# FLOW AND PRESSURE MEASURING COMPUTER

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## 2. What is supplied

| | | |
|---|---|---|
| 1. | Measuring computer | 1 |
| 2. | Connection hoses | 1 Pair |
| 3. | Quick connector R21 | 1 Pair |
| 4. | Quick connector R20 | 1 Pair |
| 5. | Measuring Needle Oventrop | 1 Pair |
| 6. | Communication cable to PC | 1 |
| 7 | CD-R disc with communications programme | 1 |
| 8. | Plastic case | 1 |
| 9. | Operating instructions and guarantee certificate | 1 |

## 3. Introduction

The T450F measuring computer is an intelligent appliance which is specifically designed for the maintenance and hydraulic balancing of heating and air-conditioning systems.

The computer provides digital measuring data processing using an integral differential pressure measurer and flow meter. This ensures a high degree of precision and stability of time and temperature. The computer operates pre-programmed with control valve characteris-tics for hydraulic balancing. The flow rate is calculated using the measured differential pressure and the valve characteristics.

The computer has an input module with a real-time circuit which enables measurements to be made, values to be stored, processed and evaluated in a PC. Where data entry is over a longer period the computer automatically changes over to a low-consumption sleep mode.

## 4. Important guidance notes for use

In order not to damage the pressure sensor, after using for fluid measurement the computer should not be stored at a temperature below the freezing (solidification) point of the measured fluid.

The connection inlets of the hoses are fitted with filters with a mesh size of 50 µm. When measuring systems with a high degree of contamination these filters can become blocked.

After disconnection of the hoses, if the computer indicates an excessive pressure value on the display or one of the pressure inlets does not work, then the filters must be replaced.

## 5. Putting into operation

The computer is ready for use once the battery has been fitted.

The clock time must be set after switching on. If the battery is removed, the clock time setting is maintained by a Lithium battery.

## 6. Preparation of the instrument for measurement - venting of the hoses.

The supply hoses must be fully vented to ensure that the T450F instrument achieves the most accurate measurement of pressure differentials and other evaluated data, therefore fill the connecting hoses before using the instrument for the first time. The automatic valves within the R20 and R21 quick connectors close off the hoses when they are removed, so there is normally no need to refill the hoses before taking further measurements. Nevertheless the hoses should always be visually checked for the presence of any air.

### 6.1 Recommended fill medium for measuring tubing

An ideal fill medium for the measuring hoses recommended by the manufacturer is a mixture of distilled water and anti-freeze solution based on ethylene or propylene glycol (minimum 50%).

### 6.2 The easiest way to vent the hoses

First, remove the R20 quick connector from the bottom of the measuring hose by pressing the black security collar on the R20 quick connector towards the connector. Pull gently to slide the hose out. Do not use any force because this may damage the surface of the hose and make disconnection more difficult.

After disconnecting the R20 quick connector, using the reverse of the procedure just described, connect the hose to the measuring adapter using the R21 quick connector (this is supplied as standard with the measuring set). Use the measuring adapter to fill the measuring hose with a liquid medium until any air bubbles disappear.

Close the hose by fitting the R20 quick connector and disconnecting the measuring adapter. After measurement has been carried out the liquid remains in the hose because both of the quick connectors are equipped with integral automatic shutoff valves.

### 6.3 Connecting the instrument to a system – detailed procedure

Measuring hose and quick connectors are used to connect the T450F instrument to a system. This hosing (1.5 metres) and quick connectors for the instrument side (R20) and for the system side (R21) are supplied as standard with the measuring instrument. The R21 quick connector enables connection to measuring valves manufactured by Vir, TA, Herz, Esbe, MNG, Honeywell, Oventrop, Heimeier and Danfoss.

In the T450F digital manometer are stored data of VIR valves 9450, 9505, 9515, 9555.

### 6.4 Hose venting – The easiest procedure

1. Use the R20 quick connector to connect hosing to measuring input of the instrument (snap connector firmly closed)
2. Connect R21 quick connector to the measuring set, valves or adapters (snap connector firmly closed)
3. Open supply of medium to measuring elements: First connect red (+) side of the instrument measuring input. Then connect blue (-) side of the instrument.
4. Set the digital filtration value. Set to zero.
5. Carry out specific pressure and flow measurements as required (consult user manual)
6. When measurement has been completed, immediately shutoff medium supply to the measuring elements. Failure to do this may result in injury from hot flow medium.
7. Disconnect hoses by reversing procedure described in paragraph 3.

### 6.5 Important notice to user!

To measure pressure ratios in a system with a liquid heat carrying medium, observe the following guidelines:

1. Do not expose the instrument to below zero °C temperatures after any contact with water.
2. In order to carry out accurate pressure differential measurements, the hoses must be fully vented (see “Preparation of the instrument for measurement”).
3. Pay special attention to safety while measuring any high-temperature liquid or any dangerous medium. Incorrect connection or disconnection of hoses may result in injury.

## 7. Keypad functions

| | |
|---|---|
| ON OFF | Switches the computer on and off. |
| ZERO | Sets the pressure on the display to zero. This corrects the relationship between differential and static pressures. |

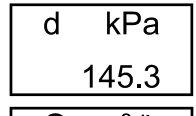
The following keys have more than one function:

| | |
|---|---|
| DISPLAY OK | 1. Switches in rotation to pressure, flow rate and time<br>2. This key is for making the selection in the computer menu |
| MENU ESC | 1. Calls up the computer menu for parameter presetting<br>2. Stops parameter selection and changes to higher menu stage<br>3. If the key is pressed for longer than 1 sec. the computer changes from the computer menu into the measuring mode |
| ◀ VALVE | 1. Calls up valve selection<br>2. Moves leftwards through the computer menu stages (press for longer time to move faster) |
| ▶ PRESET | 1. Indicates the valve presetting while measurement is taking place<br>2. Moves rightwards through the computer menu stages (press for longer time to move faster) |
| ◀ VALVE ▶ PRESET | Keys have auto-repeat function – on each brief press of the key the value is increased by one. If the key is pressed for longer than one second the step value increases to four steps per second. If pressed for a further second the frequency increases to ten steps per second. |

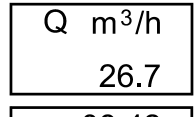
## 8. Display indicators

The appliance has a two-line alpha-numerical display, each with eight positions. During measurement the first line indicates the type of measurement and the units. The second line shows the measured value. Alongside the measurement values the appliance can also display the time and date:

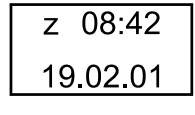
**Pressure display**




**Flow rate display**




**Time display**




NOTE: The date is given in the format Day.Month.Year

Pressing the key DISPLAY OK will switch from one display to the next.

## 9. Computer menu

| | |
|---|---|
| MENU ESC | 1. Calls up the appliance menu<br>2. Returns to the next highest menu item<br>3. Exits computer menus by pressing the key for longer |
| DISPLAY OK | Confirms the selection |
| ◀ VALVE | Moves leftwards through the computer menus (press for longer time to move faster) |
| ▶ PRESET | Moves rightwards through the computer menus (press for longer time to move faster) |

**Note:** There is a schematic of the menus on the last page of these operating instructions.

**Damping**

Damping of the indicator movements ensures that the data display remains steady. This causes a change to time constant for establishing the mid value of the value being measured. The time constant for pressure measurement is one second for the „fast“ setting, five seconds for the „middle“ setting and twenty five seconds for the „slow“ setting. The time constant for flow measurement is about 16 seconds more. The mid value means 99.9 % of the exact measured value.

**Automatic shutdown**

If no key is pressed for ten minutes, then the computer automatically shuts down.

If, however, measurement lasts longer than ten minutes, then the automatic shut down function can be deactivated.

## 9.1 To change settings

| | |
|---|---|
| MENU ESC | Calls up the computer menus |
| ◀ VALVE ▶ PRESET | Choose the selected function |
| DISPLAY OK | Confirm selected function |
| MENU ESC | To leave the menu completely, press and hold down ***MENU/ESC*** key. |

**Note:** See menu schematic in appendix for possible settings.

## 10. Configuration

Before carrying out the actual measurement the computer must be configured with the measuring criteria.

### 10.1 Selection of valve and presetting

| | | |
|---|---|---|
| ◀ VALVE | Call up valve selection. | MNG K3+<br>DN 20<br>The display shows the valve manufacturer, valve type and size |
| ◀ VALVE ▶ PRESET | Select required valve type | MNG KFII<br>DN 300 |
| DISPLAY OK | Confirm selected valve type | Preset<br>12.6<br>The display shows the actual presetting of the valve |
| ◀ VALVE ▶ PRESET | Change valve presetting | Preset<br>21.6 |
| DISPLAY OK | Confirm selected presetting | |

### 10.2 Changing the presetting

| | | |
|---|---|---|
| ▶ PRESET | Call up valve presetting | Preset<br>12.6 |
| ◀ VALVE ▶ PRESET | Change valve presetting | Preset<br>21.6 |
| DISPLAY OK | Confirm selected valve presetting | |
| ▶ PRESET | In measuring mode the presetting can be changed by pressing this key without having to redefine the valve. | |

# 11. Measurements with the T450F

## 11.1 Measurement of pressure in the system

The static pressure is measured at the inlet (red) for the higher pressure. The inlet for the lower pressure (blue) remains unconnected. The computer automatically measures the amount the pressure in the system is above atmospheric pressure.

| NOTES: | | |
|---|---|---|
| | Maximum measuring range | 0 to 10.0 bar |
| | Maximum inlet pressure above atmospheric | 15.0 bar |

⚠ Inlet pressures higher than this can destroy the sensor

## 11.2 Differential pressure measurement and flow rate evaluation

The differential pressure can be measured with the T450F in any part of the system.

The flow rate can only be evaluated for those types of regulator valve offered in the selection.

1. Connect the pressure inlets of the T450F to the pressure tappings of the valve.

⚠ Take care to observe the correct colour codings of the hoses and the pressure inlets:
- **red:** for the higher pressure (before the valve seat or valve inlet),
- **blue:** for the lower pressure (after the valve seat or valve outlet).

2. The reading must be zeroed before taking the actual measurement in order to eliminate any effects of static pressure in the system.

   This is achieved by fully opening the valve and then setting to zero by pressing key [ZERO]

3. After putting the system into operation the computer measures the differential pressure across the valve.
4. The flow rate is evaluated and displayed. Dependent on the valve selected and the presetting of the valve.
5. [DISPLAY OK] Changes to the next function.

## 11.3 Flow rate evaluation of valve types not stored in the computer using direct input of a kv-value.

This function makes it possible to carry out flow rate measurements for valve types which are not stored in the T450F .

1. Select [Menu Input kv] in computer menu
2. Confirm with [DISPLAY OK]
3. Set the required kv-values with [◀ VALVE] and [▶ PRESET]
4. Confirm with [DISPLAY OK]
5. Exit menu with [MENU ESC]

The newly entered values will immediately be used.

For long term measurements these kv-values, together with the measurement data, will be stored and will be displayed in the evaluation software under the menu item *presettings*.

## 11.4 Data input

The parameters for the data collection are selected in the data collection item in the menu. The required settings are then entered.

### 1. START

Start of the data entry.

Next, the selected valve, the presetting and the 16 character description of the measuring values are stored. At the same time the pressure and the flow rate across the valve are recorded and the computer switches over to *Sleep mode*. The *Sleep mode* is indicated by a message on the display. The computer switches automatically to the next entry time point.

The (*) in the upper line flashes on the display; the pressure and the flow rate are recorded after the wakeup period. The computer then switches back to *Sleep mode*.

GUIDANCE NOTE: The *ZERO* key has no function during the data entry.

The measuring data entry is ended by pressing the *MENU/ESC* key. If the memory capacity is exceeded during measuring data entry, then the following message appears in the display:

| FULL |
| --- |
| Memory |

The entry of measuring values is terminated by pressing any key except ON.

### 2. MEMORY CAPACITY

Control of the memory capacity.

A grid diagram with eight segments will appear on the display. Each segment corresponds to 300 data entries.

If there is insufficient memory available, the next menu point ***Entry/cancel*** will free up memory. **But note that measured values already stored will be lost.**

### 3. CANCEL

The stored data is lost.

### 4. TIME INTERVALS

Entry of the time interval between measurements are stored. Adjustable between one second and twenty four hours. When number of minutes or hours is **not** zero then seconds are ignored and the computer changes over to ***Sleep-Mode*** function. For example:

| **Time interval adjusted to** | ***Sleep mode*** | **Record periode** |
| --- | --- | --- |
| 0 h 0 min and 3 sec | **no** change to ***Sleep-Mode*** | 3 sec |
| 5 min and 0 sec | change to ***Sleep-Mode*** | 5 min |
| 5 min and 3 sec | change to ***Sleep-Mode*** | 5 min |

The display is not active with the ***Sleep-Mode*** function. Pressing any key except ***ON*** will activate the display and the following message will appear:

| Stop? |
| --- |
| OK/ESC |

After pressing the ***ESC*** key data, entry will continue and pressing the ***OK*** will terminate data entry.

### 5. WAKING TIME

Setting of the time interval before the computer wakes from *Sleep Mode* and makes the next data entry. Where a „middle“ or „long“ damper period has been chosen (see filter) this can lead to false readings if a short waking period has also been set. It is therefore recommended that a waking period of at least 25 seconds be selected for a „middle“ damping period and at least 45 seconds for a „long“ damping period.

**6. LOCATION/DESCRIPTION**

Entry of the location and description with up to 8 alpha-numeric characters (A-Z, 0-9)

| | |
|---|---|
| ◀ VALVE ▶ PRESET | Select letter or number |
| DISPLAY OK | Confirm selection |
| ZERO Press briefly | Deletes a character |
| ZERO Press and hold | Deletes all characters |
| DISPLAY OK Press and hold | Stores the entry and finishes |
| MENU ESC Press briefly | Finishes without storing |

**7. NUMBER OF DATA ENTRIES**

With this function the number of measured value data entries can be defined. Adjustable between 1 and 2500.

## 12. T450F software installation

Stored data can be processed with the PC. The programme is supplied with the equipment. The data processing is in tabular or diagram form. The measured values can be printed or exported. The measured data can be stored in the computer with the internal Format T450F (*.txt) for future processing. In addition the value can be viewed on the screen during measurement.

### 12.1 System requirements

PC 486,16MB RAM, min. 2 MB free hard disc space, Windows 95/98/NT.

### 12.2 Software installation

A CD for communication with the PC is supplied with the equipment. This is installed as follows:

1. Insert CD in PC drive.
2. Select ***RUN*** in Windows 95/98/NT start menu.
3. Enter D:`SETUP.EXE` in the command line
4. Press `ENTER`.
5. Installation then proceeds automatically.

# 13. T450F user software

### 13.1 Reading of stored data

1. Connect communication cable to computer.
2. Select ***File/Read*** .
3. The programme reads the stored data.

### 13.2 Organisation of data

The listing of the data is according to the locations entered (*see entry/location and entry/description)*. By selecting from this list, choose a data section which will then be displayed in the form of a table or diagram

### 13.3 Print

Reports of the measured pressure and flow rate data and/or time sequencing can be printed using this menu item.

### 13.4 Storing data

With ***File/Save As*** the data is stored on the hard disc or floppy disc.

### 13.5 Exporting data

With ***File/Export*** data can be exported as a text file.

### 13.6 Opening data

With ***File/Open*** data which has already been stored can be opened.

### 13.7 Unit selection

Pressure and flow rate units are selected using ***Option/Unit Selection***.

### 13.8 Actual values

If the computer is linked to a PC, the measured values can be tracked with the PC icons.

## 14. Description of the icons

| | | |
|---|---|---|
| From left: | Data open<br>Data read<br>Data store<br>Print<br>Actual values | |

## 15. Icons for diagrams

| | | |
|---|---|---|
| From left: | Original scale<br>Enlarge<br>Reduce<br>Change diagram title | |

## 16. Technical data

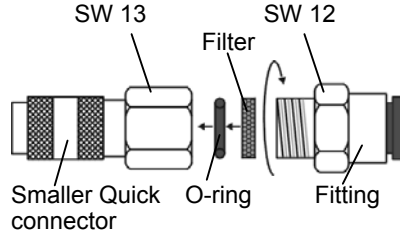
| | |
|---|---|
| **Pressure range** | 1 000 kPa |
| **Max. pressure above atmospheric** | 1 500 kPa |
| **Max. above atmospheric on one side** | 1 500 kPa |
| **Linearity fault and hysteresis** | 0.15 % of the nominal range |
| **Temperature dependence** | 0.25 % of the nominal range |
| **Influence of static pressure** | 0.06 % of the nominal range |
| **Temperature of the common medium** | -5...90 °C |
| **Ambient temperature** | -5...50 °C |
| **Storage temperature** | -10...70 °C |
| **Power supply** | 6F22; 9V battery |
| **Maximum electrical consumption** | 10 mA |
| **With PC connection** | 15 mA |
| **In sleep mode** | 0.8 mA |
| **Data-entry capacity** | 2500 entries |
| **Data-entry interval** | 1 second to 24 hours |
| **Valve-type storage capacity** | 170 valves |
| **Interface** | RS 232 |
| **Dimensions** | 77 x 192 x 25 mm |
| **Weight** | 350 g |
| **Electrical protection class** | IP40 |
| **Validity of calibration** | 12 months |

## 17. Maintenance of the computer

The computer should be calibrated and the filters be replaced every six months.

## 18. Replacement of the filters

1. Undo the fitting with an 12 mm wrench
   - Hold the quick connector from turning with a 13 mm wrench.
2. Remove filter and 5 x 1.5 O-ring.
3. Insert new O-ring and filter.
4. Screw fitting back into quick connector.
5. Do not use any thread-anchoring material, the connection is completely sealed by O-ring.

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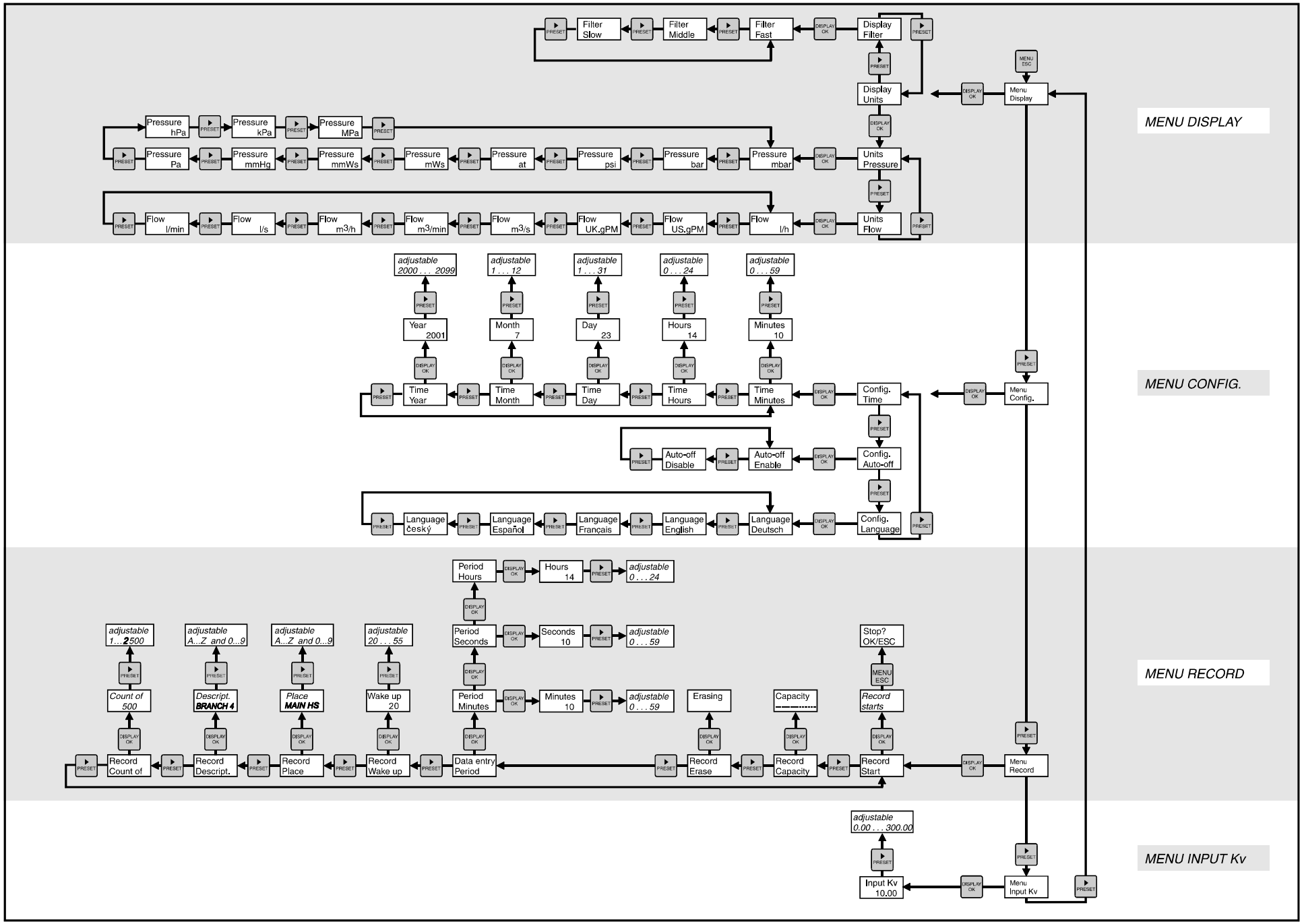
## Menu Schematic