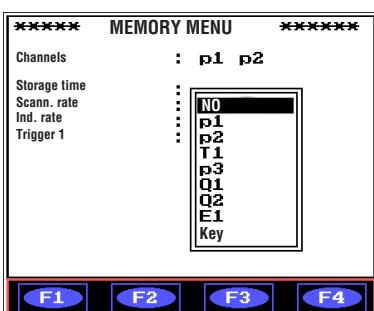
Activation/deactivation is done with „No" to „Yes" with the [ENT] key.
Use [F1] to change the parameters for the individual rate.

```
***** MEMORY MENU ******
 Channels        :  p1 T2
 Storage time    :    1 min
 Scann. rate     :    1 ms
 Ind. Rate       :  YES      ►
 Trigger 1       :  K ┌ p1    1* ┐
                      │ T1  100* │
                      └──────────┘


 CORR                    OK
  F1      F2      F3      F4
```

The following factors may be set: **1 - 10 - 20 - 50 - 100 - 200 - 500 - and 1000** .
Thus a pressure channel may be stored with 10 ms and a temperature channel with 1s (factor 100).

☞ At least one storage channel must be set with the basic scanning rate (factor 1)

```
***** MEMORY MENU ******
 Channels        :  p1 p2
 Storage time    :
 Scann. rate     :   ┌─────┐
 Ind. rate       :   │ NO  │
 Trigger 1       :   │ p1  │
                     │ p2  │
                     │ T1  │
                     │ p3  │
                     │ Q1  │
                     │ Q2  │
                     │ E1  │
                     │ Key │
                     └─────┘
  F1      F2      F3      F4
```

To define trigger 1 set the selection, for example, to „NONE" and confirm with [F4] .
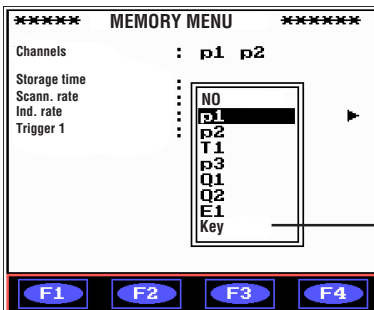
Description of the trigger options

4.7 Storage parameters

The various trigger settings offer useful options for the user to store compact measuring series that are limited to the fundamentals of a measuring process/investigation. In the past, measuring technicians used long storage cycles to „catch" a certain event. By using a certain trigger setting a specific event is detected during a process and saved as trigger event in a defined time window in accordance with the pre-trigger settings. The settings required for the triggering are explained as follows:

4.8 Selection, setting and usage of the different trigger types

If a triggered storage is required, trigger 1 must be defined. For this the appropriate trigger channel must be selected.

As a trigger channel are available: the measuring channels, a manual trigger with the F4-key and the external trigger input E1.

```
*****   MEMORY MENU   ******
Channels        :  p1 p2
Storage time    :
Scann. rate     :   ┌─────┐
Ind. rate       :   │ NO  │        ►
Trigger 1       :   │ p1  │
                    │ p2  │
                    │ T1  │
                    │ p3  │
                    │ Q1  │
                    │ Q2  │
                    │ E1  │
                    │ Key │
                    └─────┘
   F1     F2     F3     F4
```

Triggering by pressing the key

Not a measured value, but the [F4] key is used as trigger for storing.

This trigger must be used when the trigger event cannot be defined with a specific value or external signals, but only visually. The user can observe the event and activate the trigger upon recognising a malfunction. In such a case the pre-trigger should be set to 100%. After the triggering the storage should be ended. The memory contains then the values that occurred before the malfunction. Of course, due to reaction delay, also some value after the malfunction will be recorded! Precisely because of this reaction delay, the pre-trigger should be set to 100%
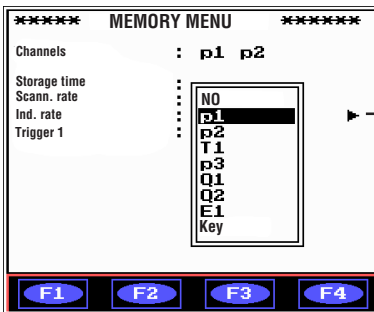
4.9 Trigger on external signal E1

```
*****   MEMORY MENU   ******
Channels        :  p1
Storage time    :      5 sec
Scann. rate     :      1 ms
Ind. rate       :  YES        ►
Trigger 1       :  E1
Type tri.       :  _
Trig. value     :  OFF
Pretrigger      :  50%
Trigger Link    :  NONE
                          OK
   F1     F2     F3     F4
```
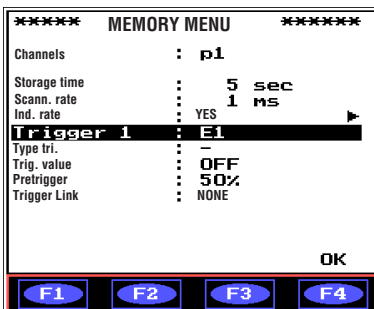
A trigger on an external signal, e.g., from an PLC or a digital valve is a useful addition if the start of a storage procedure should be controlled by an external machine control. Set the trigger value to On (LOW) or Off (HIGH), depending on when the trigger should become active.
Please make sure of the correct maximum input voltage for the external trigger input and the correct polarity of the input socket Out/In of the measuring device.
Further information about the pin-out and technical details may be found starting on
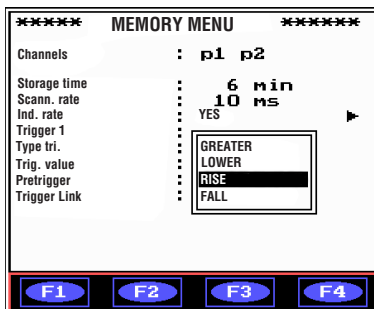**page 43.**

```
*****   MEMORY MENU    ******
Channels        : p1 p2
Storage time    :
Scann. rate     : ┌─────────┐
Ind. rate       : │NO       │   ►
Trigger 1       : │p1       │
                  │p2       │
                  │T1       │
                  │p3       │
                  │Q1       │
                  │Q2       │
                  │E1       │
                  │Key      │
                  └─────────┘

  [F1]    [F2]    [F3]    [F4]
```

Trigger by a measured value

The trigger is activated by a measuring channel. The appropriate measuring size must be selected.
Further conditions need to be considered for triggering on a measured value:
Specification of the **„trigger type"** and **„trigger value"**.

Setting of trigger type

```
*****   MEMORY MENU    ******
Channels        : p1 p2
Storage time    :      6 min
Scann. rate     :     10 ms
Ind. rate       : YES          ►
Trigger 1       :
Type tri.       : ┌─────────┐
Trig. value     : │GREATER  │
Pretrigger      : │LOWER    │
Trigger Link    : │RISE     │
                  │FALL     │
                  └─────────┘

  [F1]    [F2]    [F3]    [F4]
```

The trigger type may be used only for triggering by different input signals and for the measuring values defined for this.
The user may set the trigger type, referring to the measured value to:

- **Greater**
- **Less**
- **Ascending**
- **Descending**

The trigger is activated by the measuring signal depending on the set trigger value. The trigger value must be entered as a digit by the user.

Trigger by edge (**„Ascending or Descending"**)

These are measurings where a simple trigger by a greater/less-comparison is insufficient. In such a case an edge-controlled trigger may be programmed. For the edge a hysteresis of 5% is used. For an ascending edge the trigger value must be less than 5% before an ascending edge will be recognised.

Graphical example:

Condition: trigger value (120 -5% = 114 bar)
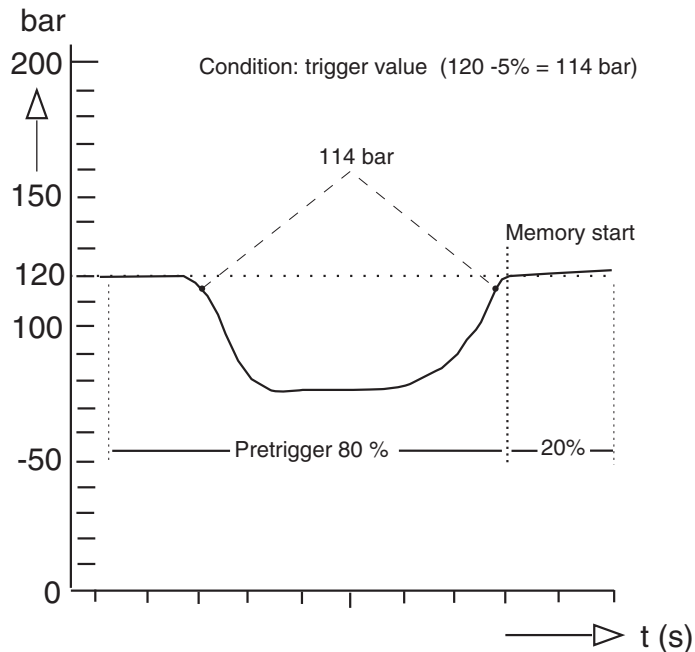
For an ascending edge the trigger channel, in the example p1 = 120 bar, must first assume a measuring value that is 5% less than the trigger value (120 bar - 5% = 114 bar). When next the trigger value of 120 bar is exceeded, the trigger event is activated.

For a descending edge the procedure is reversed. The measured value must first be 5% greater than the trigger value (120 bar). If afterwards this value is less the trigger event is activated. The hysteresis was introduced to prevent an unintentional storage of values close to the trigger value (e.g., in case of variations of the A/D- converter by 1 bit).
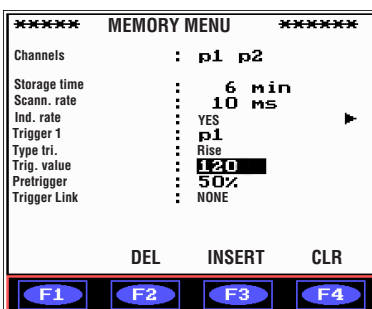
Trigger value

The last but one trigger setting is the trigger value.
In our example the trigger was set to channel p1 (pressure p1).
We enter 120 (bar) as the trigger value. When the pressure of p1 rises above 120 bar, the trigger is activated.
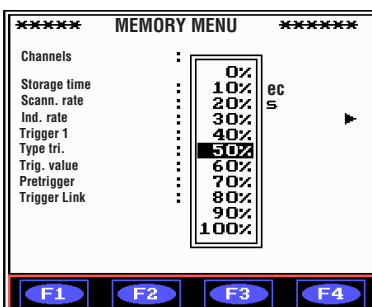
Pre-trigger

The pre-trigger setting precisely defines the time of storage. A setting of 0% specifies that storage takes place as pre specified storage time after the trigger event.
When, for example, 50% is defined, 50% of the storage time is before the event and 50% after the event.

Please note the following: If the trigger occurs prematurely, e.g., at 28%, there will still only be 50% stored after the trigger event. Thus, there will be a storage time that differs from the time specified in the storage menu.

The setting of the pre-trigger is in 10% stages.

The following page explains the pre-trigger functions with graphics.

Display and functions of the pre-trigger for internal and manual triggering

For internal triggering (e.g., greater) the trigger point depends on the setting of the response threshold (example: greater than 120 bar). If the predefined trigger threshold is either exceed or not reached, the storage is started automatically and in accordance with the pre-trigger setting a certain percentage more or less of time prior to the trigger event will be stored.
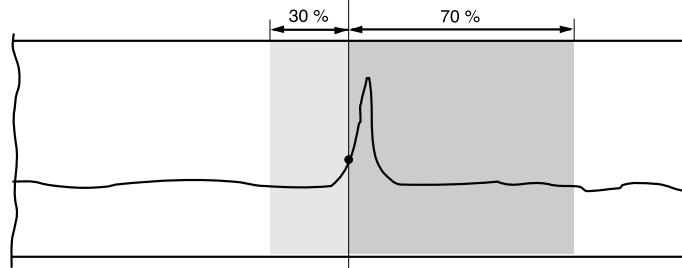
Pre-trigger setting

Trigger point >120 bar

100 %

Pre-trigger 0 %

0% storage prior to the trigger event no pre-trigger setting time

Working pressure 100 bar
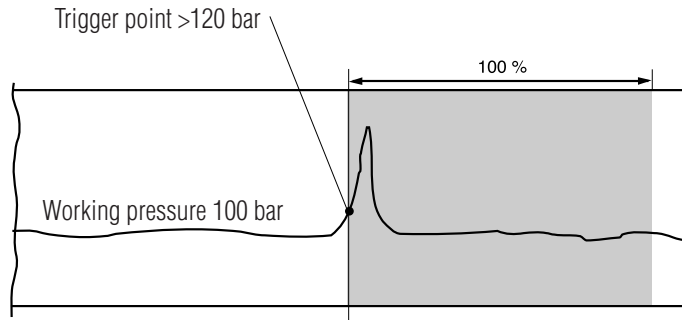
With manual triggering (keyboard) the trigger point depends on pressing F4, causing the start of storage.

Pre-trigger 30 %

30% storage before the trigger event

30 %   70 %

Pre-trigger 50 %

50% storage before the trigger event

50 %   50 %
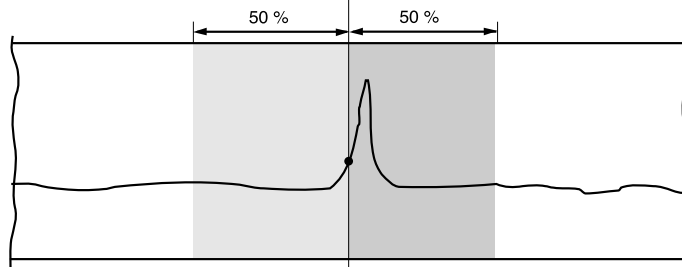
Pre-trigger 70 %

70% storage before the trigger event

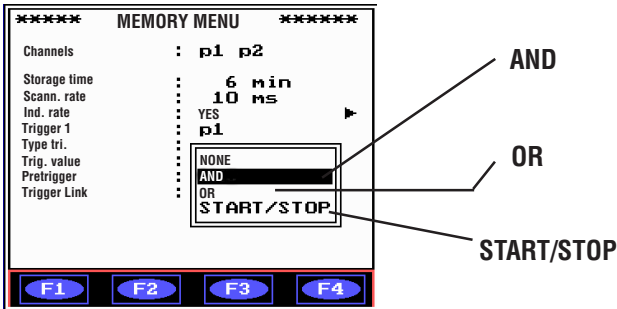70 %   30 %
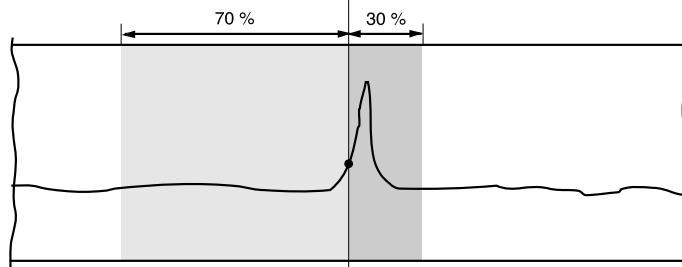
Pre-trigger 100 %

100% storage before the trigger event

100 %
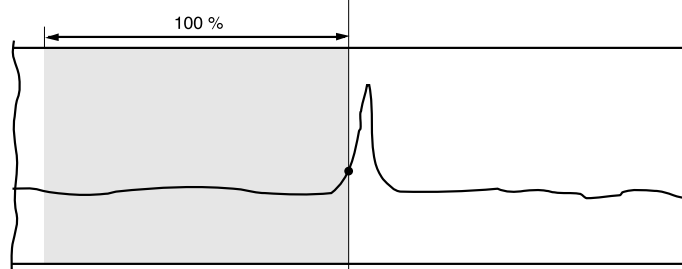
4.10 Setting two triggers via linking

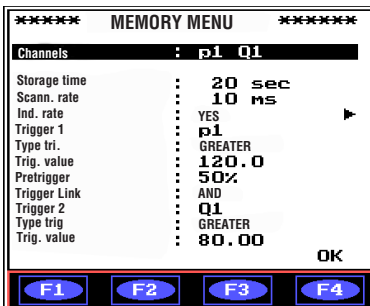A trigger in the measuring device may also be activated by linking two events.

If storage should be with two triggers, the **linking** of the trigger has to be pre-defined:

```
*****   MEMORY MENU   ******
Channels      : p1 p2
Storage time  :     6 min
Scann. rate   :    10 ms
Ind. rate     :  YES          ▶
Trigger 1     :  p1
Type tri.     :
Trig. value   :  ┌──────────┐
Pretrigger    :  │ NONE     │
Trigger Link  :  │ AND    ◢ │
                 │ OR       │
                 │ START/STOP│
                 └──────────┘

 ( F1 )   ( F2 )   ( F3 )   ( F4 )
```

AND

OR

START/STOP

Trigger takes place when an event happened with trigger 1 and 2

Trigger takes place when an event happened with trigger 1 or 2

Trigger takes place when a **Start = Trigger 1** an event took place. After this first event the storage takes place according to the pre-trigger setting and the storage time. If within this time another event occurs, causing **Stop = Trigger 2**, the storage after the trigger event will be terminated prematurely (before end of the total storage time). With this option the storage of unnecessary data, occurring after **Trigger 2** may be avoided.

```
*****   MEMORY MENU   ******
Channels      : p1 Q1
Storage time  :    20 sec
Scann. rate   :    10 ms
Ind. rate     :  YES          ▶
Trigger 1     :  p1
Type tri.     :  GREATER
Trig. value   :   120.0
Pretrigger    :  50%
Trigger Link  :  AND
Trigger 2     :  Q1
Type trig     :  GREATER
Trig. value   :   80.00
                              OK

 ( F1 )   ( F2 )   ( F3 )   ( F4 )
```

Our example shows the triggering with two measures (**p1 and Q1**) and **AND** link.

In order to achieve with manual as well as internal triggering the storage of a measuring series really corresponding to your wishes relating to storage prior and after a trigger event, the following conditions must be kept:

The trigger event should not take place before the measuring device was able to store the relevant measure values before the trigger

Please note that the pre-trigger settings are freely selectable in 10% stages from 0 % to 100%.

The examples below explain the different results of the pre-trigger.

Examples of a storage of 20 s, with pre-trigger setting 20%, time base 100 ms, trigger value input > 120 bar (left example) or <120 bar (right example)

Ideal measuring value storage
Trigger after 4 s. Remaining storage time 16 s. All measured values are captured within a total storage time of 20 s.
Different storage results between trigger point set to >120 bar and <120 bar.
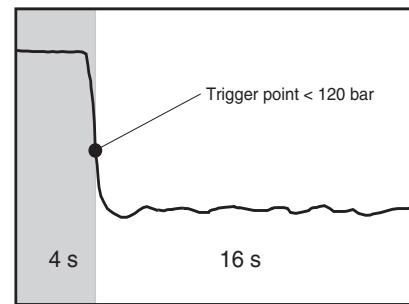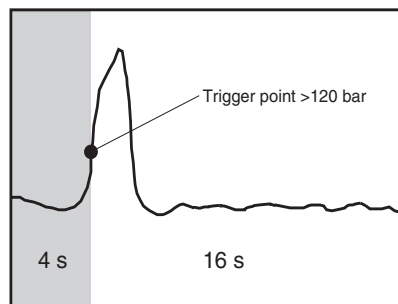
Ideal storage with pre-trigger of 4 s and residual storage time of 16 s.
The measuring device had sufficient pre-trigger time to store the data before trigger event.
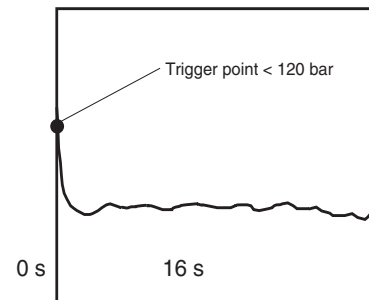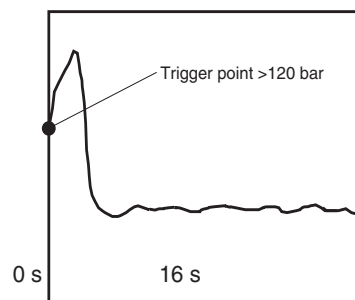
Trigger event after 2 s
Total storage time18 s
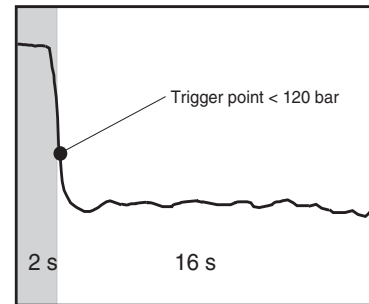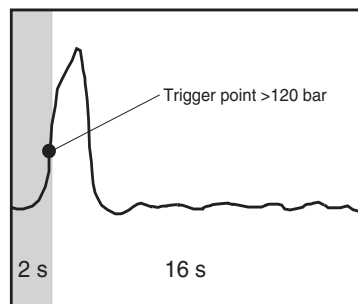
Triggering started after 2 s (too early), thus 50 % of data are not stored before the trigger event.

**Immediate trigger**
Total storage time 16 s

Triggering starts immediately, no pre-trigger time for the measuring device to store data before the trigger event.

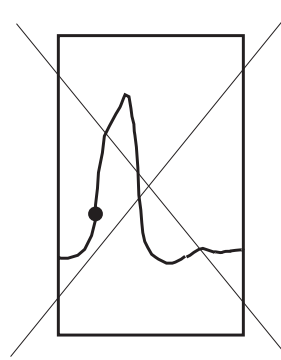**The two examples below show non-permissible storage of measured values.**

If a measuring process is prematurely aborted, namely before completing the full storage cycle or during the pre-trigger phase, no time-related interpretation of the measured data would be possible in relation to the entered storage and trigger parameters.

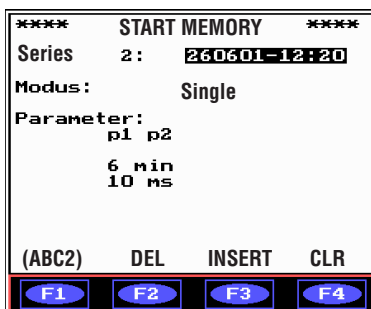Premature abortion of the total
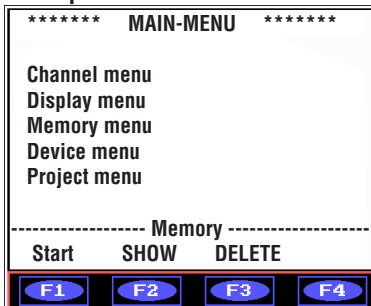storage time of 20 s

Premature abortion within the
pre-trigger time
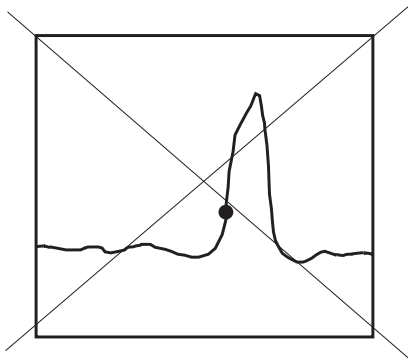
Storage time 12 s
Trigger point 9,3 s

Storage time 6 s
Trigger point 1,4 s

4.11 Starting a storage procedure

```
******* MAIN-MENU *******


Channel menu
Display menu
Memory menu
Device menu
Project menu

------------------ Memory --------------------
 Start    SHOW     DELETE
  F1       F2       F3       F4
```

```
****   START MEMORY   ****
Series    2:   260601-12:20
Modus:         Single
Parameter:
        p1 p2

        6 min
       10 ms


(ABC2)    DEL    INSERT    CLR
  F1       F2       F3      F4
```

Storage may be activated in the main menu with the [F1] key.

For this it is not absolutely necessary that the options are displayed as in our example. The storage may be activated from any item within the main menu.

The menu „Start storage" is displayed.
In our example, measuring series 2, highlighted with date and time(260601-12:20) may be altered as required by the user. Up to 12 letters/digits may be enteres. Thus, there is the possibility to identify a measuring series individually.
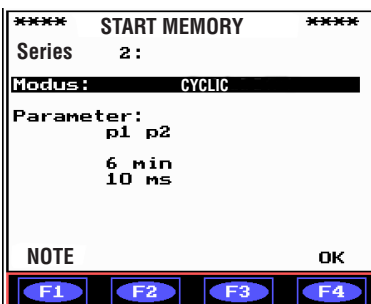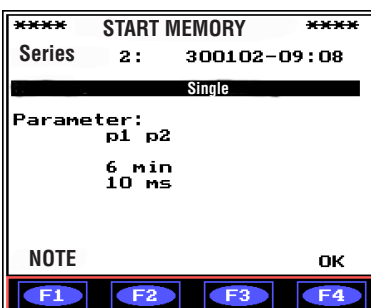
For this press the [ENT] key.

Via the soft keys the following changes may be made:

[F1]   **Upper / Lower case (Shift)**

[F2]   **Delete text and digits (individually)**

[F3]   **Insert text and digits (individually)**

[F4]   **Complete deletion**

When no changes are required, the data provided by the device (date/time) may be accepted with [ENT] .

4.12 Activating storage mode

```
****   START MEMORY   ****
Series    2:   300102-09:08
             Single
Parameter:
       p1  p2

        6 min
       10 ms


NOTE                    OK
  F1       F2       F3      F4
```

```
****   START MEMORY   ****
Series    2:
Modus:        CYCLIC
Parameter:
       p1  p2

        6 min
       10 ms


NOTE                    OK
  F1       F2       F3      F4
```

Storage mode

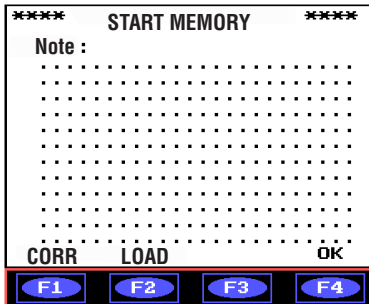When activating a storage the user may select between two options.

Single mode

In the single mode a single storage procedure takes place in accordance with the set parameters. This mode must not confused with the storage of an individual value!

Cycle mode

The cycle mode is the execution of several storage procedures in single mode. If makes only sense in cases with trigger conditions. The storage is activated once. After the trigger event has occured and the storage has finished as preset, the measuring device automatically activates another storage. This occurs until the memory is full. Thus, this type of storage is very useful for long-term monitoring.
The single mode records only the first malfunction. The cycle mode stores several of such occurrences. This storage mode, however, is not useful for the monitoring of malfunctions. It may also be used to sequentially record several processes in different process cycles.

```
****    START MEMORY    ****
  Note :
        ........................
        ........................
        ........................
        ........................
        ........................
        ........................
        ........................
        ........................
        ........................
        ........................
        ........................
  CORR     LOAD              OK
  [F1]    [F2]    [F3]    [F4]
```
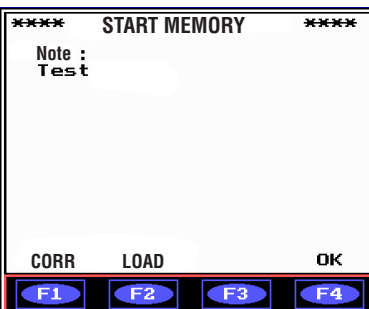
With the [F1] key (notes) the entry of comments/notes is activated.

A large text field is opened,

```
****    START MEMORY    ****
  Note :
  Test




  (ABC2)  DELETE  INSERT   CLR
  [F1]    [F2]    [F3]    [F4]
```
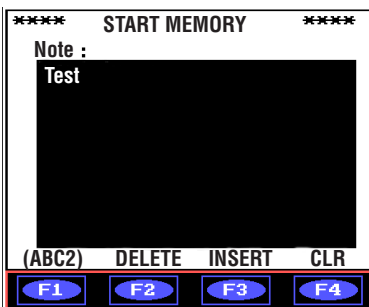
Pressing the [F1] key (Corr) again allows the entry of text.
In our example the comment: **Test** was entered.

```
****    START MEMORY    ****
  Note :
  Test




  CORR     LOAD              OK
  [F1]    [F2]    [F3]    [F4]
```

Confirm the entry with [ENT]. The illustration opposite appears.

The comment: **Test** is displayed. Save the text with the [F4] key (OK).
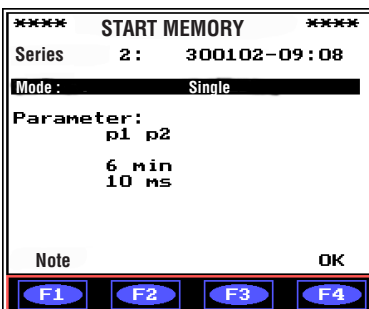
Call up the picture opposite „**Start storage**" with all relevant storage data.

```
****    START MEMORY    ****
  Series  2:   300102-09:08
  Mode :         Single
  Parameter:
          p1 p2
          6 min
          10 ms

  Note                      OK
  [F1]    [F2]    [F3]    [F4]
```
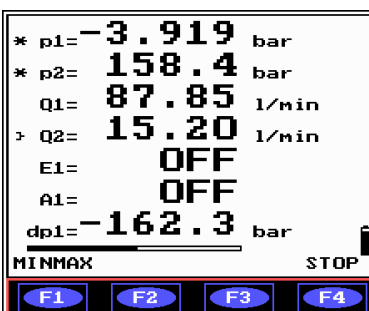
Now all entries have been made and the actual storage is started by pressing [F4] which automatically activates the storage menu.

The lower part of the diplay shows a bar indicating the progress of the storage process by filling up from left to right.
Also, the channels being stored are marked with an asterisk „*".

Upon completion of the storage both, the asterisk as well as bar disappear.

With the [F4] key any active storage process may be aborted any time.

```
* p1=-3.919 bar
* p2= 158.4 bar
  Q1= 87.85 l/min
⌐ Q2= 15.20 l/min
  E1=    OFF
  A1=    OFF
  dp1=-162.3 bar
  MINMAX            STOP
  [F1]    [F2]    [F3]    [F4]
```

In the case of cycle mode, the storage may also be aborted using the [F3] key. The user should be aware that first the active measure data are written into storage before the storage is actually ended.

4.13 Optional output of a storage either on the display screen or as hardcopy

```
******* MAIN-MENU *******

Channel menu
Display menu
Memory menu
Device menu
Project menu

---------------- Memory ----------------
 Start    SHOW    DELETE

 [F1]    [F2]    [F3]    [F4]
```
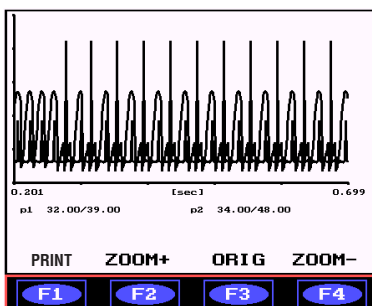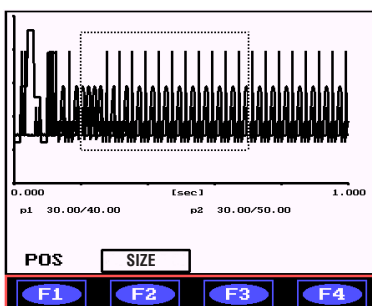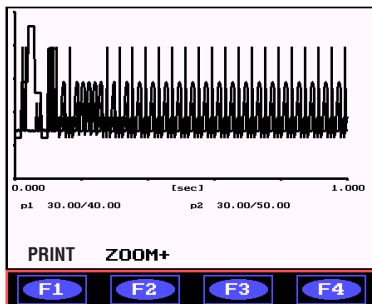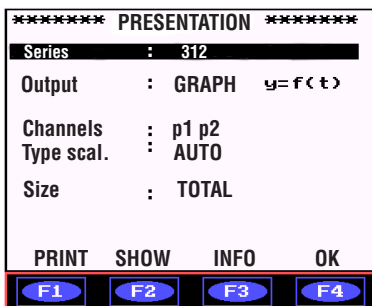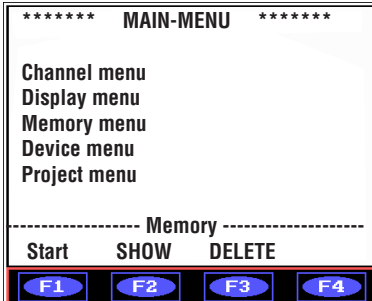
The user has the option to have the stored data shown either on the display screen or as a hardcopy on a printer.

If is advisable to choose the display on the screen since all settings necessary apply also to a possible hardcopy at a later time. Thus the user gets a general overview of what may later be reproduced on paper.

From the „Main menu" you can activate the display of a storage using the soft key [F2] („**DISPL**")

```
******* PRESENTATION *******
 Series      :   312
 Output      :  GRAPH   y=f(t)

 Channels    :  p1 p2
 Type scal.  :  AUTO

 Size        :  TOTAL


 PRINT   SHOW    INFO     OK

 [F1]   [F2]    [F3]    [F4]
```

The left illustration shows the measuring series „**312**" to be displayed as graphics. Channels p1 and p2 were selected and scaling was set to automatic (AUTO).

The complete measuring series should be displayed.

```
0.000         [sec]        1.000
 p1  30.00/40.00    p2  30.00/50.00

 PRINT   ZOOM+

 [F1]   [F2]    [F3]    [F4]
```

After pressing [F2] (DISPL) the selected series is displayed in the selected format.

The displays shows two new function keys. With [F1] the current display shown on the left, will be printed out.

[F2]   allows you to zoom the graphic.

```
0.000         [sec]        1.000
 p1  30.00/40.00    p2  30.00/50.00

 POS    [ SIZE ]

 [F1]   [F2]    [F3]    [F4]
```

After activating the zoom-function a zoom window appears on the screen. Its position and size may be changed using the arrow keys.

After selecting the desired section press [ENT]

A series may be zoomed up to 5 times.

For a zoomed series 2 further new function keys are available.

```
0.201         [sec]        0.699
 p1  32.00/39.00    p2  34.00/48.00

 PRINT   ZOOM+   ORIG   ZOOM-

 [F1]   [F2]    [F3]    [F4]
```

[F3] (ORIG) shows the series in its original state,

[F4] (ZOOM) returns to the previous zoom level.

The display section of a zoomed graphic may be moved as desired, using the arrow keys.

```
0.201          [sec]          0.600
(p1) 36.20/43.20      p2  42.40/56.40

PRINT    ZOOM+    ORIG    ZOOM-
  F1       F2      F3      F4
```

▲ p1
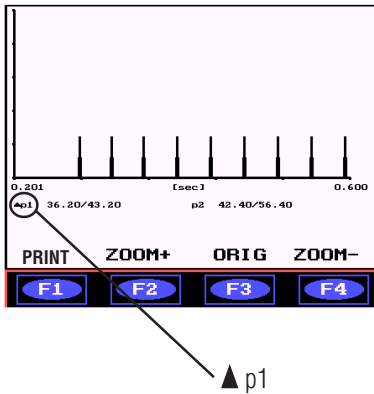
In the picture on the left the display section of the graphic was moved so that only the curve of one value is still visible. In the graphics legend the value p1 is marked by an arrow 🔴

This arrow pointing up indicates that the display section needs to be moved with the up arrow so that the value p1 will become visible in the graphic display.

```
******       312        ******
[sec]        p1     p2
0,000      32.5   35.8
0,100      37.8   35.8
0,200      34.8   35.8
0,300      35.8   39.2
0,400      33.7   35.8
0,500      35.4   35.8
0,600      33.7   35.8
0,700      35.4   35.8
0,800      33.7   35.8
0,900      35.4   35.8
1,000      33.7   35.8

PRINT    DETAIL
  F1       F2      F3      F4
```

The next picture shows a table. The selected section in tabular displays are always divided into 10 identical areas, each of which is shown on a separate line.

If more than three values are stored, the display shows in the bottom right hand corner a triangle. This indicates that all other values may be moved with the arrow keeys in order to be viewed on the display.

```
******       312        ******
[sec]        p1     p2
0,000      32.5   35.8
0,100      37.8   35.8
0,200      34.8   35.8
0,300      35.8   39.2
0,400      33.7   35.8
0,500      35.4   35.8
0,600      33.7   35.8
0,700      35.4   35.8
0,800      33.7   35.8
0,900      35.4   35.8
1,000      33.7   35.8

PRINT    DETAIL
  F1       F2      F3      F4
```

If the user wishes to view a particular section of the series in more detail, he may select the detail display with the 〔F2〕 key. Upon activation a bar is displayed that must be placed in the desired position. In our example the area between 0.5 and 0.6 s is selected.

Confirm the selection with 〔ENT〕

```
******       312        ******
[sec]        p1     p2
0,500      35.4   35.8
0,510      33.7   35.7
0,520      33.7   35.8
0,530      34.8   35.8
0,540      35.4   35.8
0,550      33.7   35.7
0,560      33.7   35.8
0,570      34.8   35.8
0,580      35.4   35.8
0,590      33.7   35.7
0,600      33.7   35.8

PRINT    DETAIL RESET
  F1       F2      F3      F4
```

A new picture shows the area between 0.5 and 0.6 s. This, too, is subdivided into 10 identical sections. The detailed display may be repeated any number of times. The viewing area of a detailed display may be moved as desired with the arrow keys.

The function key 〔F3〕 (RESET) returns to the previous level.

```
******* PRESENTATION *******
Series      :  312
Output      :  ┌─────────────────┐
               │ TABLE           │
               │ STATISTICS      │
               │ GRAPH    y=f(t) │
Channels    :  │ GRAPH    y=f(x) │
               └─────────────────┘

Device menu :  TOTAL



   F1      F2      F3      F4
```
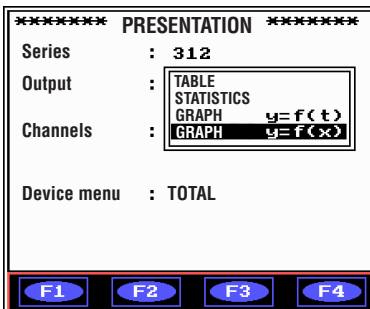
The menu item **Output** also allows the display of statistics and graphics y = f (x) with the ENT key.

```
******      312      ******
          Min     Max    Mean
   p1    32.5    39.2    35.7
   p2    35.7    45.9    39.2




   F1      F2      F3      F4
```
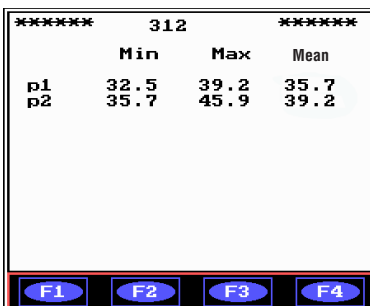
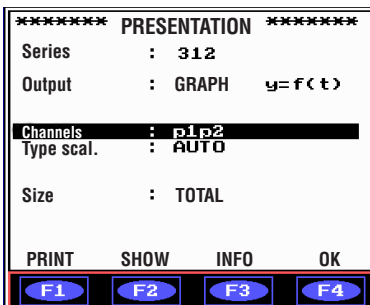When selecting „**Output statistics**" the picture on the left is shown.

```
******* PRESENTATION *******
Series      :  312
Output      :  GRAPH    y=f(t)

Channels    :  p1p2
Type scal.  :  AUTO

Size        :  TOTAL

PRINT    SHOW    INFO    OK
   F1      F2      F3      F4
```

For hardcopy output it is important to determine the symbols (cross, circle, square, etc.) and the colour of the graphics curves.

Select and confirm with ENT.
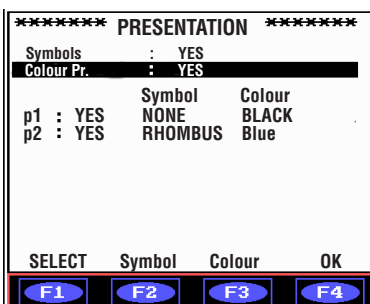
The next menu step follows automatically. Here it is important to pay particular attention to the subject of colour printing.

```
******* PRESENTATION *******
Symbols      :    YES
Colour Pr.   :    YES
              Symbol    Colour
p1 : YES      NONE      BLACK
p2 : YES      RHOMBUS   Blue




SELECT  Symbol  Colour   OK
   F1      F2      F3      F4
```

Please note that the selection of a colour printer from the device menu does not automatically produce a colour printout. The user has the option between black and white or colour print. If you want to print in colour you must select Colour print = „Yes", if not, choose „No".

With the softkeys F1 to F3 the following print options may be selected:

F1 SELECT — Selection or de-selection of a series

F2 SYMBOL — Specification of a symbol for a particular series, e.g., cross, asterisk, circle, etc. This is advisable for b/w printing. The symbols may be activated/de-activated in the display menu.

F3 COLOUR — Determines a line colour for a series. A b/w printer produces different shades of grey.

5.0 Activate the project menu

```
********    MAIN-MENU   **********

Channel menu
Display menu
Memory menu
Device menu
Project menu

------------------ Memory --------------------
 Start      SHOW     DELETE
  [F1]      [F2]      [F3]      [F4]
```
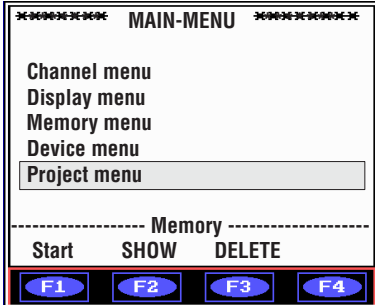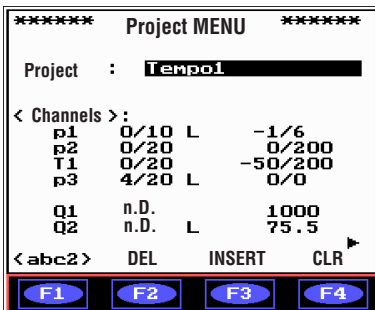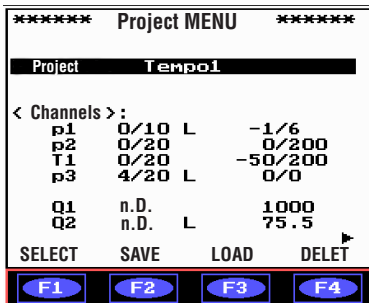
Via the project menu, device settings may be stored and later activated. This is very useful for the user since he may store different device settings for different measuring tasks.
In this sensor parameters, storage settings, etc. may be changed faster, if frequent changes between different projects are required. A maximum of 5 project settings are supported.

Use the arrow keys to select „project menu" and confirm with [ENT].

```
******    Project MENU     ******

Project    :  Tempo1

< Channels >:
    p1    0/10 L      -1/6
    p2    0/20        0/200
    T1    0/20      -50/200
    p3    4/20 L       0/0

    Q1    n.D.         1000
    Q2    n.D.   L     75.5
                               ►
<abc2>     DEL     INSERT    CLR
  [F1]      [F2]      [F3]      [F4]
```
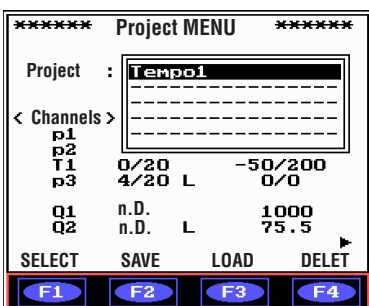
Automatically we move to the next menu level. View the current settings using the arrow keys.

If you wish to save these, enter the project name. In our example „Tempo1".

```
******    Project MENU     ******

 Project      Tempo1

< Channels >:
    p1    0/10 L      -1/6
    p2    0/20        0/200
    T1    0/20      -50/200
    p3    4/20 L       0/0

    Q1    n.D.         1000
    Q2    n.D.   L     75.5
                               ►
 SELECT    SAVE    LOAD    DELET
  [F1]      [F2]      [F3]      [F4]
```

The project is stored with the [F2] key.

```
******    Project MENU     ******

 Project    : Tempo1
              --------------------
              --------------------
< Channels > --------------------
    p1        --------------------
    p2
    T1    0/20      -50/200
    p3    4/20 L       0/0

    Q1    n.D.         1000
    Q2    n.D.   L     75.5
                               ►
 SELECT    SAVE    LOAD    DELET
  [F1]      [F2]      [F3]      [F4]
```
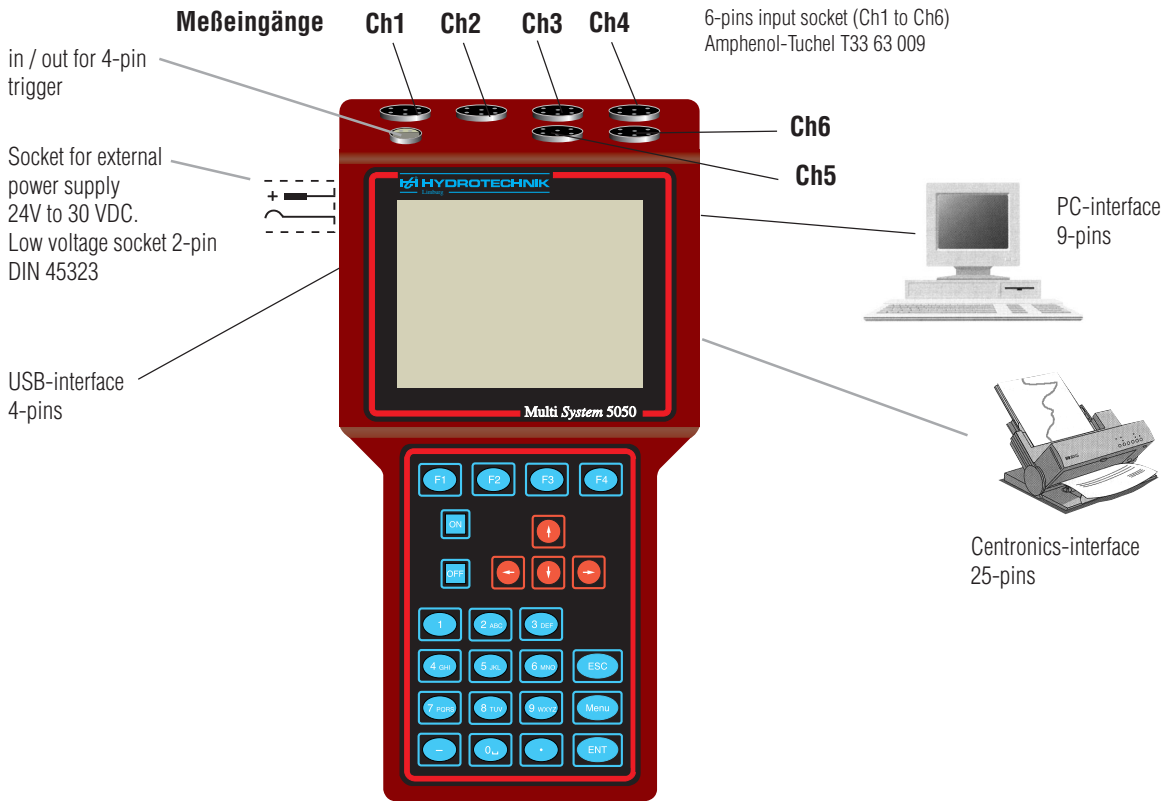
With [F1] you select a project from the project list.

After selection you can view the settings for this project using the up/down arrow [↑] [↓] keys.

You load this project and all its settings with [F3] or delete it in case of changes

with [F4].

6.0   Connectivity of the Multi-System 5050

Meßeingänge   **Ch1   Ch2   Ch3   Ch4**

6-pins input socket (Ch1 to Ch6)
Amphenol-Tuchel T33 63 009

in / out for 4-pin
trigger

Ch6

Ch5

Socket for external
power supply
24V to 30 VDC.
Low voltage socket 2-pin
DIN 45323

PC-interface
9-pins

USB-interface
4-pins

Centronics-interface
25-pins

Measuring input	Ch1/Ch2/Ch3/Ch4	Measuring input	Ch5 or Ch6	In / out	
Top view pin-out	Analogue measuring input	Top view pin-out	Digital measuring input	Top view pin-out	Description
1	Signal input for power (0 to 20 mA / 4 to 20 mA)	1	Signal input >3,5 to 30 V square wave signal	1	Digital signal output mass (Signal) **no galvanic separation - Out**
2	Mass (Ch1 to Ch4)	2	Mass (Ch5 or Ch6)	2	Digital signal output Signal + **no galvanic separation + Out**
3	+Ub (K1/K3) 14,4 VDC (battery) (external 24 VDC)	3	+Ub (K1/K3) 14,4 VDC (battery) (external 24 VDC)	3	Digital trigger input galvanic separation Signal + **+ In**
4	10 Volt DC signal output	4	Directional signal	4	Digital trigger input galvanic separation Signal - **- In**
5	Shielding	5	Shielding		
6	ISDS-signal for Hydrotechnik sensors	6	ISDS-signal for Hydrotechnik sensors		

6.1 Detailed technical description of the measuring inputs, digital In/Out and power supply

Measuring inputs / outputs:
All inputs or outputs are not galvanically separated and are connected with each other via the negative pole of the power supply or via the mass connection of the sensors, as well as via the common power voltage.
The only exception is the digital trigger input which is galvanically separated (Opto coupler).

6.2 Analogue inputs:

Number:	4 (ch1 to ch 4)
Signal input:	optional 0 to 20 mA, 4 to 20 mA or 0 to10V
Max.resolution:	12 Bit (4096 Digit)
Measuring rate:	1ms
Measuring error:	$\pm 0,1$ % of full scale
Resolution:	Power approx. 3500 Digit, Voltage approx. 3300 Digit
Temperature variation:	$\pm 0,1$ % of full scale / 10°C
Cross talk:	to neighbouring channel at max. resolution 1 Digit
Over range:	>10 % of end value
Filter function:	controlled via software (1, 2, 4, 8 and 16 ms)
Commection:	6-pin housing
ISDS:	company-specific serial data transmission

Measure input	Pin No.	Function	Ri.	Ci.	Limitation	Protection
Top view	1	20mA Signal	105 Ohm	0,022 uF	5,6 VDC	VDR,Transildiode
	2	Mass				
	3	Ub*			100 mA	Current limitation-PTC
	4	+10V Signal	24,7 kOhm	0,022 uF	+30 VDC	VDR,TRANSIL diode
	5	Shield				
	6	ISDS	1 kOhm	100 pF	5,6 VDC	TRANSIL diode

U_b* Voltage for mains operation 24 V-2 V, for battery U_{batt} −0,6 V

6.3 Frequency inputs:

Number:	2 (ch5 and ch6), with optional direction sensor
Frequency signal:	> 0,25 Hz to 5 kHz
Input level:	> 3,5 to 30 VDC (square wave signal)
Measuring error :	±0,15 % of full scale
Direction sensor:	by phase displacement of 90° to the frequency signal
Period measurement:	adjustable time gate with factor 1 = 10,9 ms (min.) to factor 100 = 1092,3 ms (max.)
Connection:	6-pins input socket
ISDS:	company-specific serial data transmission

Measuring input	Pin No.	Function	Ri.	Ci.	Limitation	Protection
Top view	1	Frequency	4,7 kOhm	1 nF	33 VDC	VDR, Zener diode
	2	Mass				
	3	Ub*			100 mA	Current limitation- PTC
	4	Direction signal	4,7 kOhm	1 nF	33 VDC	VDR, Zener diode
	5	Shield				
	6	ISDS	1 kOhm	100 pF	5,6 VDC	TRANSIL diode

The supplied measuring cable MKS is suitable for all measuring inputs (ch1 to ch6)
(all sensors with or without ISDS may be connected)

X
Connectivity
plug

white
brown
green
yellow
shielding
blue

Y
Connectivity
socket

Connection to measuring instrument
Multi Handy 3050 / Multi System 5050

Connection to
measuring sensors
with or without sensor recognition

8824-S1-XX.XX

X →

← Y

Red marking for sensor
identification (ISDS)

Red marking for sensor
identification (ISDS)

L
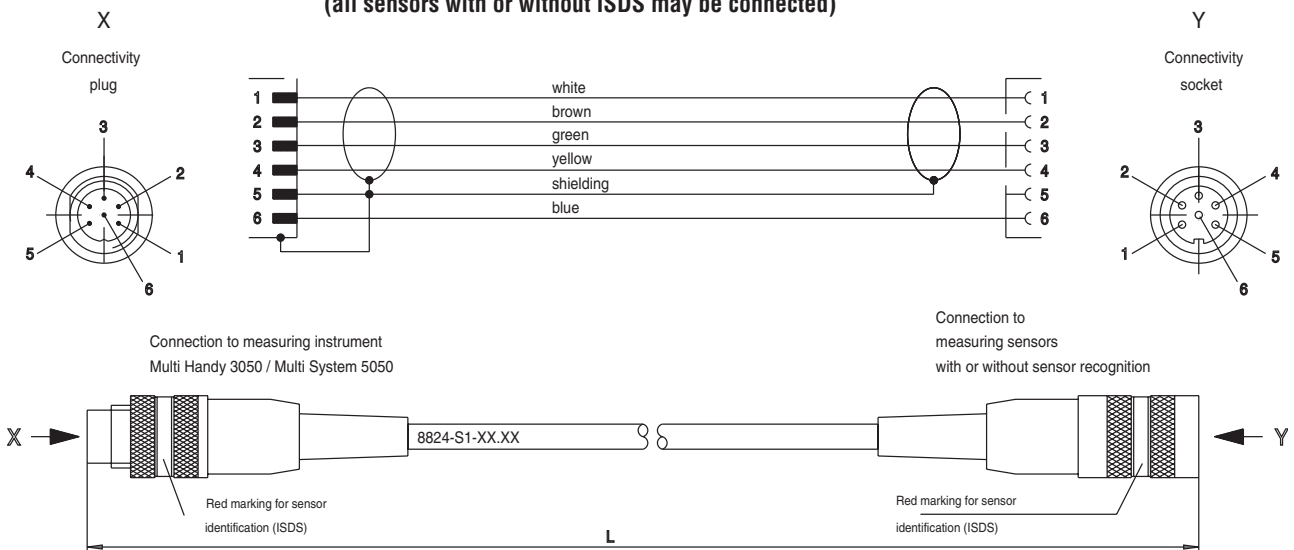
Operating temperature:	-20 °C to +70 °C
Storage temperature	-40 °C to +70 °C
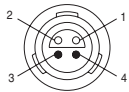
Ordering information for measuring cable MKS

Cable lenght L (in mm)	Part-number
2500	8824-S1-02.50
5000	8824-S1-05.00
6000	8824-S1-06.00
7500	8824-S1-07.50
10000	8824-S1-10.00
12500	8824-S1-12.50
20000	8824-S1-20.00

6.4 Digital trigger input (In):

Input:	**galvanic separation**
Input level:	> 3,5-30VDC
Input power:	approx. 1 mA constant current
Input impedance:	depending on input level
Frequency range:	static to 500 Hz.
Polarity protection:	Diode
Connector:	4-pole Lemosa (2 male plug).

Attention! This input must not be connected directly to inductive consumers, (coil of a magnetic valve).
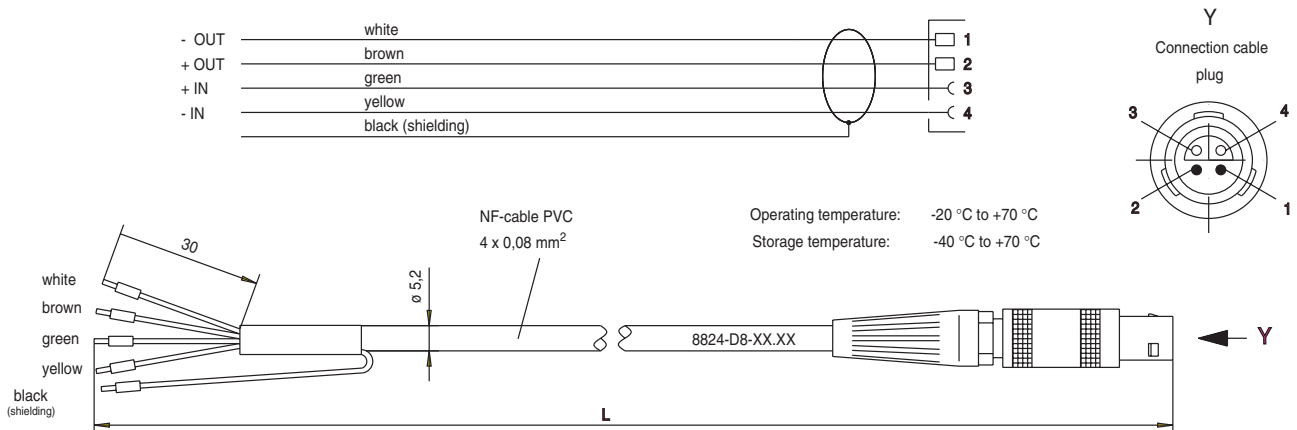
In (Top view)	Pin No.	Function	Limitation	Protection
	3	Signal +	33VDC	VDR, TRANSIL diode
	4	Signal -	33VDC	VDR, TRANSIL diode

6.5 Digital signal output (Out):   No galvanic separation !

Output:	N-channel FET (Open Collector)
Running current:	max. 10 mA
Switching voltage:	max. 30 VDC
Gating:	Diodes - or connected with internal 5 V supply via a 825 Ohm resistor
Connector:	4-pole Lemosa (2 sockets).

Out (Top view)	Pin No.	Function	Limitation	Protection
	2	Signal +	33 VDC	PTC, TRANSIL diode
	1	Mass (Signal-)	33 VDC	PTC

Connecting cable for external trigger (In/Out)

- OUT	white	1
+ OUT	brown	2
+ IN	green	3
- IN	yellow	4
	black (shielding)	

Y
Connection cable plug

NF-cable PVC
4 x 0,08 mm^2

ø 5,2

8824-D8-XX.XX

| Operating temperature: | -20 °C to +70 °C |
| Storage temperature: | -40 °C to +70 °C |
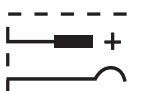
	Cable length L (in mm)	Part-number
Order information for connecting cable for external trigger (In/Out)	4000	8824-D8-04.00
	5000	8824-D8-05.00

6.6 Power supply:

External:	24 VDC 340 mA mains adapter minimum 12,5 VCD with limitation of the battery charging and sensor supply voltage
Internal:	14,4V Ni-Cd battery 1,2Ah
Connector:	jack bush

Input jacket	Pin	Function	Limitation	Protection
	Centre pin	Supply+	33 VDC	PTC, TRANSIL diode Diode reversal protection diode
	Sleeve	Supply-	33 VDC	PTC,TRANSIL diode

6.7 Supplementary specifications about internal battery voltage and external power supply:

Supply voltage 24 VDC current requirements approx. 220 mA with empty battery without sensors.
Minimal supply 12.5 VDC with limited battery charging and sensor power supply.
Automatic battery charge U/I technology max. charging current approx. 150 mA max. charging voltage 17.3 VDC charging time 14 to 16 hours for empty batteries. Automatic current reduction for full batteries. Partial charging possible. Charging always starts as soon as mains adapter is connected with the charging socket.
Minimal requirements for complete battery load $\geq$ 21 VDC. Leakage current approx. 40 μAh.

Battery type 12 cells 4/5 A nickel Cadmium 14.4 nominal voltage 1.2 Ah. External charging with 120 mA/16 h.

Internal RAM charging 3,6 V/60 mAh (operating mode).
Internal RAM working current with clock approx. 9 μAh.

Internal voltage loss (in the device) supply or sensor connection:

For mains operation approx. - 2,0 V
For battery operation approx. - 0,6 V

Device power requirements without battery and sensor at:

12,5 V	approx. 120mA
13 V	approx. 110mA
14 V	approx. 106mA
15 V	approx. 102mA
18 V	approx. 87mA
24 V	approx. 72mA

7.0 Technical data for the Multi-System 5050
(Reference for the specified data 23 °C ±3 °K)

Measuring inputs:
6 input sockets (6-pin, Amphenol-Tuchel)
4 x 6-pin, analogue signal inputs Ch1 to Ch4: 0 to 20 mA, 4 to 20 mA
or 0 to 10 V, selectable via internal software.

2 x 6-pin, digital signal inputs Ch5 toCh6 (frequencies)
0,25 Hz to 5000 Hz (input level: > 3,5 to 30 VDC square wave signal)

Standard measures:
Pressure, pressure peaks, volume flow rate, revolution, direct current, DC
voltage, power, torque, distance and speed are freely selectable with a maximum
of 5-characters displayed and floating point

Revolution: from 60 min^{-1}, display max. 5-characters (brelative to a scanning mark)

Measuring rate:
Analogue input: 1 ms
Digital inputs (Impulse): Between 1 Hz and 91 Hz there will be a single
period measurement.
From 91 Hz the measuring time is constant at 10,9 ms.

Error tolerances:
Analogue: ±0,1 %   of the end value
Digital (Frequency):   ±0,15 % of measured value

Resolution A/D-converter:
12 bit (4096 Digit)

Extreme value storage:
Background storage of min. and max. values of all channels, display via keyboard

Measured data storage:
Max. 500,000 values (depending on the selected measured value), with selectable
scanning rate between 1 ms and 99 minutes.

Data storage:
Battery - powered RAM storage for backup

Display:
16 lines LCD, front size 4 - 7 mm, depending on settings or number of displayed channels

Interfaces:
Centronics for printer
RS 232 for PC-connection
USB for PC-connection (supports Windows 98SE, Windows ME, Windows 2000 and Windows XP)

CE-certificate:
Meets requirements of EN 50 081-1 and EN 50 082-1

Power supply:
Internal 14.4 V NiCd batteries, 0.7 Ah for approx. 5 hours continuous operation with
integrated charging switch and battery status display. External power supply with mains
adapter 230 VAC, secondary 24 VDC or through external voltage supply (stabilised 24 V to
30 VDC)

Operating environment:
Operating temperature: 0 °C to+ 50 °C,
Relative humidity: < 80% (Moisturising not permissible)

General :
Device housing: ABS-plastic
Dimensions: 108 x 277 x 84 mm (B x L x H)
Weight: 1,4 kg

Technical modifications are subject to change without notice

8.0 Technical appendix

8.1 Error analysis measuring device

The Multi-System 5050 has been tested and calibrated in accordance with the strictest quality standards. Should, in spite of this, some problem occur, you should check the device with the following list „**technical faults/handling errors**" or check the next page „**other faults**".

Fault / handling error	Analysis / correction
After switching on: **- no display**	• Battery discharged, re-charge internal battery for 14 - 16 hours with the mains adapter 230 VAC / secondary 24 VDC. Change contrast setting.
- very weak or no display	• Keep arrow up-key pressed during initialisation until contrast is sufficient to show display
- only horizontal lines in the display. — — — —	• Sensor or measuring cable for 4 to 20 mA sensor not connected or defect. Please check whether it is caused by the sensor or the cable by replacing these parts one after the other.
Measuring fault (value) of pressure or temperature	• Currency signal of the sensor not set correctly in the measuring device to 0 to 20 mA or 4 to 20 mA. Correct if necessary.
Wrong pressure difference ($\triangle$-p measure unrealistic).	• Faulty pressure difference gauging. Execute gauging in accordance with operating instruction on page 29.
Wrong peak pressure values.	• Old min./max. values still in memory. Always delete memory before a new measuring process.
"Over" - display.	• Input measuring range was exceeded. - short circuit in sensor or cable - pressure measuring cell was overloaded
Values of a stored measuring series are displayed or printed out wrongly	• During the transmission of measuring series to the PC (USB/RS232) no simultaneous output of a measuring series on the display or on a printer must take place. • Measuring channel has not yet been programmed (measuring range and calibration value is zero).
cal?	• Value annot be displayed because it is invalid. The cause is usually the entry of invalid data for the measuring range, the calibration value and the linearization.
NaN	

8.2   Other errors

This chapter offers some comments about faulty reactions of the measuring device without displaying an error message. Every fault may have one or more caused, so the user should investigate each comment made in relation to every fault.

RS232- no connection to the PC
- wrong interface selected at the PC (COM1/COM2)
- conflicting baud rate setting at measuring device and PC
- USB- cable connected to measuring device (USB cable immobilises RS232 interface)

Diverging values between hardcopy / display / communication
- check menu item „device parameter" of the HYDROcomsys/WIN32 software - measuring device must be correctly identified
- during the data transmission to the PC (USB/RS232) it is not permissible to simultaneously output a measuring series on the display or printer

Colour printer selected, but the curve is printed b/w
- colour printout was not selected in the menu „PRESENTATION CHANNELS".
- b/w was selected for the individual channels

Device switched on - no display
- battery discharged -> connect mains adapter
- mains adapter is connected -> contrast too weak -> immediately after switching on keep the key „arrow up" pressed (2 - 5 sec.) until the contrast is sufficient to read the display. The fine tuning of the contrast may be made later with the display menu.
- total system crash -> new initialisation with keys 1 - 2 - 3 after switching on (manual reset).
- no software loaded -> install software

Device switched on - display is black
- contrast too strong -> immediately after switching on keep the key „arrow down" pressed (2 - 5 sec.) until the contrast is sufficient to read the display. The fine tuning of the contrast may be made later with the display menu.

Undefined characters in the display, measuring device re-starts upon function activation
- the memory of the measuring device or parts of it is in an undefined state.
Re-start the system with key 1 - 2- 3 after switching on.

8.3 FAQ's - Frequently asked questions

In the graphical presentation measured values are displayed in accordance with the set display rate as averages. How can I look at the pressure peaks?

Using the soft key F1 it is possible to move into the min/max display. In this case a vertical line between the min. and max. value is drawn (rate of 1 ms).

How can a specific value be displayed as a table in cases of substantial measuring series?
After activation of the tabular display the measuring series is subdivided into 10 identical sections, displaying a single record for each section. Activate the detail view and select the displayed line containing the record preceding the required record. The measuring series is now divided in 10 identical sections between this record and the following data record. This process needs to be repeated until the required data record is displayed.

Example:

1000 records at a sensor rate of 1 ms, required record: 0,565 sec.
1. picture: 0,000 0,100 0,200 0,300 0,400 0,500 0,600 0,700 0,800 0,900 1,000
now activate details selection 0,500
2. picture: 0,500 0,510 0,520 0,530 0,540 0,550 0,560 0,570 0,580 0,590 0,600
detail selection 0,560
3. picture: 0,560 0,561 0,562 0,563 0,564 0,565 0,566 0,567 0,568 0,569 0,570

How, in the case of substantial measuring series, can I print out only every xth value?

After activating the tabular display, a table is shown with 11 data records. If you now select hardcopy the printout contains also only 11 table lines. In the case of a measuring series of 1000 records, every 100th record is printed. When activating the detail display, each section is again subdivided into 10 subsections and a printout produces 101 table lines. For a measuring series of 1000 records every 10th recrod is being printed.

A colour printer was selected but the printout is b/w?

Independent of the printer settings it must be specified in the menu „Presentation - Channels" for each channel whether the selected printer should print in b/w or in colour. Also the required colour must be specified for each channel. A colour printout for tables is not supported.

A storage with pre-triggering was executed. Why is the trigger time incorrect?
In order to achieve a correct measuring result with trigger settings, an important condition must be met. The measuring device must be capable of receiving sufficient measuring values before and after the trigger event. If this cannot be guaranteed, the stored measuring process does not correspond with the programmed trigger setting.

The following causes may be responsible:

- Trigger event occurs to early. In this case the measuring series is shorter than the set storage time.
- Ths user has aborted the storage manually. The measuring series may (but need not) be shorter than the set storage time.

8.4 Printer support

The market offers numerous different printer types from different manufacturers. These differ not only in design and performance but also in the driver software required for each model. The Multi-System 5050 supports a large number of printer drivers.

Printer setting	Printer addressing	Example[*]
EPSON 9 dot matrix	9-Pin ESC/P	NEC P2x EPSON LQ500
EPSON-24 dot matrix	ESC/P	NEC P2x EPSON LQ500
EPSON colour	ESC/P2	EPSON Stylus COLOR880
HP mono	HP PCL	HP Laserjet 1100 HP 350C with black catrige HP 890C HP 990Cxi
HP colour	HP PCL	HP 350C with colour catridge HP 890C HP 990Cxi
Canon (Bubble Jet Drucker)	Canon Extended Mode Commands	Canon S450

[*] These examples represent only a selection of the printers tested by HYDROTECHNIK. Any printer supporting one of the above mode may be used.

Attention: original Windows-printer (e.g., HP720) are not supported by the measuring device

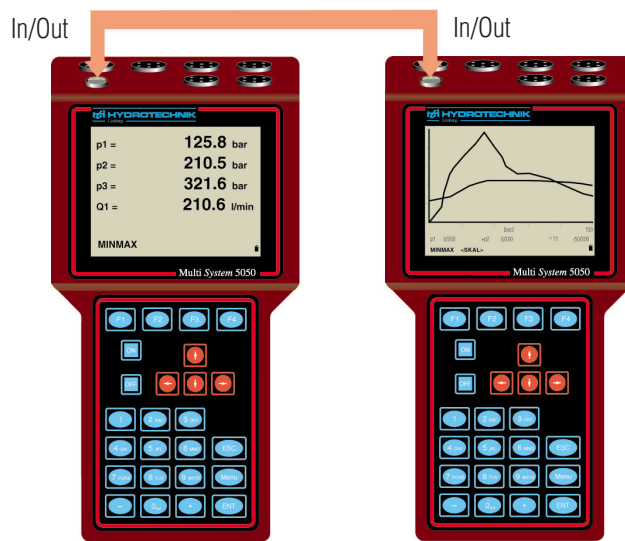## 8.5   Linking two measuring devices

General

A maximum of 6 values may be measured or stored with the Multi-System 5050, leaving the additional channels (calculation channels, trigger channels). For some situations this number is insufficient and more channels need to be stored. If you have more than one measuring device available you may link these and store data simultaneously in several measuring devices. Although there is no hardware-specific limit to the devices to be linked, the number of linked measuring devices should not exceed 4. The reason for this recommendation is that as a rule all measured values should be stored in a single PC-file. The PC-software HYDROcomsys/WIN32, however, only supports measuring series with max. 24 values = 24 measuring channels.

When linking several devices one of them must always be specified as master, the others as slave.

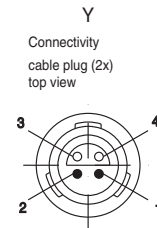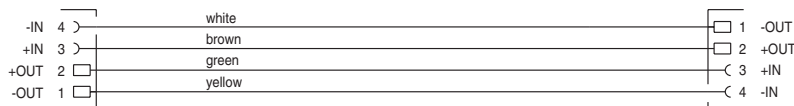### Electrical connection of the devices

Coupling of two measuring devices:

The two devices are simply connected with the link cable (Part-number: 8842-F2-00.50).
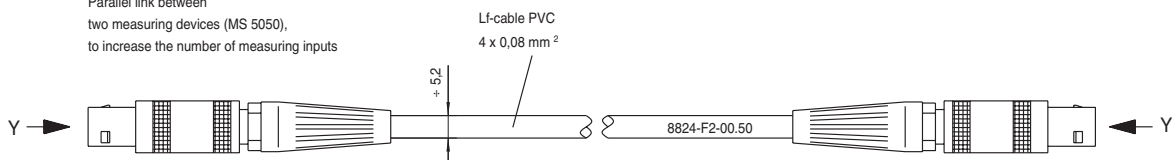

### Connection cable MS 5050
(length 50 cm)

8.6 Linking of more than two measuring devices with triggering on an external signal

A connecting cable for external trigger (Part-number: 8842-D8-04.00) is required for the master device and for each slave. The trigger signal is to be connected to pins 3 and 4 (green/yellow). Pins 1 and 2 (white/brown) are to be connected to pins 3 and 4 of the next device. For this device, again, the pins 1 and 2 are to be connected with pins 3 and 4 of the next device.

Serial: Synchronisation error (deviation of the simultaneous storage)
Device 1 -> Device 2   max. 1 ms
Device 2 -> Device 3   max. 1 ms
Device 1 -> Device 3   max. 2 ms
Device 1 -> Device 5   max. 4 ms
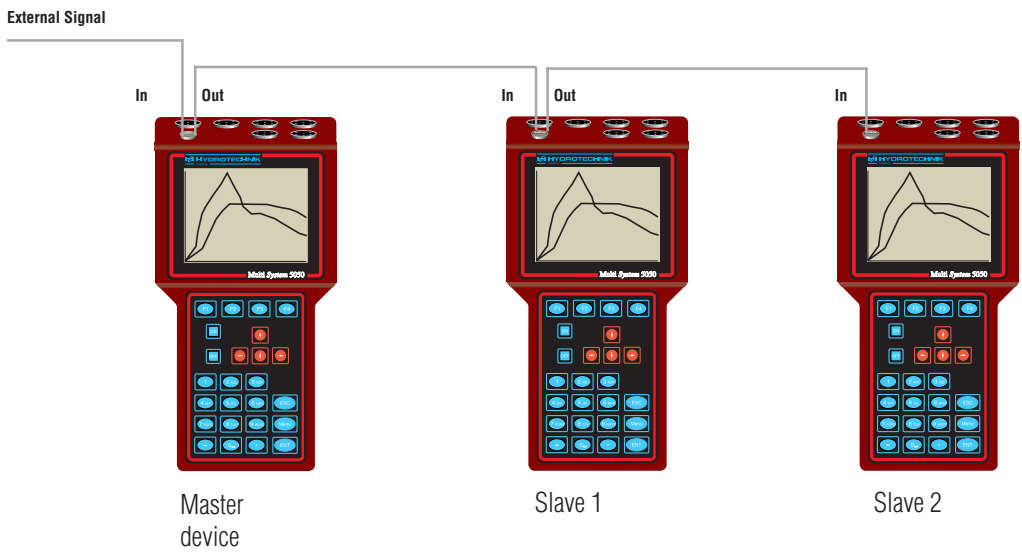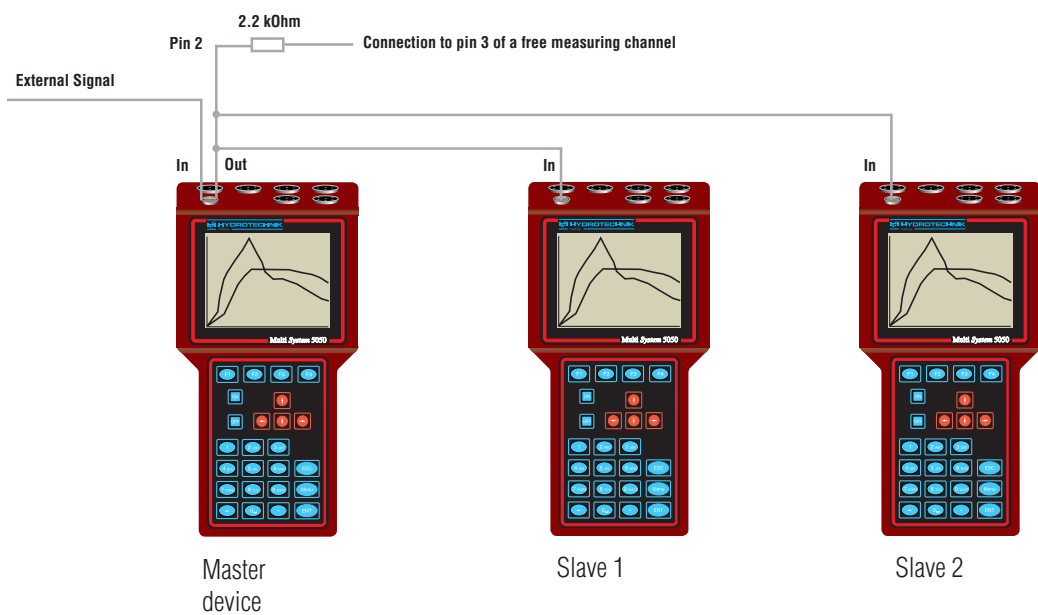

Paralles: Synchronisation error (deviation of the simultaneous storage)
Device 1 -> Device 2   max. 1 ms
Device 2 -> Device 3   max. 1 ms
Device 1 -> Device 3   max. 1 ms
Device 1 -> Device 5   max. 1 ms
Please note that this variance applies only to a max. of 10 devices!

8.7 Appropriate programming for linkes measuring devices

General

Before the linked storage may be started, the following settings must be affected in all devices:
1. Selecting the storage channels in each device
2. Programming identical scanning rates, storage time and pre-trigger setting

For the following settings differences must be observed between master and slave device:

Master device:
1. Storage must be with triggering. Trigger settings (key, triggering on value, edge or external signal) may be selected as desired.
2. The trigger output of the measuring device is to be set to „ACTIVE" and „SP_TRIG". With this setup the signal is passed to the trigger output upon recognition and is, therefore, available for other measuring device.

Slave(s):
1. Storage must be with triggering. The setting for trigger 1 must be trigger input E1 = ON.
2. The trigger output of the measuring device is to be set to „ACTIVE" and „SP_TRIG". With this setup the signal is passed to the trigger output upon recognition and is, therefore, available for other measuring devices. This is only necessary when another measuring device is connected as described in option a).

Activating the storage

The storage is to be activated at each device as usual. It must be made sure that the trigger event has not already been activated at the master device, while the other devices are still inactive. Also, it is very important that all measuring devices are allowed sufficient time to store the pre-trigger process. When a pre-trigger time of 10 sec. was selected (e.g., 20% pre-trigger at 50 sec. storage time) and the trigger event occurs already 5 sec. after activation the storage in the last device, no data synchronisation takes place in the individual measuring devices. This state may be recognised by the fact that the devices show different volumes of measuring values (-> storage time). Equally, in no measuring device must the storage be permaturely aborted via the keyboard. Also, a cyclical storage should be avoided because of the problem of a permature triggering.

Creating a measuring value file from stored data from linked measuring devies

After storage, the stored data must be transmitted by each individual device to HYDROcomsys/WIN32. This program collates these data into a single measured value file. Further information may be obtained from the HYDROcomsys/WIN32 users manual.

8.8 Interpretation of the error messages in the display of the measuring device

If the device detects faulty entries it will display an error message in the format **??? \<text\> ???** on the last display line. Some error messages consist of two lines, displayed sequentially. Such errors are described in detail (alphabetically) below. The number in brackets is an internal number not displayed in the message.

Printer error: no paper (1020/1021)
Printer error: offline (1020/1022)
Printer error: timeout (1020/1023)
Printer error: printer switched off (1020/1024)

All of the above errors occur in connection with printing of data. The cause of the error must be removed and the printout resumed with **CONTIN** (F3-key). Should this be not possible, abort the print with F2. The printer error „timeout" indicates that the printer does not accept data from the measuring device (print buffer full).

Error measuring channel (1017)
This error can occur in connection with ISDS sensors. If an analogue sensor is connected to a frequency input or a digital sensor to an analogue input, the measuring device will issue an error message. The wrong channels are shown in the display.

ID number (311)
Every linearization table is identified by a table name. When defining the current table no name was entered or the name consisted of blanks.

Ind. rate (1016)
When a storage is to be activated with individual scanning rate at least one channel must be set to individual rate = 1. If all channels are to be stored with a lesser sensor rate the basic scanning rate must be changed accordingly.

Function blocked: ISDS (1018/69)
A manual alteration of the channel parameters of an ISDS sensor was attempted. This is not possible with an activated ISDS mode. If the user still wishes to do this (e.g. using a pressure sensor for measuring power) the ISDS modus must be deactivated in the device menu. After switching on the device again, these sensor parameters may be changed.

Calibration ADC (2001)
This error can only occur in the initialisation menu when switching-on the device. The device must be switched-on again since a malfunction occurred at the AD converter during initialisation.

Channel X - axis (1029)
A f(x)-graphic was selected for the display. This requires the definition of a channel for the x-axis.

No channel selected (1003)
For the proper execution of the requested version at least one measuring channel must be selected.

No channels (1027)
In the „DISPLAY" menu at least one channel must be selected for display.

No records (1028)
An attempt was made to display a measuring series containing no records. This storage may be deleted. The error occurs only when a storage was activated and the first record was aborted before storage.

ConfigMemory full (1013)
A max. of 5 different configurations (projects) may be stored in the measuring device. The configuration memory is full.

Max. 8 channels (1010/1026)"

A max. of 8 channels may be selected for storage. (Including the two internal calculable measuring values, e.g., difference, sum, etc.)

Measuring range (303)

An invalid range was entered for a channel. The first value of a range must always be smaller than the second value. Also, the second value must never be zero.

Select measuring series (1002)

No measuring series has been selected for the display.

NaN

When you see this display it indicates an undefined value. Check the channel parameters.

Project name? (1012)

It was attempted to store a configuration in the project menu. This always requires a name which must not consist of only blanks.

Standard / Actual (313)

A linearization table must consist of at least one valid pair of values (standard / actual for analogue input channels or Hz/actual for digital input channels). No values have been defined for the current table. A value pair (0,000/0,000) is an invalid definition and will be used internally as table end. If a small value needs to be specified, the zero point may be entered as „,0001/,0001" (leading zero is omitted) setting the zero point to zero.

Storage channel (1014)

A storage channel was selected that has not yet been programmed (calibration value or measuring range = zero)

Storage active (1005)

Is was attempted to carry out one of the following functions although a storage was active:
Start of a storage
Display of a storage
Deletion of a storage

Memory full (1004)

The measuring device has a storage capacity for max. 36 measuring series. An attempt is made to store a 37th series. Series no longer required should be deleted or printed out or transmitted to the PC.

Memory too small (1015)

A storage is attempted that requires a memory size exceeding the device capacity.
The following remedies are available:
- delete not required measuring series
- reduce storage time or scanning rate
- use individual scanning rates for individual channels
- reduce the number of storage channels
- linking of two measuring devices and split the frequency channels of both devices
  (attention: observe the optimal distribution of frequency channels of both devices!)

To calculate the exact storage requirement that the frequency inputs need 6 Bytes and the other measuring channels 2 Bytes for each measuring value.

Overflow time (1008)

This error occures when for the display of a section the area was defined wrongly. The start area is outside the measuring range.

From > to (1007)

This error occurs when for the display of a section the area was defined wrongly. The start area must always be smaller than the end area.

Select project (1011)
Before a stored configuration may be loaded in the project menu, a project must be selected.

Select table (1009)
Linearization was chosen for a measuring channel. This requires the selection of the table to be used.

Value too small (1000)
The entry for the current field was rejected because it is too small. This error occurs when zero is entered for storage time or sensor rate or when for manual scaling the max. value is smaller than the min. value.

Value too big (1001)
The entry for the current field was rejected because it is too big. This error occurs when the time gate of the frequency channel (DEVICEMENU -> CHANNELFILTER) is greater than 100.

8.9 Comments on the transmission of measuring series to the PC

Stored measuring series may either be shown on the display, printed out or transmitted to the PC via the USB - or RS232 interface. The transmission of measuring series to the PC takes place in the background of the measuring device. This means that the device may be used during this time for measuring purposes. This option should not, however, be used or the transmission rate could be markedly reduced. Also, sensors connected to the frequency channels with higher frequency rate might adversely affect the transfer rate.

Under no circumstances should, during the transmission of a stored measuring series, this same or another measuring series be activated for output on the display or a printer. This does not apply to online transmissions!

The PC USB interface, according to the USB specification, Revision 1.1, allows the linking of max. 127 USB units. This is not supported by HYDROcomsys/WIN32. You may only connect one measuring device (Multi-System 5050) with the PC.

8.10 Memory requirements of a measuring series

The measuring channels require different Bytes for storage:

A/D- channel	2 Bytes
IN/OUT- channel	2 Bytes
Frequenz- channel	6 Bytes

For each storage header is also being saved. The storage head requires 64 Bytes for storage parameters (scanning rate, storage time, trigger setting, etc.) and 146 Bytes for each storage channel for channel parameters (calibration, sensor type, linearization table,....). The smallest storage unit with an AD channel requires 212 Bytes (1 measuring value).

The storage of calculated values of the channels offers a special feature. The measured values of the channels require for the calculation are stored. The calculation channel only stores the channel parameters in the storage header. This means that the following storages have identical storage requirements:

> p1 and p2 and dp
> p1 and dp
> p2 and dp
> only dp

This is interesting insofar as the storage of p1 and p2 and a later calculation of the pressure difference dp with the analysis software „HYDROcomsys/WIN32" does not cause any savings for the measuring value storage (excepting the 146 Bytes channel paramter dp). A later calculation by the analysis software has even the disadvantage that a pressure difference comparision is neglected when an non-linearized sensor is used with the measuring device.

The menu „DISPLAY ->MEASURING SERIES SELECTION" the utilised storage capacity for each series may be displayed.

The following displays are possible:

<1 kB	measuring series requires less than 1 KB of storage.
xxx kB	measuring series occupied
1 MB	measuring series occupied 1 MB (memory full)
??? kB	memory usage unknown. Storage illegally aborted (device switched off during storage)

8.11 Input editor

A numeric and alphanumeric input editor has been installed into the measuring device. These editors help you to enter and correct data in parameter fields.

Numeric entries

The numeric entry will be activated when entering numeric values (sensory measuring range, scaling values, graphics, ...and always refers to a single line parameter field. Size and position of the current input field is always indicated by inverse display. A further indication, that the user is in the „input mode" are additional function keys. The following keys are available:

0-9	digits 0 to 9
-	minus indicator, always preciding a digit
.	Decimal point
→	The cursor in the input field will be moved to the right
←	The cursor in the input field will be moved to the left
F2 (ENTF)	Deletes the character at the current position. Subsequent characters are moved leftwards. In the case of multi-line input fields this displacement affects all lines of the input fields
F3 (EINFG)	Inserts a blank at the current position by moving the current and all following characters to the right. The character at the last cursor position is deleted.
F4 (LOE)	Deletes the contents of the current input field.
ENT	Concludes the entry in the current field. If it is a group of input fields (e.g., measuring range, linearization values) the entry for the next input field will be activated.
ESC	Concludes the entry in the current field without saving the entries.

Alphanumerical entry

The alphanumerical entry is activated for entries of text (name of measuring series, description of linearization tables, comments, company name) and may be a single or multiple line parameter field. Size and position of the current input field is always highlighted by inverse display. Another indication that the user is in the „input mode" are the availability of special function keys. Their use is analogue to the keys of the keyboard on mobile telephones where single or multiple pressing of keys produce different letters or digits. Upon pressing a key the input position is shifted to the right. If two characters occupying the same key need to be entered, wait about 2 seconds after entering the first chracter. The cursor moves to the next position. This may also be done with the cursor key. During an alphanumeric entry the first pressing of the key selects the first letter and the 4th and 5th pressing of the key the selection of the digit.

The following keys are available:

0	blank and digit 0
1	special letters in german Ä Ö Ü and digit 1
2	Letters A B C and digit 2
3	Letters D E F and digit 3
4	Letters G H I and digit 4
5	Letters J K L and digit 5
6	Letters M N O and digit 6
7	Letters P Q R S and digit 7
8	Letters T U V and digit 8
9	Letters W X Y Z and digit 9
-	negative sign/hyphen
.	full stop (end of the record)
➔	Cursor in the input field is shifted by one position to the right
⬅	Cursor in the input field is shifted by one position to the left
↑	Cursor in the input field is shifted up by one position
↓	Cursor in the input field is shifted down by one position

F1 (<ABC2>) Changing the entry from upper case to lower case. The text in brackets shows the current setting.
<abc2> -> lower case active, <ABC2> upper case active

F2 (ENTF) deletes the character at the current position. Following characters are moved to the left

F3 (EINFG) inserts a blank at the current position by moving the current and all following characters by one space to the right. The character at the last position disappears or is moved to the first position of the next line.
This function, therefore, also affects all other lines of the input field.

F4 (LOE) deletes all characters on all lines of the current entry field.
ENT Concludes the entry in the current field. If it is a group of input fields (e.g., measuring range, linearization values the entry for the next input field will be activated.

ESC Concludes the entry in the current field without saving the entries.

9.0 Guarantee

Within the terms of our guarantee terms and conditions we guarantee the immaculate state of our technical devices.
The guarantee period is 6 month.

Only our general terms and conditions of trade shall apply.

Any guarantee claims be invalid in cases of repairs or interventions by persons not authorised by us to do so.

Within the guarantee period we shall remove free of charge any deficiencies that have been proved to be due to production faults provided they are reported to us immediately after detection but not later than 6 months after delivery.

In case of guarantee claims we reserve the right to either repair defective parts or replace these with new parts.

Devices for which a guarantee claim is made are to be returned to us postage paid, with the appropriate invoice or delivery note (copy) included, addressed to:

HYDROTECHNIK - Kundendienststelle

9.1 Maintenance

Your measuring device is a precision instrument which, if taken proper care should assure problem-free operation for many years. Should there be any problems, please refrain from attempting self-repairs; leave the maintenance or repair exclusively to our HYDROTECHNIK customer service

HYDROTECHNIK - Kundendienststelle

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