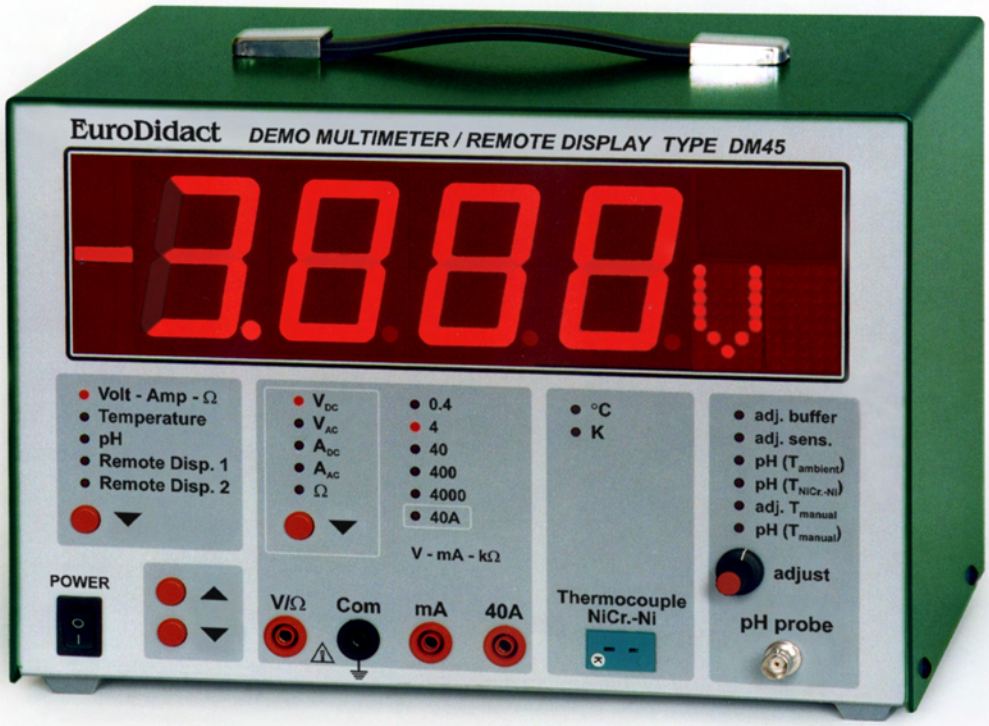
EuroDidact®

Demo Multimeter / Remote Display Type DM45



User's Manual

Version 2.22

English

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Overview

EuroDidact "Demo Multimeter / Remote Display" is a microprocessor based multi-instrument. Specially designed for the education in Physics, Chemistry and Biology.

The instrument has the following functions and measuring modes:

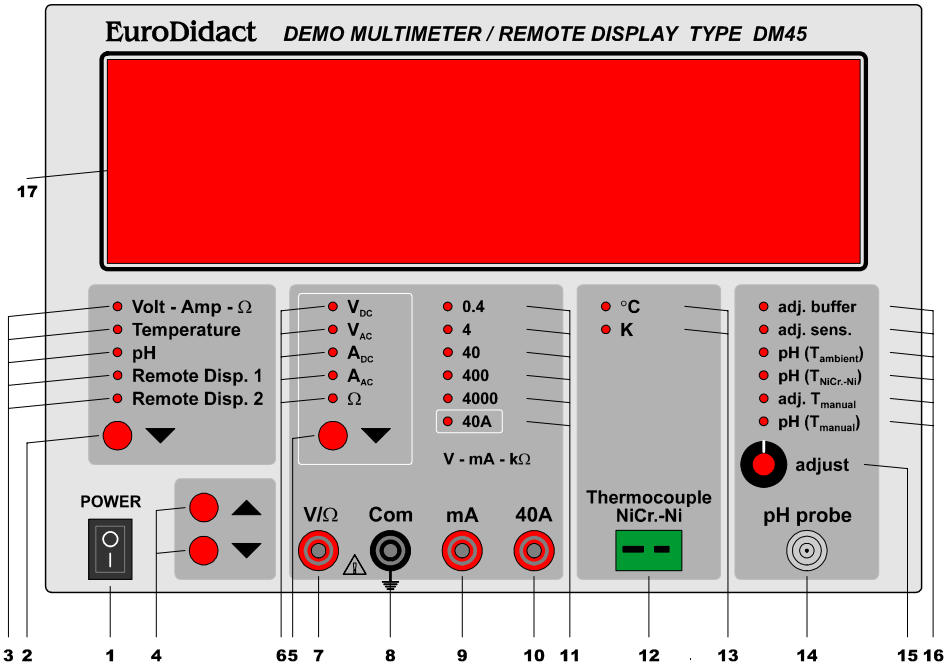
- Voltage measurement DC & AC
- Current measurement DC & AC
- Resistance measurement.
- Temperature measurement with standard NiCr.-Ni thermocouple (type K: –50°C to +1200°C).
- pH measurement with pH combination electrode.
- Remote Display. Configuration for two different instrument inputs at the same time.

The result of the measurements is displayed on a large 57 mm 4 digit LED display. The units of measurement are shown with two character LED matrix display.

A display at the rear panel is simultaneously displaying the result for the teachers convenience.

The DM45 can be used as a stand-alone instrument, or with a PC. The Windows program included with the instrument, is for remote control, installation, setup and adjustment of the multimeter.
Also included with the instrument and s/w, is a cable for RS232C PC-connection, and an x-adaptor plug (0-Modem) for connection with other instruments (i.e. an electronic balance) when working as a Remote Display.

OPERATION



FRONT PANEL

1. POWER : Mains switch
2. Function select : Push-button for function select
3. Function indicators : 5 LED‘s for indication of selected function
4. Shift ▲ & ▼ : Push-buttons for range select, temperature unit or pH compensation method, dependent of the selected function
5. V - A - Ω select : Push-button for selection of the multimeter function
6. V - A - Ω indicator : 5 LED for indication of selected multimeter function (Volt-Amp-Ω)
7. V / Ω : Input bushing for voltage or resistance measurements

   WARNING : Only connection of touch-safe high voltages are allowed !
8. Com : Common input bushing for V, A or Ω measurements

   WARNING : This bushing is connected to chassis !
   Only connection of touch-safe voltages are allowed !
9. mA : Input bushing for measurement of current. Max.4A
10. 40A : Input bushing for measurement of current in 40A range (no fuse - do not overload)
11. Measurement range : 6 LED‘s for indication of selected measurement range.
12. Thermocouple NiCr.-Ni : Compensation plug for connection of standard thermocouple type K (NiCr.-Ni).
13. °C / K : 2 LED‘s for indication of temperature unit
14. pH probe. : BNC-bushing for connection of pH-combination electrode
15. adjust : Knob for adjusting buffer, sensitivity (Nernst‘s equation) and manual temperature compensation
16. pH function : 6 LED‘s for indication of selected pH-function
17. Display : 4 digit LED display (57 mm) with sign and measurement units

REAR PANEL

- Power 230 V AC — 230 V AC mains
- Fuse 0.5AT — Mains fuse for instrument. (0.5 AT)
- Fuse 4AT — Fuse for ammeter ranges from 4mA to 4A (4AT)
- RS232 interface — RS232 interface to PC and Remote Display input (with supplied X-plug)
- Display — 4 digit LED display with sign. Same readout as front display

Instructions for use

DM45 consists in principle of 4 instruments:

- A standard multimeter with measuring ranges for voltage and current (both with ac / dc) and resistance in Ohm.
- Temperature meter with standard input for thermocouple NiCr.-Ni (type K) and a temperature range from –50C to +1200°C.
- pH-meter with standard BNC-input for combination pH electrode.
- Remote Display: DM45 can also function as a Remote Display for another EuroDidact instrument, or a balance and other measuring instruments with RS232 output. In addition to this, the user has the possibility to program a PC to write the display any characters/signs possible. Two different Remote Display configurations in the DM45 at the same time are available.

The instrument is powered by activating the switch marked **'POWER'.**

Immediately on power-on the instrument displays the version number (i.e. **'R 1.00'** for approx. 2 secs.).
The DM45 is now ready for use.

First select the function (instrument) with the push-button **'Function select (2)'**.
The selected function is indicated with a lit LED.

Multimeter

First push the **'Function select (2)'** to select the function **'Volt-Amp-Ω'**, and then with the **'V-A-Ω select (5)'** push-button select between $\mathbf{V_{DC}}$ $\mathbf{V_{AC}}$ $\mathbf{A_{DC}}$ $\mathbf{A_{AC}}$ and **Ω**.
Use push-button **'Shift ▲ & ▼ (4)'** to select the range.

Test leads are connected to the inputs:
At voltage and resistance measurements : **'Com'** and **'V/Ω'**
At current measurements < 4A : **Com** and **mA**.
At current measurements > 4A : **Com** and **40A**. *No fuse on this input!*.

WARNING : The 'Com' bushing is connected to chassis !
Only connection of touch-safe voltages are allowed !

Temperature meter

Push the **'Function select (2)'** to select the function **'Temperature'**.
Connect a Thermocouple NiCr.-Ni (type K) to the green standard input **'Thermocouple NiCr.-Ni** (12)**'**.
Use **'Shift ▲ & ▼ (4)'** to select the reading in Deg. Celsius (°C) or Kelvin (K).

pH-meter

Push the **'Function select (2)'** to select the function **'pH'**, and connect a pH probe to the **'pH probe (14)'** input.

pH probe calibration:

The following two parameters are used:

- **Zero point value:** The pH value of the probe giving an output of 0 mV (ideal value pH=7.00).
- **Relative sensitivity:** The sensitivity of the pH probe relative to the **Ne**rnst Equation.

Calibration procedure:

The instrument supports two methods of calibrating of the pH probe. The 1-buffer method is the simple and easiest to do, and sufficient for measurements in solutions in the range pH 6 to pH 8.

1-buffer adjusting:

- The **'adj. buffer (16)'**-LED is lit, and the pH probe is placed in a pH 7.00 buffer solution. When the reading on the display has settled, adjust with the knob **'adjust (15)'** the display reading to 7.00.
- Push the **' ▼ (4)'** to save the adjustment in the instrument, and the **'adj. sens (16)'**-LED is now flashing and display is '----Ne'. Now rinse the pH probe and push the **' ▼ (4)'** to abort the sensitivity adjusting (and using the last memorized sensitivity).

The 2-buffer method is for accurate measurements in the full pH measurement range.

2-buffer adjusting:

- The **'adj. buffer (16)'**-LED is lit, and the pH probe is placed in a pH 7.00 buffer solution. When the reading on the display has settled, adjust with the knob **'adjust (15)'** the display reading to 7.00.
- Push the **' ▼ (4)'** to save the adjustment in the instrument, and the **'adj. sens (16)'**-LED is now flashing and display is '----Ne'. Now rinse the pH probe and place in a pH 4.00 buffer solution.
- Push *simultaneously* the **' ▼ (4)'** and the **' ▲ (4)'**. When the reading on the display has settled, adjust with the knob **'adjust (15)'** the display reading to 4.00.
- Push the **' ▼ (4)'** to memorize the calculated sensitivity in the instrument, and the **'adj. sens (16)'**-LED is now lit. Now rinse the pH probe.

Please observe that each time the pH meter function on the DM45 is selected, at least a 1-buffer adjusting must be performed. The 'Relative sensitivity' of the electrode is memorized, but the 'Zero point value' is *not*. It is not possible to 'Shift ▲ (4)' back to calibration, without leaving the pH meter function.

Tip: The 'Zero point value' is displayed if you short-circuit the BNC-input, after a calibration has been performed.

pH measurement

The instrument is now ready for measuring, with one of the three temperature compensation methods available:

- Ambient temperature: Select **'pH ($T_{ambient}$)'** using **'Shift ▲ & ▼ (4)'**.
  The internal temperature sensor of the instrument is used for compensation.
- NiCr.-Ni thermocouple: Select **'pH ($T_{NiCr.-Ni}$)'** using **'Shift ▲ & ▼ (4)'**.
  Use the connected thermocouple to measure the temperature of the pH solution.
- Manual temperature: First select **'adj. T_{manual}'** using **'Shift ▲ & ▼ (4)'**.
  Use the knob **'adjust (15)'** to set the temperature (0 to 50 °C), and push **'▼ (4)'** to start measure with the function **'pH (T_{manual})'.**

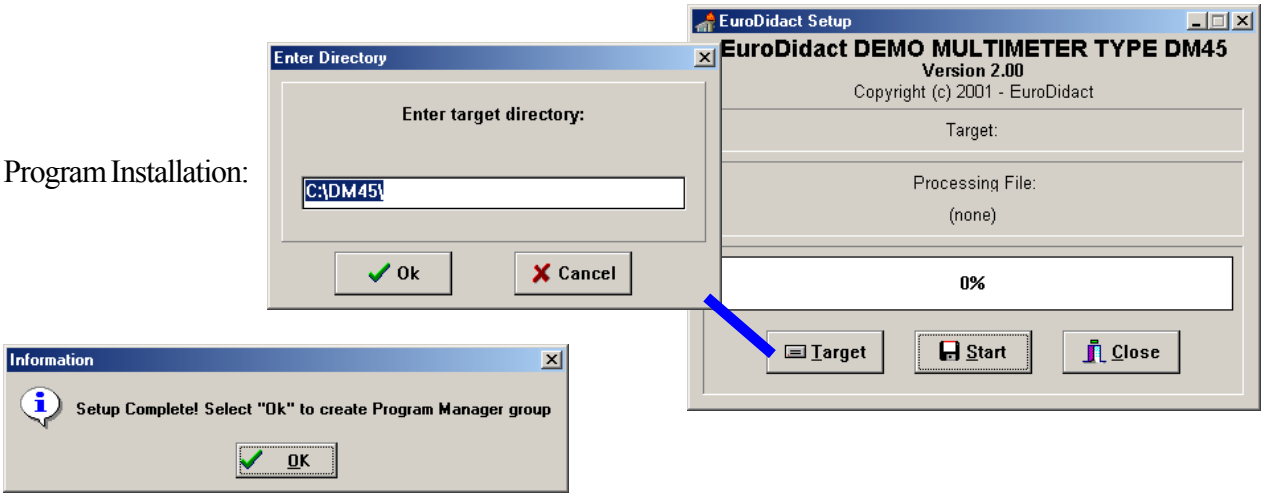
PC program DM45

Installation

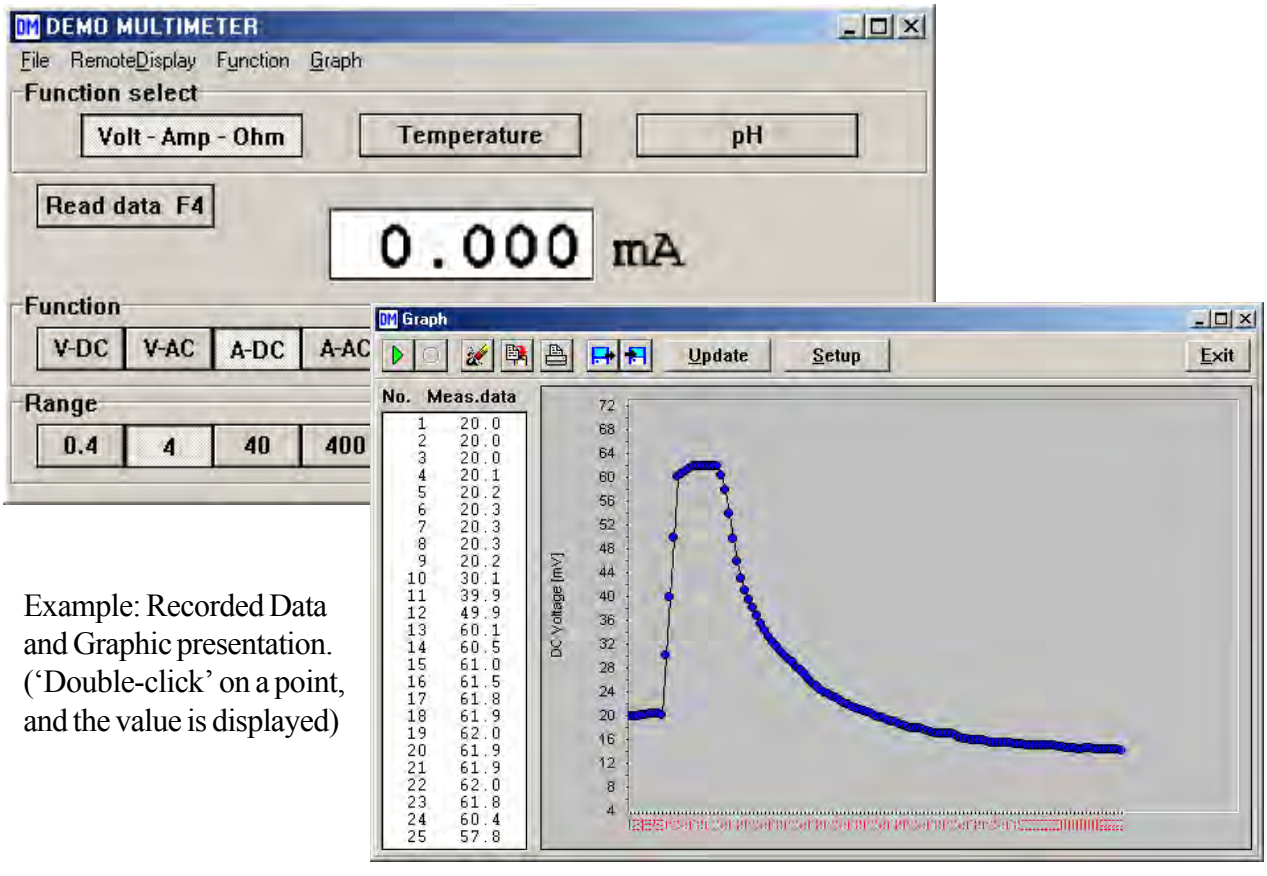
Insert the CDROM in drive. From Windows, run the program <D:EuroDidact/DM45 PC-software/ SETUP.EXE>. Click the „Target"-button to select where you want to install the program (e.g.: C:\DM45\).

Start the installation with the „Start"-button. The program is then installed on your hard disk and the Group „EuroDidact" is added.

Program Installation:



Start the program „DM45" in the group „EuroDidact", and select the ComPort from the File pull down menu, used to connect to the Demo Multimeter. When the Demo Multimeter DM45 has been correct connected **with the supplied cable**, the program automatically displays the current function set on the Multimeter. See the example below.

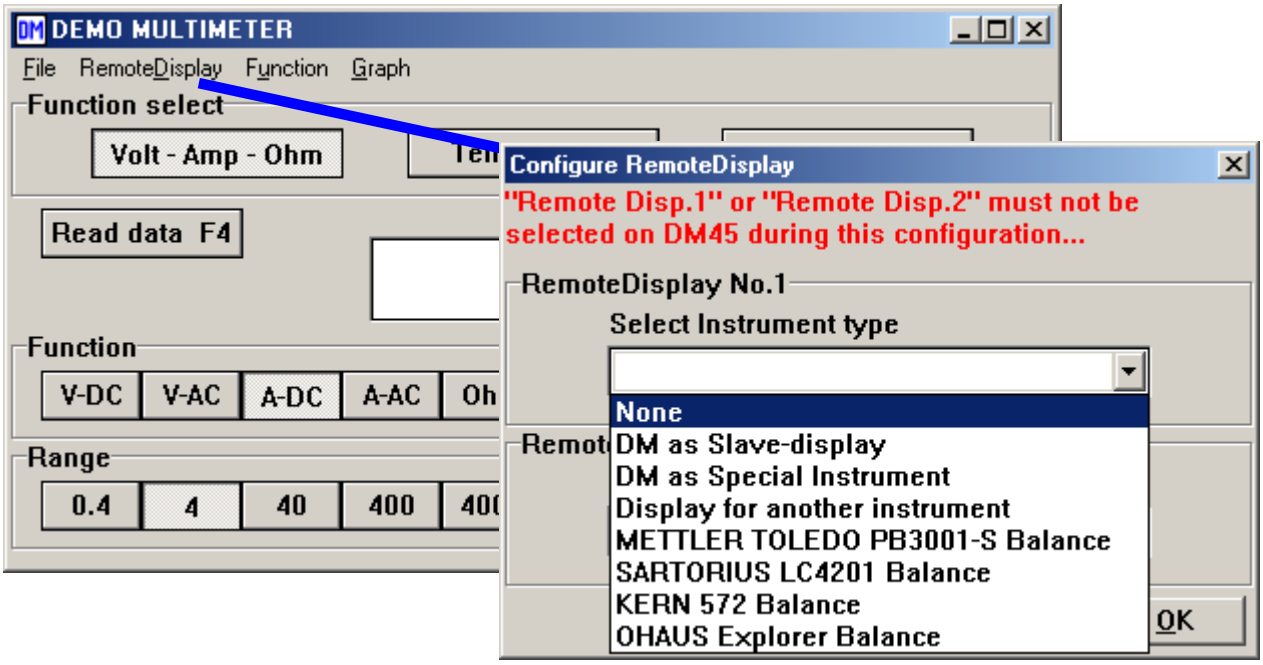


Example: Recorded Data and Graphic presentation. ('Double-click' on a point, and the value is displayed)

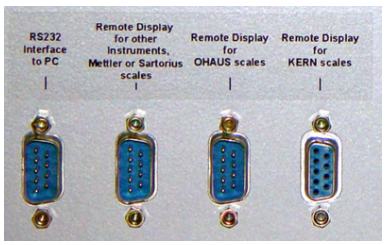
Remote Display

Using the software (DM45.exe) delivered with the instrument, it is possible to configurate the DM45 as a Remote Display for different types of instruments. Two configurations can be set at a time.

- None: The functions Remote Disp.1 and/or 2 can not be selected.
- DM45 as slave-display: It is possible to **write** to the display, using two special commands.
- DM45 as special instrument: The DM45 functions as a Multimeter but readings are not displayed. The readings are transferred to the PC for calculations and this result is then displayed on the DM45. (As an example: Connect a pressure transducer to the Multimeter for measuring the mV from this transducer. The measurements are calculated in the PC and read-out on the DM45‘s display as ´1026mB‘).
- EuroDidact instruments: Functions as Remote Display for Pressure meter, Rate meter, pH meter and Energy meter. The DM45 finds out on its own which EuroDidact instrument is connected.
- METTLER TOLEDO PB3001-S Balance: Connect to METTLER PB3001-S balance.
- SARTORIUS LM4201 Balance: Connect to Sartorius LC4201 balance.
- KERN 572 Balance: Connect to KERN 572 balance.
- OHAUS Explorer Balance: Connect to OHAUS Explorer balance.



Note: The DemoMultimeter with 4 DB-9 plugs at the backside connects directly to the balance/ instrument, using the cable delivered with the DemoMultimeter.



Configuration of RemoteDisplay

Start the DM45 programme (DM45.exe), and select the **Instrument type** from the pull-down menu. You may now close down the PC-program, and disconnect the RS232 cable from the PC, and setup the Intrument type according to the instructions on the following pages:

Configuration of the METTLER TOLEDO PB3001-s balance

Mettler PB3001S must be setup as follows, when used with the DM45:

Connected unit	:	Host
Transmit function	:	S. Cont.
Transmit format	:	S. PM
Baud rate	:	9600
Bits/Parity	:	8b-no
Handshake	:	HS oFF

Now connect the cable supplied with the DM45 Multimeter, between the DM45 /DB-9 plug "... Mettler ..." and the Mettler balance.

Configuration of the Sartorius LC4201 balance

Sartorius LC4201 must be setup as follows, when used with the DM45:

			Code:	
Baud rate	:	9600	5 1 7	
Parity	:	Space	5 2 2	
Number stop bits	:	1 stop bit	5 3 1	
Handshake	:	Software	5 4 1	
Data output	:	Auto print	6 1 4	(or: 6 1 5)

Now connect the cable supplied with the DM45 Multimeter, between the DM45 /DB-9 plug "... Sartorius ..." and the Sartorius balance.

Configuration of the KERN 572 balance

When connected to DM45 it is possible to use the **PRINT-Key**, **AUTOPRINT** or **AUTOPRINT_PC,** but not the **Enunerator-function.**

Kern 572 must be setup as follows, when used with the DM45:

Display:	*Press key:*
	MODE + MODE
PRINTER	YES + MODE + MODE + MODE
9600 Bd?	YES + MODE
NUMERATOR	NO + MODE
AUTOPRINT	NO
AUTOPRINT PC?	YES + MODE

Now connect the cable supplied with the DM45 Multimeter, between the DM45 /DB-9 plug "Kern" and the Kern balance.

Select on the DM45 front panel the RemoteDisplay 1 (or 2) and the weight is displayed with the unit selected on the Kern balance (g, kg, oz, dw, lb ....) *when the reading is stable*.

Configuration of the OHAUS Explorer balance

The OHAUS Explorer must be set up as follows, when used with the DM45 Multimeter/ RemoteDisplay:

Procedure for connection of the OHAUS Explorer balance to the DM45:

1. Connect the EuroDidact RS232 cable between the balance and DM45 /DB-9 plug "Ohaus".
2. Turn on the DM45
3. Select the OHAUS balance (Remote Display 1 or 2).
   Note: If ***´OHAUs´*** is not displayed on the DM45, use the PC-program to setup the DM45 as described on page 8 in this manual.
4. Turn on the OHAUS balance
5. Setup the OHAUS balance this way:

Display:	*Press key:*
WEIGH	**Setup**
CAL	> (seven times)
RS232	**Enter** + **Enter**
BAUD	**Enter** + **(arrow up/down) until** 9600 + **Enter**
PARITY NONE	**Enter** + **(arrow up/down) until** NONE + **Enter**
DATA 8	**Enter** + **(arrow up/down) until** 8 + **Enter**
STOP 1	**Enter** + **(arrow up/down) until** 1 + **Enter**
LOCK OFF	**Enter** + **(arrow up/down) until** OFF + **Enter**
EXIT	**Enter**

Display:	*Press key:*
WEIGH	**Setup**
CAL	> (six times) until PRINT + **Enter**
AUTOPRNT	**Enter** + **(arrow up/down) until** INTER + **Enter**
INTER	**Enter** + **(arrow up/down) until** 1 + **Enter**
STABLE	**Enter** + **(arrow up/down) until** INTER + **Enter**
NUMERIC	**Enter** + **(arrow up/down) until** OFF + **Enter**
PRTDATE	**Enter** + **(arrow up/down) until** OFF + **Enter**
PRTTIME	**Enter** + **(arrow up/down) until** OFF + **Enter**
REFEREN	**Enter** + **(arrow up/down) until** OFF + **Enter**
LOCK	**Enter** + **(arrow up/down) until** OFF + **Enter**
EXIT	**Enter**

That concludes the procedure.
The weight is now displayed on the DM45 with the unit selected on the OHAUS balance (g, kg, oz, dw, lb ....) *when the reading is stable*.

DM45 as special instrument

Setup:

In the menu point '**RemoteDisplay**' the '**DM45 as special instrument**' is selected. Then the dialogue box '**Setup of special instrument**' appears, from this select the DM45's function and measure range.

Function:

When '**Remote Disp. 1/2**' is selected, the DM45 shows the function and measure range on the LED's. DM45 then measures as when in normal Multimeter function. The connected PC must then ask the DM45 for the measurement result, convert this and send a package with the result back to the DM45 for displaying.
Data packs for the DM45 uses the same protocol and format as '**DM45 as slave display**'.

Protocol for DM45 as slave display

Description of the protocol for communication between a PC and the EuroDidact Demo Multimeter DM45, when this is used as a slave display or special instrument.

Interface: RS232
Baudrate: 9600
Data bits: 8
Stop bits: 1
Parity: NONE

The following 2 formats for packages can be used:

Package with full control over each segment in the display:
(COM = 220)
Package format:

STX	LEN	COM	D0	D1	D2	D3	D4	D5	D6	CHKS	ETX
#02 (Start)	12	220	Sign: 0: None 1: Sign	7-segment Digit-3	7-segment Digit-2	7-segment Digit-1	7-segment Digit-0	Dot-Matrix-1	Dot-Matrix-2	Check sum	#03 (Stop)

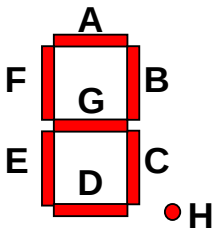
Package to send a decimal number to the display:
(COM = 221)
Package format:

STX	LEN	COM	D0	D1	D2	D3	D4	D5	D6	CHKS	ETX
#02 (Start)	12	221	One **float** in C Or one **single** in Pascal / Delphi				Number decimals 0 : Auto 1 : 1 dec. 2 : 2 dec. 3 : 3 dec.	Dot-Matrix-1	Dot-Matrix-2	Check sum	#03 (Stop)

Writing to 7-segment

(At COM = 220)

Each of the 8 bits in D1 - D4, represents one segment in the display. This method gives full control over all 4 x 8 segments.



Display shows	H b7	G b6	F b5	E b4	D b3	C b2	B b1	A b0	Hex	Dec
0	0	0	1	1	1	1	1	1	3F	63
1	0	0	0	0	0	1	1	0	06	6
1.	1	0	0	0	0	1	1	0	86	134
2	0	1	0	1	1	0	1	1	5B	91
A	0	1	1	1	0	1	1	1	77	119
Etc.										

Example: If a display of '**11.2A**' is wanted. Send **D1 = 6**, **D2 = 134**, **D3 = 91** & **D4 = 119**.

Writing to DotMatrix

(At both COM = 220 & 221).

Write to the two DotMatrix displays using the following code:

Blank : 0
A to Å : 1 to 29
a to å : 31 to 59
Ω : 61
° : 62
⊇ : 63
µ : 64
▣ : 65
% : 66

Technical Information

Mains: 230 V AC ± 10% 50 Hz 45 VA

WARNING : Com bushing is connected to chassis !
Only connection of touch-safe voltages are allowed !

Display:

Front	:	57 mm large 4 digit LED display. Meas.units displayed with 2 characters.
Rear	:	21 mm large 4 digit LED display.

Voltage DC:

Range	:	400mV 4V 40V 400V 4000V
Precision	:	± (1% + 1 on least significant digit)

Voltage AC:

Range	:	4V 40V 400V 4000V
Precision	:	± (1% + 1 on least significant digit)

Current DC / AC:

Range	:	4mA 40mA 400mA 4A 40A	(Duration max. 2 minutes)
		20A	(Continuously)
Precision	:	± (1% + 2 on least significant digit)	

Resistance:

Range	:	400 ohm	4 kohm 40 kohm	400 kohm	4 Mohm
Precision	:	± (1% + 1 on least significant digit)			

Temperature meter:

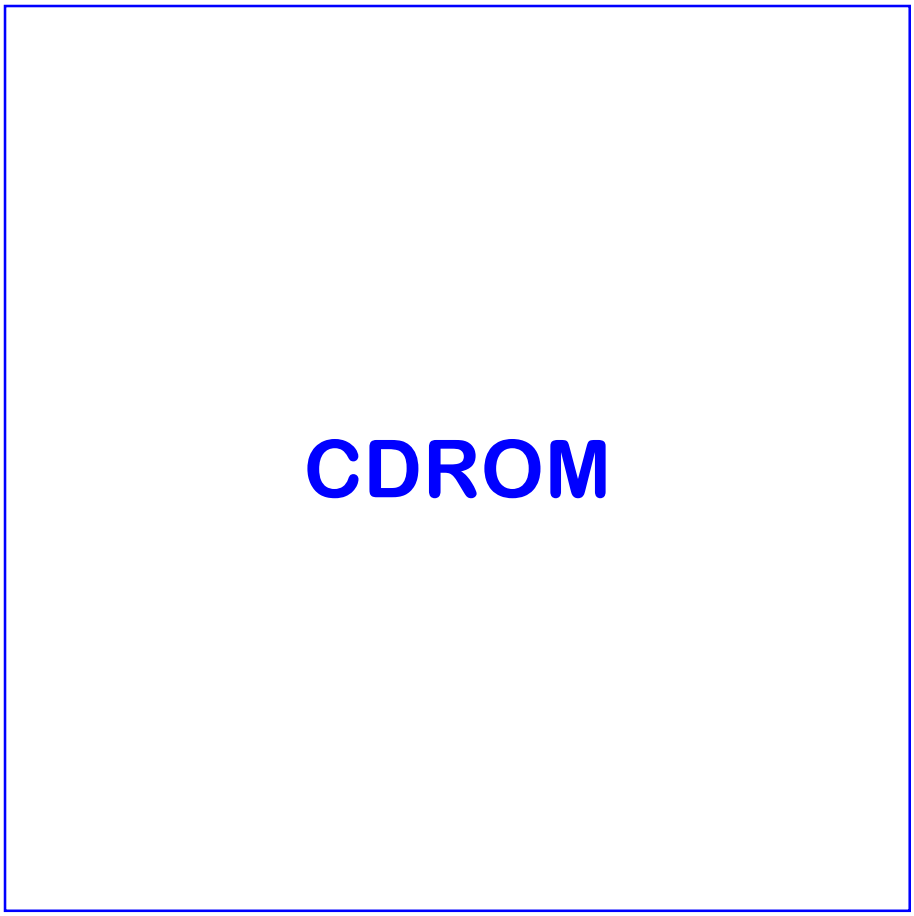
Input	:	Standard thermocouple NiCr.-Ni (type K)
Meas.unit	:	Degrees Celsius (°C) or Kelvin (K).
Range	:	-40°C to +1200°C
Resolution	:	< 1000°C : 0.1 °C. >1000°C : 1°C
Precision	:	± (1% + 1 on least significant digit)

pH meter:

Input	:	pH combination electrode.	
Range	:	0 to 14pH	
Adjustments	:	Zero point value	(Buffer adjust)
		Sensitivity	(electrode relative sensitivity to Nernst Equation).
Temperature compensation	:	Three methods	1 : Automatic via the built-in sensor.
			2 : Automatic via NiCr.-Ni thermocouple.
			3 : Manual adjustable from 0 to 50°C
Resolution	:	0.01 pH.	
Precision	:	± (1% + 1 on least significant digit)	

RS232 Interface:

The interface is galvanically separated from the measurement circuits of the DM45.


CDROM