



Operating Instructions

Millimar X 1741 and X 1715

Mahr



Safety instructions

This unit complies with the relevant safety provisions. However, the following instructions must be strictly observed to ensure the safety of operating personnel and third parties!

1. **Before** connecting the unit to the power supply, check that the supply voltage given on the type plate corresponds to the local mains voltage. If it does not, do not connect the unit under any circumstances.
2. This unit is equipped with a safety-approved power cable and may only be connected to shockproof power sockets which are **grounded in accordance with requirements**. Any extension cables must comply with VDE regulations or equivalent.
3. Any modification to or intervention in the unit requires the express written approval of Mahr GmbH and may only be performed by trained personnel. Before opening the unit, disconnect the plug from the power outlet and ensure it is not connected to a power supply.
4. Any unauthorized opening of the unit or unauthorized intervention invalidates the warranty and frees Mahr GmbH from all liability.
5. Disconnect the unit from the mains before cleaning it. Do not allow liquids to get inside the unit! Never use cleaning agents which are harmful to plastics.
6. **Before** putting the unit into service, read the operating instructions carefully and pay particular attention to the notes they contain.
7. Only use the unit **for the purpose intended**.
8. If a unit fuse needs to be replaced, it is important to use a fuse of the same type, with the **same** rating and characteristics as specified in the operating instructions.

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The following symbols are used in these operating instructions:



General instruction.



Important note. Failure to do this can lead to faulty results or damage to the unit!

1 Introduction



These operating instructions describe the instrument and its functions as well as its operation via the Windows based D1000X software.

The Millimar X 1741 and the Millimar X 1715 are intelligent measuring data acquisition instruments and "the" links between a PC and all types of probes and gages commonly used in industrial metrology.

The Millimar X 1741 consists of a basic unit and up to four plug-in modules while the Millimar X 1715 consists of a basic unit and up to two plug in modules.

The plug-in modules contain either

- four inductive probe inputs (Mahr, Mahr/Federal, Tesa or Marposs),
- four analog voltage inputs (+/- 5 V, +/- 10 V or 4 - 20 mA),
- two incremental probe inputs (Heidenhain, 1 V_{pp}) or
- one Mahr or Mahr/Federal air/electronic converter.



When using several plug-in modules for inductive probes, these must be of the same type while modules of other types can be combined with one another at will.

Both units offer:

- automatic static or dynamic measurements
- internal measuring value combination and tolerance monitoring
- internal storing of the last 5000 measuring values and statistics functions
- comfortable Windows-based program for:
 - entering measuring task parameters
 - external control
 - measuring result presentation
- external operation also via the following protocols: ASCII, Millitron 1240, Sylvacs/d (OPTO-RS), MarTalk
- statistics functions in the M1240 protocol
- customer calibration

In addition the Millimar X1741 offers:

- connection of auxiliary units to the parallel interface (6 opto-coupled inputs and 12 outputs) or two analog outputs

In addition the Millimar X1715 offers:

- connection of auxiliary units to the parallel interface (3 opto-coupled inputs and 6 outputs) or an analog output

2 Control and functional elements

2.1 Rear view



The rear view of the Millimar X 1741 and the X 1715 may differ depending on the number and type of plug-in modules used.



When a plug-in module is replaced, the replacement module must be calibrated anew.

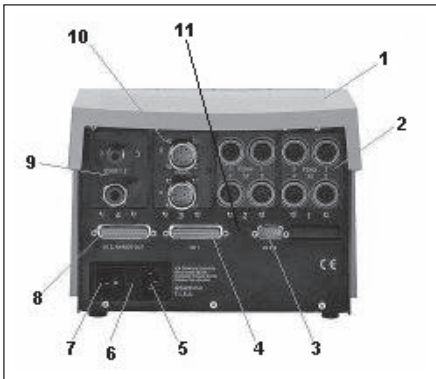


Figure 1
Rear of the Millimar X 1741 (example)

- 1 Basic unit
- 2 Inductive module
- 3 Serial RS232 interface
- 4 Interface 1 for auxiliary units (25-pin D-Sub)
- 5 Mains supply
- 6 Fuse, 230V; 1,5 A; time-lag
- 7 Mains switch
- 8 Interface 2 for auxiliary units (25-pin D-Sub)
- 9 A/E converter module
- 10 Incremental module
- 11 Status lights

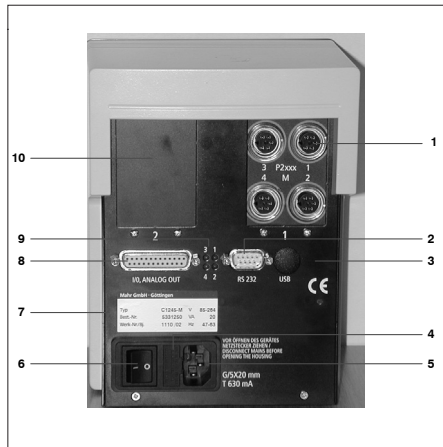
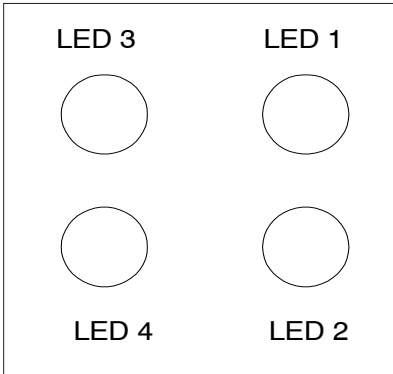


Figure 2
Rear of the Millimar X 1741 (example)

- 1 Inductive module
- 2 Serial RS232 interface (9-pin D-Sub)
- 3 USB interface (optional; not yet available)
- 4 Fuse
- 5 Mains supply
- 6 Mains switch
- 7 Type plate
- 8 Interface for auxiliary units (25-pin D-Sub)
- 9 Status lights
- 10 Cover

Arrangement of the status lights



Function of the status lights

LED 1: No function

LED 2: Flashes when the Millimar is ready to communicate with the PC

LED 3: Lights up on receiving a command via RS232

LED 4: Lights up when the mains switch is set to ON

2.2.1 Jack for inductive probes

The plug-in module for inductive probes contains four input channels for inductive probes.

i The probe jacks are identified by a colored ring to highlight their different compatibilities. The jacks are labelled for original Mahr probes from the P20xx series.

Probe	Ring color	Desig.
Mahr	red	M1 to M4
Mahr/Federal	white	F1 to F4
Tesa	gray	T1 to T4
Marposs	blue	U1 to U4

Other probes can naturally also be connected. These include, though this list is not necessarily complete:

	Mahr	Federal	Tesa	Marposs
Trägerfrequenz [kHz]	19,4	5	13	7,5
Amplitude [V]	5	2	3	3,5
Empfindlichkeit [mV/V/mm]	192	78,74	73,75	115
Kompatibel zu	1300 1301/1303		GT21 GT22	AH 100 AH250
			Hirt 101	
	P2001		Solartron:	
	P2004		AX2.5/SH	
	P2010*		AX1.5/SH	
	1318			
	1310*			

Other sensitivities are possible depending on a suitable choice of CHANNEL/CHA FACT in accordance with the manufacturer's instructions.

i If several plug-in modules for inductive probes are used, use only modules for the same type of probe. Do not connect probes with varying compatibility to the same module.

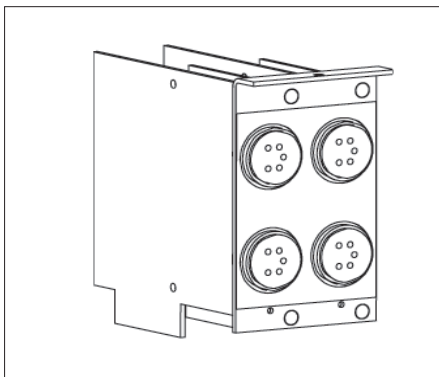


Figure 3
Input module for "Inductive probes"

* CFACTOR = 10

2.2.2 Jacks for incremental probes

The plug-in module for incremental probes contains two input channels for Millimar 1508, 1514 or 1526 incremental probes.

Signal voltage: 1 V_{pp} sinusoidal
 Increment: 4 μm
 (adjustable 1 to 100)
 Interpolation: 50x
 Measuring range: ± 999.999 mm
 Supply voltage: 5V

2.2.3 Jacks for air gages

The plug-in module for air gages contains an input channel for pneumatic recorders and a compressed air connection for the air supply (precision pressure reducing device required).



The supply pressure should be set with a suitable precision pressure reducing device to 2 bar (Mahr) or 2.1 bar (Federal) (± 5%). Only compressed air which is free from oil or contamination should be used.

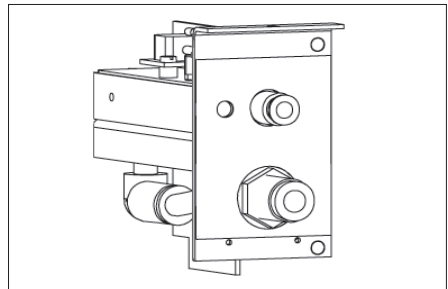


Figure 4
Input module for "Air gages"

Depending on the converter version, ratios of 2500:1, 5000:1 or 10000:1 (as per labelling) can be used.

Ratio	MR* Mahr	MR* Federal
2500:1	± 50 μm	± 38 μm
5000:1	± 25 μm	± 19 μm
10000:1	± 12.5 μm	± 7.6 μm

* MR = measuring range

2.2.4 Jacks for measuring devices with analog output

The plug-in module for measuring devices with analog output contains four input channels for DC voltage signals.

Input range: $\pm 5\text{ V}, \pm 10\text{ V},$
 $4\text{ to }20\text{ mA}$

Probe power supply: $+ 5\text{ V}, 200\text{ mA}$

Pin assignment:

- 1 Probe power supply $+ 5\text{ V}$
- 2 Current input I +
 $I_{\text{max}} = 80\text{ mA},$ reverse-bias protected
- 3 Voltage input $\pm 10\text{ V}, 8\text{ M}\Omega$
- 4 Ground GND
- 5 Voltage input $\pm 5\text{ V}, 4\text{ M}\Omega$
- 6 Current input I -
 $I_{\text{max}} = 80\text{ mA},$ reverse-bias protected

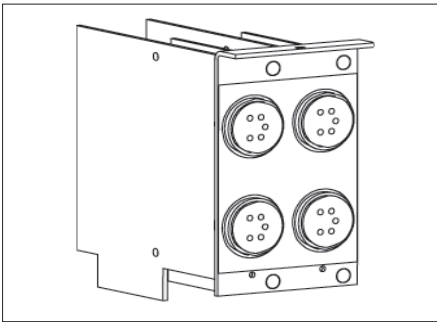





Figure 5
Input module for "DC voltage signals"



3 Putting into operation

When commissioning the Millimar X 1741 proceed as follows:

1. Connect the Millimar X 1741 to the local supply network using the mains cable (voltage range 90 to 264 V).
2. As the case may be, connect auxiliary units to the 25-pin socket.
3. Connect the probes and gages to the input channels of the respective plug-in module.
 When connecting inductive and incremental probes as well as measuring instruments with analog output, make sure that the connectors are tightly screwed onto the jacks.
 When air gages are used, make sure that the compressed air is connected properly.
4. Switch the unit on. Status light 4 lights up.
After performing a self-test, the unit is ready for operation. Status light 2 flashes.
5. Install the Windows-based D1000X software on a PC.
6. Use the null modem cable to connect the Millimar X 1741 to this PC.
7. Start the Windows-based D1000X software.
8. As the case may be, set up the probe using the PROBE SET UP function in the "Extra" menu.
9. As the case may be generate an application program and transfer it to the Millimar X 1741.
10. As the case may be perform a customer calibration.
11. Close the application program.
12. As the case may be connect the required application hardware instead of the PC.
 After successful commissioning, putting into operation usually just comprises steps 4 and 12!

4 Menu "Extra"

4.1 Meas. Unit

Selects one of the measuring units
 μm / mm / inch

4.2 Set up

Menu item "Extra/ Set up" sets up the probe. The raw values of the connected probes or measuring instruments are displayed.

This function is only required for ensuring that the probes or gages are clamped correctly into the measuring device or for checking that they are functioning correctly.

"Probe" field

Selecting one of the available probe inputs either via mouse click or the arrow buttons pointing to the left and right.

"Measuring range" field

The indication range can only be modified by way of the provided command buttons via mouse click. The measuring range is arranged symmetrically around the zero point. You may choose among the below settings:

- **mm:** ± 0.01 / ± 0.03 / ± 0.1 / ± 0.3 / ± 1 / ± 3 / ± 10 mm
- **μm :** ± 10 / ± 30 / ± 100 / ± 300 / ± 1000 / ± 3000 / ± 10000 μm
- **inch:** ± 0.0003 / ± 0.001 / ± 0.003 / ± 0.01 / ± 0.03 / ± 0.1 / ± 0.3 inch

The sample rate can be changed either on tab "Measured values" or in the dialog box opened with "Extra/Set up".

- For this, click the dialog box/tab with the right-hand mouse button.
- In the appearing "Measurement data parameters" dialog box, sample rates between 1 and 300 measured values/s can be entered.

4.3 Master measurement

Performs a master measurement.

During a master measurement, the current probe combination results are established. When accepting these values, the difference to the entered master actual value is saved. For any measurement taken thereafter, this deviation is compensated for in the computed measuring result.

The master measurement is performed as selected with parameter MASTER MEASUREMENT/OPERATING MODE.



For characteristics including one of the functions MAX-MIN, MAXSORT or MINSORT no master measurement is performed.

4.4 Calibration

Menu item "Extra / Calibration" can be used to calibrate a connected probe or air/electronic converter.

To do this:

- Select the channel in question.
- Click **START**.
- As the case may be, enter the values for zero point, minimum and maximum value into the "Input values" box.



The values used in the "Input values" box must agree with the data of the auxiliary tools actually used for calibration. Auxiliary tools may be electrical masters or calibrated probes in combination with gage blocks.

- Insert the gage blocks for assessing the zero point (= offset or center value), the minimum and the maximum values one after the other into the measuring unit and click "Next".
- As the case may be, calibrate the other channels as described above.

4.5 Test digital I/O

Displays the status of the digital inputs. The outputs can be activated either individually or together.

4.6 Millimar RS232 Parameters

Adjusts the transmission parameters of the RS232 interface.

5 Setting mode

The parameters of the Millimar X 1741 are entered on the tabs "Display/Channel/Feature ...".

5.1 "Display" tab

For up to 10 features the indication range, the bar graph type and the resolution of the digital display can be selected for tab "Measured values".

In the top right list box, the bar graph number can be selected from left to right.

Group box "Analog display"

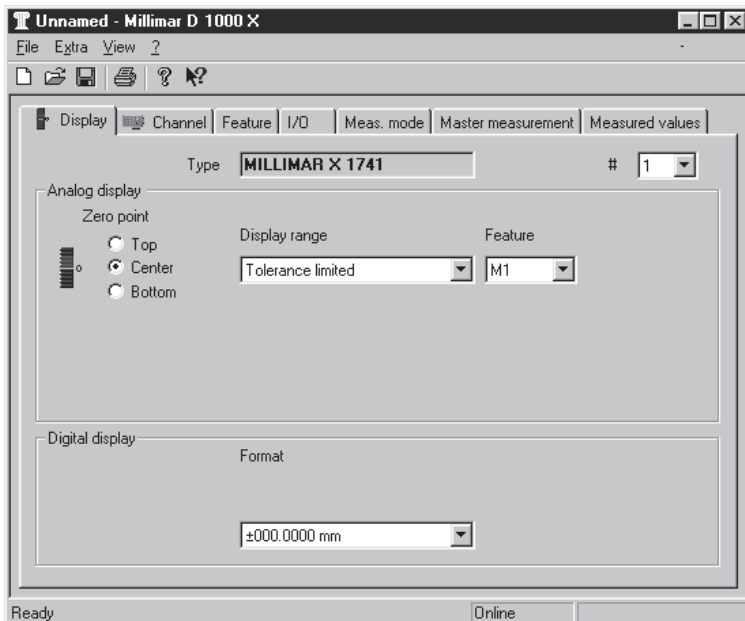
For selecting the display mode of the bar graph:

Option button "Zero point"

Selects the zero point position.

Clicking one of the option buttons selects the zero point position of the indication range and outputs the selected option as an icon next to the option buttons:

- Top
- Center
- Bottom



"Display range" list box

Selects the scaling of the display range on the "Measured value" tab. The list box offers several display range options in dependency on the system of units selected in menu "Extra/Meas. unit". Menu item "Tolerance limited" implies that the tolerance limits are set to $\pm 80\%$ of the total display range.

With measuring unit "mm":

Tolerance limited / ± 0.01 / ± 0.03
/ ± 0.1 / ± 0.3 / ± 1 / ± 3 / ± 10 mm

With measuring unit μm :

Tolerance limited / ± 10 / ± 30 /
 ± 100 / ± 300 / ± 1000 / ± 3000 /
 ± 10000 μm

With measuring unit inch:

Tolerance limited / ± 0.0003 /
 ± 0.001 / ± 0.003 / ± 0.01 / ± 0.03 /
 ± 0.1 / ± 0.3 inch

"Feature" list box

Selects the feature.

Selects one of the features (M1 to M16) to be indicated in the display range. In case "None" is selected, the bar graph is deactivated for this display range.

Group box "Digital display"

For determining the display format of the digital display on the "Measured value" box.

"Format" list box

Selects the format for displaying values.

The list box offers several display range options in dependency on the system of units selected in menu "Extra/Meas. unit":

With measuring unit mm:

- ± 000.00 mm
- ± 000.000 mm
- ± 000.0000 mm

With measuring unit μm :

- $\pm 00000.$ μm
- ± 00000.0 μm

With measuring unit inch:

- ± 0.0000 inch
- ± 0.00000 inch
- ± 0.000000 inch

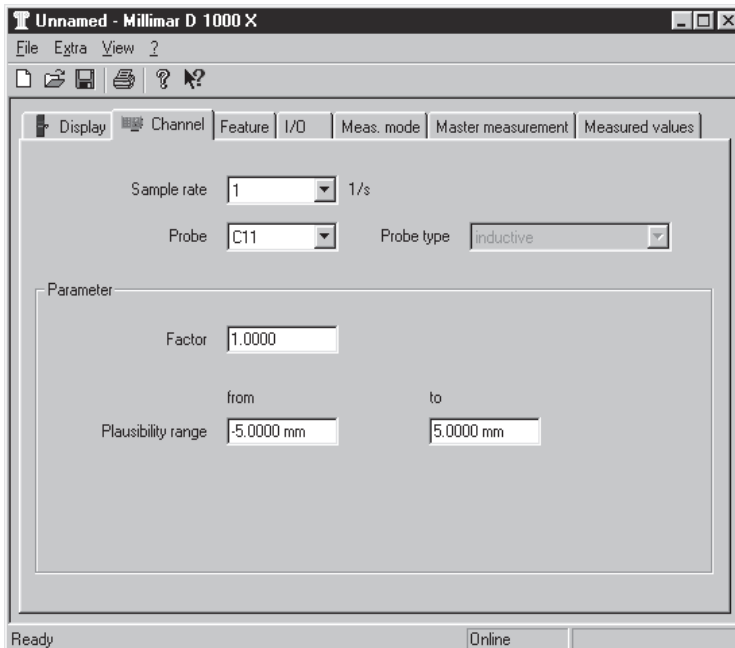
5.2 "Channel" tab

The signals at the inputs (inductive and incremental probes; analog voltages and A/E converter signals) will be digitally processed. On this tab, the channel to be used and the parameters for digitally processing the measured values are established.

"Sample rate" list box

Selects the sample rate. The smaller the selected value, the more filtered will be the signal and the more suppressed will be quick changes in measured values or disturbances. Changing this settings impacts all channels alike.

With complex linking formulae, the set sample rate may be reduced automatically in case the complex formula prevents faster measured value processing.



"Probe" list box

Selects the channel.

The channel number of the input is formed by the number assigned to the corresponding plug-in module socket (in the below example presented by an x) and the number of the input on the module. With plug-in module socket 2 and input 3 the resulting channel number will be 23.



With air/electric and incremental modules, however, the input numbers are limited to one or two pre-set values, respectively.

Example:

- Inductive = input numbers 1 to 4 (e.g. Cx1, Cx2, Cx3, Cx4)*
- Analog = input numbers 1 to 4 (e.g. Cx1, Cx2, Cx3, Cx4)*
- Incremental = input numbers 3 and 4 only (e.g. Cx3, Cx4)*
- Air/Electric= input number 3 only (e.g. Cx3)*

"Type" display box

Displays the probe/gage type selected.

Group box "Parameter"

Determining the parameters for signal processing:

Input box "Factor"

Entering the correction factor.

The entered values takes in to consideration the relation between changes in work piece geometry and the corresponding changes in probe deflection. The pre-set value is 1.0000.



When entering decimal figures use the decimal point as separation character.

Input boxes "Plausibility range" *from* and *to*

Entering the negative and positive limit value of the plausibility range. The plausibility range is a range measured values which have not been corrected by the correction factor. If any value is outside the plausibility range, a corresponding error message is output.

Enter the negative limit value into input box "from" and the positive limit value into the "to" box.

Input box "Period"

Entering the increment (separation of scale marks).

Enter the signal period (increment) of the sinusoidal output signals of the employed incremental probe.



This input box is display only with an incremental probe being selected in list box "Probe".

* The "x" in the channel number takes the place of the number of the plug-in socket occupied by the corresponding plug-in module.

5.3 "Feature" tab

Determining the features (i.e. the way measuring results are to be computed).

List box "Feature"

Selects the feature for which parameters are to be entered.

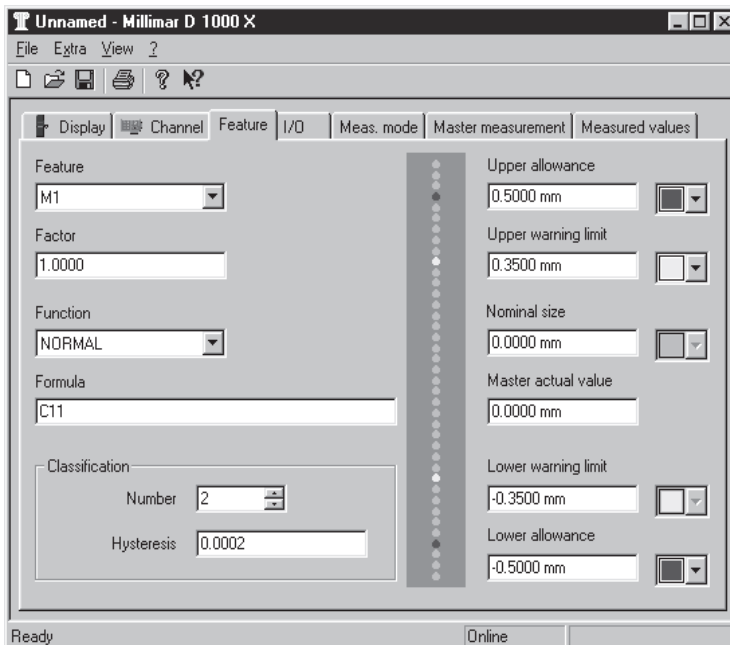
Up to 16 features can be selected one after the other here. All parameters entered on this tab will be used for the currently selected feature.

List box "Factor"

Entering the factor (formula multiplier) for measuring value computation.



When entering decimal figures use the decimal point as separation character.



List box "Function"

Selecting the function for calculating the measured value.

The below functions are available:

- NORMAL = Result of a static individual measurement combination.
- MAXIMUM = Largest value of a dynamic measured value combination.
- MINIMUM = Smallest value of a dynamic measured value combination.
- MAX - MIN = Difference between the largest and smallest values.
- MAX + MIN = Total of largest and smallest values
- AVERAGE = Mean value from the individual results acquired during the measuring period.
- SQUARE ROOT = Square root of a measured value combination.
- ARC TANGENT = Arc tangent of a measured value combination in degrees
- MAX SORT = Largest result from a list of features
- MIN SORT = smallest result from a list of features



If the combined result is a negative value, then the square root is calculated from the absolute value.

Example:

$M6 = \text{MAX SORT} (M1+M2+M3)$

Values:

$M1 = 17,5 \mu\text{m}$, $M2 = 56,3 \mu\text{m}$,
 $M3 = 23,8 \mu\text{m}$

Result:

$M6 = 56,3 \mu\text{m}$
 (since in this example M2 has the largest values)



Here, the "+" signs do not entail the summing up of values. They merely serve as separators.

Input box "Formula"

Entering the formula for calculating the measured value.

The formula links the different channels as required and may comprise up to 80 characters.

- Permissible characters:
+ - * / . () M C 1 2 3 4 5 6 7 8 9 0
- Use "C" to specify the number of the input channel. Enter the two-digit number of an available channel directly after "C" (without a space); for example, C11. Depending on the device configuration (plug-in modules), the following channel numbers are possible:
 - Module 1: C11 to C14*
 - Module 2: C21 to C24*
 - Module 3: C31 to C34**
 - Module 4: C41 to C44**
- Use "F" to specify the number of a feature. Enter the number of a feature between 1 and 16 directly after "F" (without a space), for example, F5.
- For formulas that do not contain any input channels, no master measurement is required.
- Do not mix input channels and features in one formula, because the rules for a master measurement are not unambiguously defined in this case.
- Up to 4 levels of parentheses are possible.
- Character sequence "-(" not allowed at the start of a formula!

* Observe the channel number limitations for certain plug-in module types (cf. page 19).

** Modules 3 and 4 as well as the corresponding channel numbers can only be selected Millimar X 1741 units.

Selection box "Number"

Defining the number of equally large classes into which the tolerance range of the feature is to be divided. The number of classes must be between 2 and 998. Results that lie below the tolerance limit fall into class 0. Results higher than the upper tolerance limit fall into the number of classes +1, e.g. in the case of 998 classes into class 999.

Input box "Hysteresis"

Enter a value by which a class limit must be exceeded in order to switch into a class number. This suppresses any change in class when there are small coincidental changes of the measuring result which lies on the boundary between two classes. The hysteresis is limited to the maximum half class range, and it proceeds symmetrically to the limit (half-value of the hysteresis, e.g. ± 0.05 for 0.1).

Input box "Upper allowance"

Entering the upper tolerance limit. Entry of the upper tolerance limit ("upper allowance") relative to the nominal dimension.

In the list box to the right of the input box, select the color of the bar graph for displaying values exceeding the upper (positive) allowance limit.

Input box "Upper warning limits"

Entering the upper warning limit. Entry of the upper warning limit relative to the nominal dimension.

In the list box to the right of the input box, select the color of the bar graph for displaying values exceeding the upper (positive) warning limit.

Input box "Nominal size"

Entry of the nominal dimension in the form of an absolute value.

Input box "Master actual value"

Entry of the master actual value in the form of an absolute value.

The master actual value (work piece reference) is required for master measurements on a setting master or normal.

Input box "Lower warning limit"

Entering the lower warning limit.

Entry of the lower warning limit relative to the nominal dimension.

In the list box to the right of the input box, select the color of the bar graph for displaying values exceeding the lower (negative) warning limit.

Input box "Lower allowance"

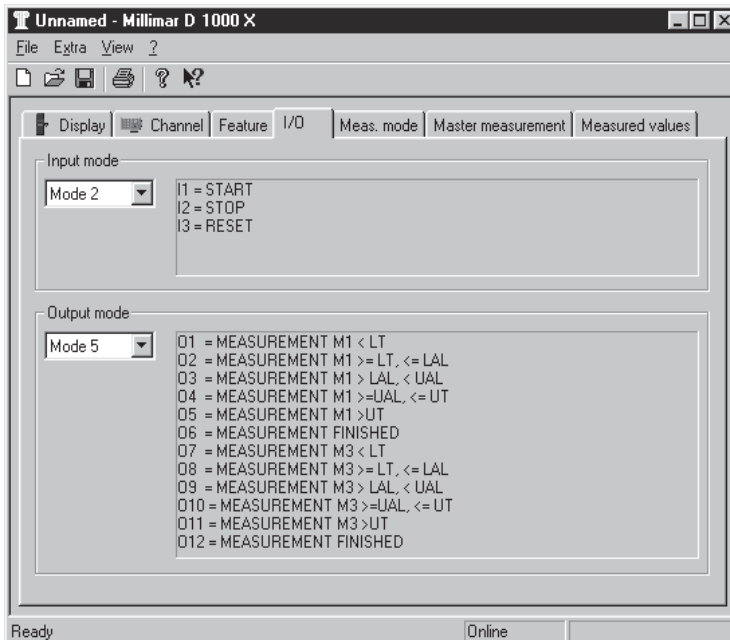
Entering the lower tolerance limit.

Entry of the lower (negative) tolerance limit ("lower allowance") relative to the nominal dimension.

In the list box to the right of the input box, select the color of the bar graph for displaying values exceeding the lower (negative) allowance limit.

5.4 "I/O" tab

On this tab, the input and output signals for the auxiliary equipment interfaces can be defined. The interfaces are located on the rear of the Millimar and are labelled "I/O 1", "I/O 2-ANALOG OUT" (both X 1741) and "I/O-ANALOG OUT" (X 1715). The interfaces enable the data transfer between the Millimar X 1741/1715 and other units aof the Millimar programme.



Group box "Input mode"

Selection of the input signals.

The below modes can be selected in the list box:

Mode 0

Signals at the inputs are ignored.

Mode 1

Input 1 Measuring period (Start / Stop signal).

Input 2 Start signal for master measurement.

Input 3 Adopt signal for master measurement.

Mode 2

Input 1 Start signal.

Input 2 Stop signal.

Input 3 Reset signal to clear the MAX-MIN memory.

Mode 3

Input 1 Measuring period (Start / Stop signal).

Input 2 Signal to send a measured value.

Input 3 Start and adopt signal for master measurement.

Mode 4

For connecting the Millimar S 1840/SG control unit.

Input 1 Measuring period (Start / Stop signal).

Input 2 Start signal for master measurement.

Input 3 Adopt signal for master measurement.



If the **MODE 4** parameter is selected for the input signals, **MODE 4** is automatically set for the output signals as well.

Group box "Output mode"

The below modes can be selected in the list box.



Modes 1 to 6 are possible with both the Millimar X 1741 and the Millimar X 1715. With the Millimar X 1741 modes 7 to 10 can be selected in addition.

Mode 0

No signals are fed to the outputs.

Mode 1

- Output 1 Signal "Measurement in progress"
- Output 2 Signal "Measurement finished"
- Output 3 Signal "Measurement OK"

Mode 2

- Output 1 Signal "Measurement OK"
- Output 2 Signal "Measurement outside warning limits"
- Output 3 Signal "Measurement outside tolerance"
- Output 4 Signal "Measurement in progress"
- Output 5 Signal "Measurement finished"

Mode 3

- Output 1 Signal "OK".
- Output 2 Signal "Rework".
- Output 3 Signal "NOT OK".
- Output 4 Signal "Measurement in progress".
- Output 5 Signal "Measurement finished".

Mode 4

For connecting the Millimar S 1840/SG control unit.

- Output 1 Signal "OK".
- Output 2 Signal "Rework".
- Output 3 Signal "NOT OK".
- Output 4 Signal "Measurement in progress".
- Output 5 Signal "Measurement finished".



If **MODE 4** is selected for the output signals, **MODE 4** is automatically set for the input signals as well.

Mode 5

Output 1	Signal "Measurement F1 < lower tolerance limit"	Output 8	Signal "Measurement M3 >= lower tolerance limit, Measurement F3 <= lower warning limit".
Output 2	Signal "Measurement F1 >= lower tolerance limit, <= lower warning limit"	Output 9	Signal "Measurement F3 > lower warning limit, Measurement F3 < upper warning limit".
Output 3	Signal "Measurement F1 > lower warning limit, Measurement F1 < upper warning limit".	Output 10	Signal "Measurement F3 >= upper warning limit, Measurement F3 <= upper tolerance limit".
Output 4	Signal "Measurement F1 >= upper warning limit, Measurement F1 <= upper tolerance limit".	Output 11	Signal "Measurement F3 > upper tolerance limit".
Output 5	Signal "Measurement F1 > upper tolerance limit".	Output 12	Signal "Measurement finished"
Output 6	Signal "Measurement finished"		
Output 7	Signal "Measurement F3 < lower tolerance limit"		

Mode 6

Output 1	Signal "Measurement F1 < lower tolerance limit"
Output 2	Signal "Measurement F1 in Class 1".
Output 3	Signal "Measurement F1 in Class 2".
Output 4	Signal "Measurement F1 in Class 3".
Output 5	Signal "Measurement F1 in Class 4".
Output 6	Signal "Measurement F1 > obere Toleranzgrenze".
Output 7	Signal "Measurement F3 < untere Toleranzgrenze".
Output 8	Signal "Measurement F3 in Class 1".
Output 9	Signal "Measurement F3 in Class 2".
Output 10	Signal "Measurement F3 in Class 3".
Output 11	Signal "Measurement F3 in Class 4".
Output 12	Signal "Measurement F3 > upper tolerance limit".

Mode 7

Output 1	Signal "Measurement F1 OK".
Output 2	Signal "Measurement F1 Rework".
Output 3	Signal "Measurement F1 NOT OK".
Output 4	Signal "Measurement F3 OK".
Output 5	Signal "Measurement F3 Rework".
Output 6	Signal "Measurement F3 NOT OK".
Output 7	Signal "Measurement F5 OK".
Output 8	Signal "Measurement F5 Rework".
Output 9	Signal "Measurement F5 NOT OK".
Output 10	Signal "Measurement F7 OK".
Output 11	Signal "Measurement F7 Rework".
Output 12	Signal "Measurement F7 NOT OK".

Mode 8

Output 1	Signal "Measurement F1 < lower tolerance limit".
Output 2	Signal "Measurement F1 in Class 1".
Output 3	Signal "Measurement F1 in Class 2".
Output 4	Signal "Measurement F1 in Class 3".
Output 5	Signal "Measurement F1 in Class 4".
Output 6	Signal "Measurement F1 in Class 5".
Output 7	Signal "Measurement F1 in Class 6".
Output 8	Signal "Measurement F1 in Class 7".
Output 9	Signal "Measurement F1 in Class 8".
Output 10	Signal "Measurement F1 in Class 9".
Output 11	Signal "Measurement F1 in Class 10".
Output 12	Signal "Measurement F1 > upper tolerance limit".

Mode 9

Output 1	Signal "Measurement in progress"
Output 2	Signal "Measurement finished."
Output 3	Signal "Measurement OK (all the features)"
Output 4	Signal "Measurement F1 < lower tolerance limit."
Output 5	Signal "Measurement F1 in Class BCD1."
Output 6	Signal "Measurement F1 in Class BCD2."
Output 7	Signal "Measurement F1 in Class BCD4."
Output 8	Signal "Measurement F1 in Class BCD8."
Output 9	Signal "Measurement F1 in Class BCD10."
Output 10	Signal "Measurement F1 in Class BCD20."
Output 11	Signal "Measurement F1 in Class BCD40."
Output 12	Signal "Measurement F1 > upper tolerance limit."

Mode 10

Output 1	Signal "Measurement in progress"
Output 2	Signal "Measurement finished"
Output 3	Signal "Measurement OK (all the features)"
Output 4	Signal "1st Sorting criterion, BIN1"
Output 5	Signal "1st Sorting criterion, BIN2"
Output 6	Signal "1st Sorting criterion, BIN4"
Output 7	Signal "1st Sorting criterion, BIN8"
Output 8	Signal "2nd Sorting criterion, BIN1"
Output 9	Signal "2nd Sorting criterion, BIN2"
Output 10	Signal "2nd Sorting criterion, BIN4"
Output 11	Signal "2nd Sorting criterion, BIN8"
Output 12	Without function

5.5 "Meas. mode" Tab

The file card is used to specify the course of measurement (measuring mode).

Option button "Manual measuring mode"

Activates the manual measuring procedure. In manual mode, the memories for the MAXIMUM, MINIMUM and AVERAGE values are reset to the current values, by means of the Start signal..

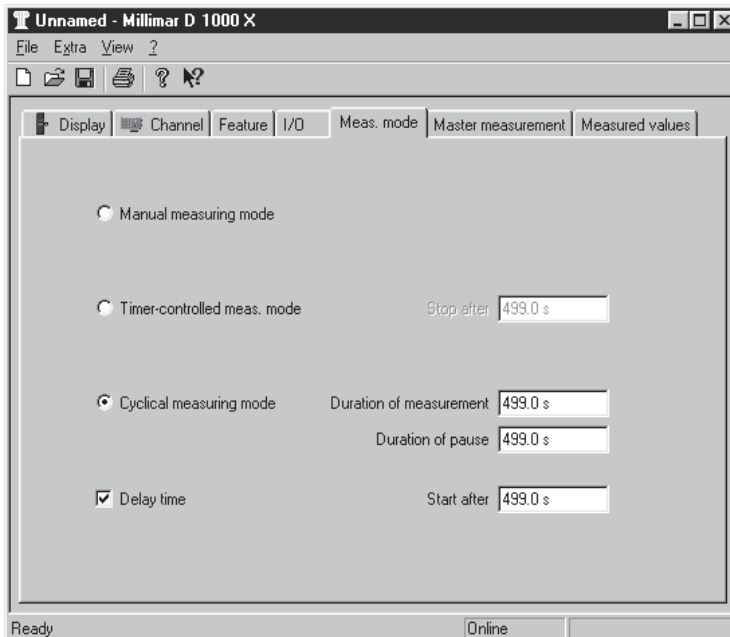
Option button "Timer-controlled meas. mode"

Activates the time-limited measuring procedure.

Measuring must commence with a start signal. Measurements are recorded for the duration of time specified in the "Stop after" input box, or until the Stop signal is triggered. After the measuring time has expired, the measuring process ends.



If decimal separators are required for the numeric entries, use a decimal point as separator.



Input box "Stop after"

Here you enter the measuring time (seconds) for the time-limited measuring procedure. If you enter 0.0, the measuring time is infinite. In this case, the measuring time can only be stopped by means of the Stop signal.



The input box is only activated when you click the "Timer-controlled meas. mode" button. The time entered is adopted automatically into the "Duration of meas." input box for the cyclical measuring mode.

Option button "Cyclical measuring mode"

Activates the cyclical measuring procedure.

Measuring must commence with a start signal. Measurements are recorded for the duration of the time specified in the "Duration of meas." input box. After the pause time has expired, measurements are recorded anew until the duration of measurement has expired anew. This cycle is repeated until a stop signal ends the measuring process.

"Duration of measurement" input box

Here you enter the duration of measurement (seconds) for the cyclical measuring procedure.



The input box is only activated when you click the "Cyclical meas. mode" button. The time entered is adopted automatically into the "Stop after" input box for the timer-controlled measuring mode..

"Duration of pause" input box

Here you enter the duration of the pause (seconds) for the cyclical measuring procedure.

The input box is only activated when you click the "Cyclical meas. mode" button.

"Delay time" check box

Activates a delay in measurement recording.

Measuring only starts after the time specified in the "Start after" input box has expired. After the start signal for the measuring process has been triggered and the relevant pause time (in cyclical measuring mode) has expired, the measurements are recorded only after the delay time has also expired.

"Start after" input box

Here you enter the delay time (seconds) for the delay in measurement recording.



The input box is only activated when you click the "Delay time" check box

5.6 “Master meas.” file card

The operating mode can be selected on the file card.

“Interval” input box

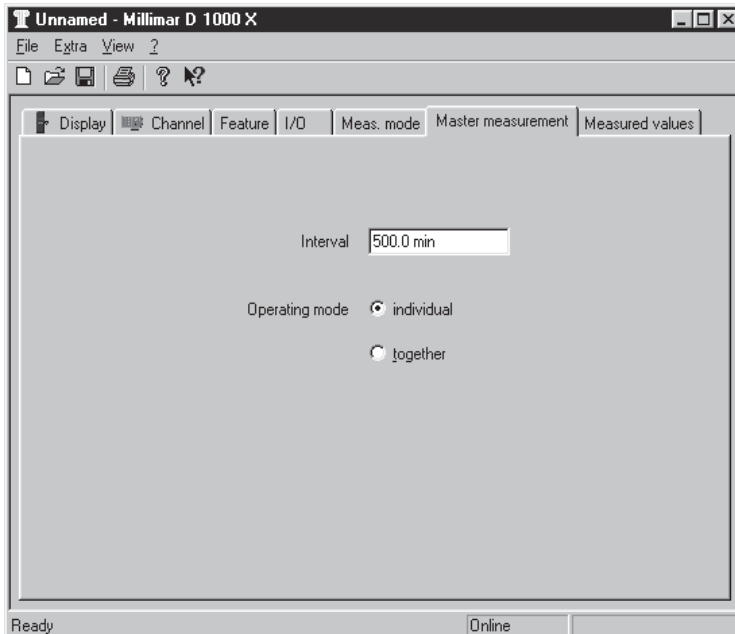
No function.

The displayed value of “0.0” cannot be modified.

“Operating mode” button

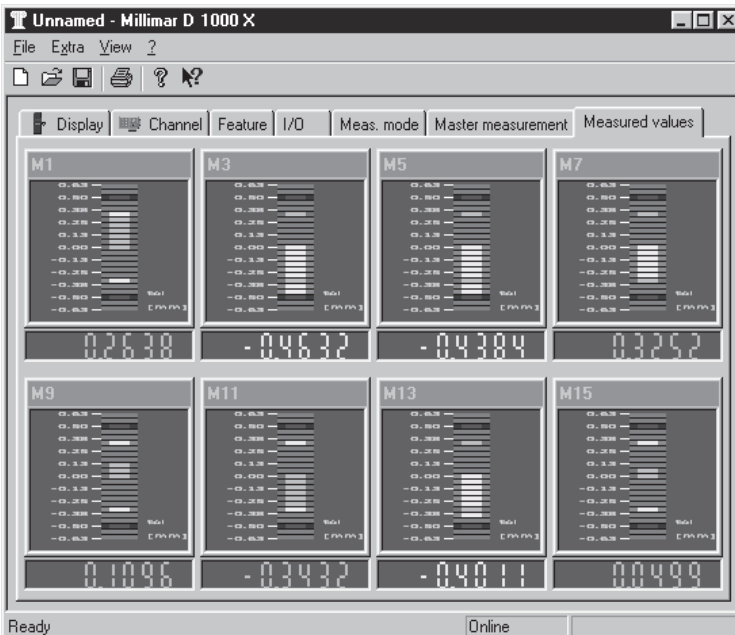
Here you select the mode for a master measurement.

- Individually:
The individual features are adopted consecutively.
- Combined:
The features are adopted together.



5.7 “Measured values” file card

The “Measured values” file card shows max. 10 features, in analog and digital form, depending on the specifications made on the “Display” and “Feature” file cards.

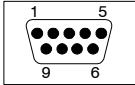


6 Appendix

6.1 RS232 interface

The serial RS232 interface is used to

- output results to a printer,
- exchange data with a PC,
- configure the Millimar X 1741/1715 via a PC.



Assignment of the socket

(9-pin D-Sub)

Pin	Desig.	Function
1	NC	Not assigned
2	RxD	Data input
3	TxD	Data output
4	DTR	Handshake output
5	Gnd	Ground connection, 0 V
6	NC	Not assigned
7	RTS	Send
8	CTS	Ready to send
9	OUT	+ 5 V max. 300 mA

To set the interface parameters:

- Use menu item "Extra/Millimar RS232 parameters" to define the protocol type, data format, protocol method and the transfer rate.

The Windows-based program Millimar D1000X automatically changes the interface parameters to 'MarTalk', '38400 Baud', '8N'1 and 'no Handshake'. After downloading the values, these parameters will be replaced by the originally entered parameters.

6.1.1 Connecting a printer

Measuring results can be printed out on all Epson printers (and compatible devices) equipped with a serial interface.



Do not **under any circumstances** connect the printer to the 25-pin D-Sub jacks for auxiliary equipment.



Depending on the protocol type selected in the "Extra / Millimar RS232 parameters" menu, the measured values are printed out in the appropriate protocol format.

6.1.2 Connecting a PC

When a PC is connected to the serial interface, the Millimar X1741/1715 can be configured or controlled from the PC.

During the configuration process, protocol type MarTalk must be selected in the "Extra / Millimar RS232 parameters" menu.



The parameters of the Millimar X 1741/1715 are archived as a parameter file by the PC and can be transferred via the RS232 interface.

MarTalk comes with a software handshake of its own. When selecting MarTalk (see menu "Extra / Millimar RS232 parameters"), the protocol type for controlling the data transmission is deactivated.

The protocol type selected in the "Extra / Millimar RS232 parameters" menu is used **for control purposes**.

6.1.3 ASCII protocol

After pressing the **DATA** button, all the features are sent:

- Millimar: xxx.xxx <CR><LF>



The data format corresponds to that of the digital display.

6.1.4 M1240 protocol

An acknowledgement is given when a command is executed. The following commands can be used:

- Interrogation of the equipment setting
PC: <CR>
Millimar: MAHR GMBH,MMillimar<CR>
- Activation of the interface
PC: I<CR>
Millimar: I,MAHR GMBH, MMillimar,
Vn.nn <CR>
mit Vn.nn = Versionsnummer
- Deactivation of the interface
PC: X<CR>
Millimar: X<CR>
- Starting the measurement with set measuring period (T-TIMER)
PC: F1<CR>
Millimar: F1<CR>
- Starting the measurement
PC: F2<CR>
Millimar: F2<CR>
- Terminating the measurement
PC: F3<CR>
Millimar: F3<CR>
- Switching to basic status (RESET)
PC: R<CR>
Millimar: R<CR>
- Starting the master measurement
PC: Z<CR>
Millimar: Z<CR>
- Request current measured values*
PC: M<CR>
Millimar: M1,xxx.xxx<CR>
- Request the current measured values of a specific feature "n".
PC: Mn<CR>
Millimar: Mn,xxx.xxx<CR>
- Request all stored measured values
PC: M70<CR>
Millimar: nnnnn,-xxx.xxx<CR>



Up to 5000 values are stored and output with "F70". The memory is cleared by reading the values out with "F70" or by switching off the unit. The feature number and then the measured value are transferred in the data format of the digital display. The oldest measured value is transferred first.

- Setting the nominal value of a feature "n" where n = 1 to 16
PC: P8,Mn=1.0<CR>
Millimar: P8,Mn=1.0<CR>
- Setting the master value of a feature "n" where n = 1 to 16
PC: P91,Mn=1.001<CR>
Millimar: P91,Mn=1.001<CR>
- Reading the master value of a feature "n" where n = 1 to 16
PC: P91,Mn<CR>
Millimar: P91,Mn, 1.0010<CR>

* The data format corresponds to that of the digital display.

Statistics functions

- Deleting the statistics
PC: P82,3<CR>
- Request the quantity of all measuring values with the number of the first feature used
PC: P60,80<CR>
Millimar: nnnnn,-xxx.xxx<CR>
- Request the mean values of all measuring values with feature numbers
PC: P60,82<CR>
Millimar: nnnnn,-xxx.xxx<CR>
- Request the minimum values of all measuring values with feature numbers
PC: P60,83<CR>
Millimar: nnnnn,-xxx.xxx<CR>
- Request the maximum values of all measuring values with feature numbers
PC: P60,84<CR>
Millimar: nnnnn,-xxx.xxx<CR>
- Request the standard deviations of all measuring values with feature numbers
PC: P60,86<CR>
Millimar: nnnnn,-xxx.xxx<CR>
- Request the ranges of all measuring values with feature numbers
PC: P60,88<CR>
Millimar: nnnnn,-xxx.xxx<CR>
- Request/Set the master value
PC: Request P8,Mn<CR>
Millimar: nnnnn,-xxx.xxx<CR>
PC: Set P8,Mn,xxx.xxx<CR>
Millimar: nnnnn,-xxx.xxx<CR>



The master value must consist of at least two characters e.g. P8,M1,1.0<CR>. The command P8,M1,1<CR> is invalid..

- Request/Set the nominal dimension
PC: Request P91,Mn<CR>
Millimar: nnnnn,-xxx.xxx<CR>
PC: Set P91,Mn,xxx.xxx<CR>
Millimar: nnnnn,-xxx.xxx<CR>

6.1.5 OPTO-RS-Simplexprotocol

After pressing the **DATA** key, all the features are sent

- Millimar: *xxx.xxx <Einheit><CR><LF>*

6.1.6 OPTO-RS-Duplex protocol

The following commands can be used:

- Requesting the current measuring value of the first feature *
PC: ?<CR>
Millimar: *xxx.xxx <Einheit><CR><LF>*
- Carrying out the master measurement
PC: PRE<CR>
- Requesting the name of the manufacturer and unit
PC : ID?<CR>
Millimar: *MILLIMAR Millimar<CR><LF>*
- Requesting the software version number
PC: VER?<CR>
Millimar: *Version 1.39<CR><LF>*
- Requesting the unit of measurement
PC: UNI?<CR>
Millimar: *mm <CR><LF>*
- Requesting the serial number
PC: SER?<CR>
Millimar: *xxx/xx<CR><LF>*
- Setting the unit of measurement to millimeters
PC: mm<CR>
- Setting the unit of measurement to inches
PC: in<CR>
- Setting the unit of measurement to micrometers
PC: um<CR>

* The data format corresponds to that of the digital display.

6.2 Interface for auxiliary units

The interfaces for auxiliary equipment designated with "I/O 1" and "I/O 2, ANALOG OUT" (Figure 1) enables the transfer of data between the Millimar X 1741/1715 and other units from the Millimar program.

To set the signals for the interface inputs and outputs:

- Set the mode on the "I/O" tab.

Assignment of the jacks I/O 1 (X 1741) and I/O-ANALOG OUT (X 1715)

(25-pin D-Sub)

Pin	Desig.	Function
1	Outp.1	TTL output O1*
2	Outp.2	TTL output O2
3	Outp.3	TTL output O3
4	GND	Ground connection
5	IN-2	Opt. input I3 (+)
6	IN-2	Opt. input I3 (-)
7	V _{out}	Int. power supply, 12 V
8	IN-1	Opt. input I2 (+)
9	IN-1	Opt. input I2 (-)
10	OUT-5	Opt. output O6 (+)
11	IN-0	Opt. input I1 (+)
12	IN-0	Opt. input I1 (-)
13	AOUT 1	Analog output 1
14	AGND	Analog ground
15	OUT-5	Opt. output O6 (-)
16	OUT-4	Opt. output O5 (+)
17	OUT-4	Opt. output O5 (-)
18	OUT-3	Opt. output O4 (+)
19	OUT-3	Opt. output O4 (-)
20	OUT-2	Opt. output O3 (+)
21	OUT-2	Opt. output O3 (-)
22	OUT-1	Opt. output O2 (+)
23	OUT-1	Opt. output O2 (-)
24	OUT-0	Opt. output O1 (+)
25	OUT-0	Opt. output O1 (-)

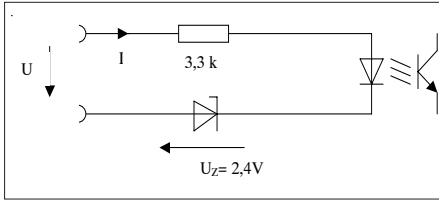
Assignment of the jack I/O 2- ANALOG OUT (X 1741 only)

(25-pin D-Sub)

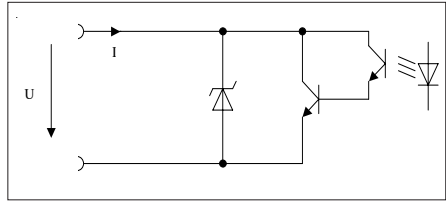
Pin	Desig.	Function
1	Outp.4	TTL output O4*
2	Outp.5	TTL output O5
3	Outp.6	TTL output O6
4	GND	Ground connection
5	IN-5	Opt. input I6 (+)
6	IN-5	Opt. input I6 (-)
7	V _{out}	Int. power supply, 12 V
8	IN-4	Opt. input I5 (+)
9	IN-4	Opt. input I5 (-)
10	OUT-11	Opt. output O12(+)
11	IN-3	Opt. input I4 (+)
12	IN-3	Opt. input I4 (-)
13	AOUT 2	Analog output 2
14	AGND	Analog ground
15	OUT-11	Opt. output O12 (-)
16	OUT-10	Opt. output O11 (+)
17	OUT-10	Opt. output O11 (-)
18	OUT-9	Opt. output O10 (+)
19	OUT-9	Opt. output O10 (-)
20	OUT-8	Opt. output O9 (+)
21	OUT-8	Opt. output O9 (-)
22	OUT-7	Opt. output O8 (+)
23	OUT-7	Opt. output O8 (-)
24	OUT-6	Opt. output O7 (+)
25	OUT-6	Opt. output O7 (-)

* Depending on the switching state either +5 V or GND

Basic circuit of an input



Basic circuit of an output



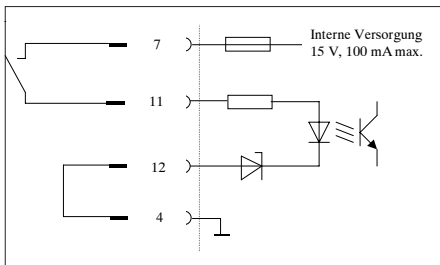
Input data

		min.	typ.	max.	
U	Input voltage	"On"	6	30	V
		"Off"	-4	2	V
I	Input current			10	mA

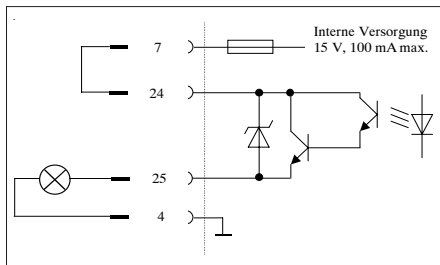
Output data

		min.	typ.	max.	
U	Voltage drop when "On"	1.5		V	
I	Output current			150	mA

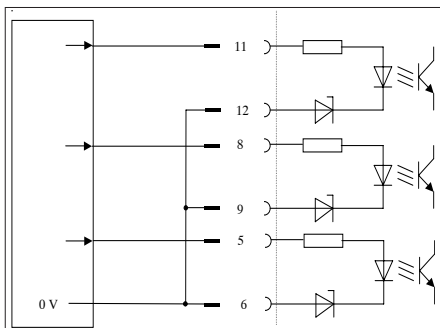
Connecting a switch to an input



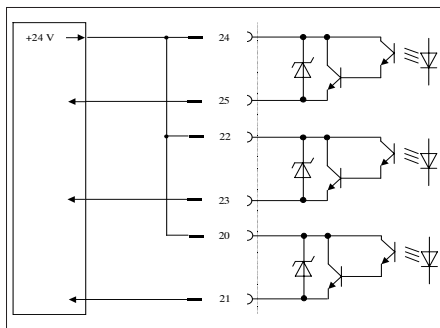
Controlling a lamp via an output



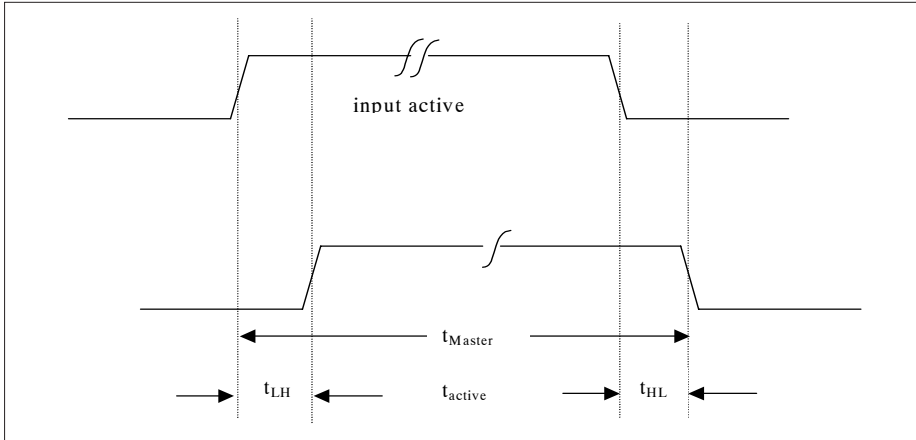
Controlling by means of a PLC



Controlling a PLC



Timing Diagram



Description of the 'Timing' diagram

	X1741 interface box	min.	max.	
tLH	Time offset between "Input active" and "Function executed".	60	160	ms
tHL	Time offset between "Input inactive" and "Function completed". The data has to stay stable for the duration of tHL.	50 ⁽³⁾	60 ⁽³⁾	ms
tactive	Pulse width	60 ⁽³⁾		ms
tMaster	"Master measurement" pulse width	120 ⁽³⁾	infinite	ms
twait	Time offset between "Function executed" and "Ready for measuring".	200	250	ms



Information on the 'Timing' diagram

1. "Input active" means there is "flow of current through the optocoupler of the respective input".
2. During a data transmission via the RS232 interface, the respective offset is increased by the time that is required to complete the data transmission.
3. The specified time is valid for programs with a single feature. Each additional feature increases the specified durations by 5 ms respectively.

6.3 Maintenance

Care taken during the development and manufacturing stages coupled with meticulous quality control in the production plant ensure that the Millimar X 1741/1715 is able to offer the specified features. A relatively small amount of care can ensure that this status is retained for many years ahead.



Improper use can result in signs of wear and tear which may have an impact on measuring accuracy.

6.3.1 Cleaning

The housing can be cleaned with a damp cloth. Acetone or acetone compounds must **not** be used.

6.3.2 Changing the fuse

- Detach the mains cable from the socket on the rear of the unit.
- Reach into the socket and pull out the fuse housing.
- Replace the faulty fuse with a fuse of the same type
230 V: 1,5 A, träge
- Fit the fuse housing back into position and re-connect the mains cable

6.3.3 Opening the unit

Any intervention in the unit must be performed by qualified personnel and only with the written agreement of Mahr GmbH. Any contravention will render invalid any warranty claims against Mahr GmbH..

6.4 Scope of delivery and accessories

Null modem cable
1840SG control unit

Order number
7024634
5330950

6.5 Technical data



For the technical specifications of your device, please refer to the supplied data sheet or the sales and delivery documents.





Konformitätserklärung

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We **Carl-Mahr-Str. 1**
Nous **D- 37073 Göttingen**
Nosotros **Germany**
Noi

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Bezeichnung: **Interface-Box**
name: / nom: / nombre: / nome:

Typ: **X 1741**
type: / type: / tipo: / tipo:

ab Lieferdatum oder Serien-Nr.: **#1110/02**
from delivery date or serial number:
à partir de date de livraison ou n° de série:
a partir de fecha de entrega o núm. de serie:
da data di consegna o numero di serie:

mit folgenden Normen übereinstimmt: **DIN EN 61010-1: 2002-08+B1/B2**
is in conformity with the following standards: **DIN EN 55011: 2003-08; group 1, class B**
est conforme aux normes: **DIN EN 61000-6-2: 2006-03, level C**
está conforme con las normas siguientes:
é conforme alle norme seguenti:

gemäß der Richtlinie(n): **Niederspannungsrichtlinie 73/23/EWG, i.d.F. 93/68/EWG**
following the Directive(s):
conformément à la Directive: **Richtlinie Elektromagnetische Verträglichkeit 89/336/EWG,**
con arreglo a la Directiva: **i.d.F. 93/68/EWG**
secondo alla Direttiva:

Ort u. Datum: Göttingen **24.4.08**
Place and date:
Lieu et date:
Lugar y fecha:
Luogo e data:

Unterschrift: **i. A. Kochta**
Signature: **Gerhard Kochta**
Signature:
Firma:
Firma:

Prüfbeauftragter
Inspector
Contrôleur en chef
Ingegnere collaudatore
Verificador jefe

Dokument-Id.-Nr.:
3755967

<p>Mahr GmbH</p> <p>Carl-Mahr-Str. 1 D-37073 Göttingen Telefon 05 51/70 73-0 Fax 05 51/7 10 21 http://www.mahr.de</p>	<p>Geschäftsführer: Stephan Gais Thomas Keidel</p> <p>Sitz der Gesellschaft: Göttingen Registergericht HRB 2507 UST-IDNR. DE115299942</p>	<p>Längenmess- und Steuer- geräte, Präzisions- Längen- messtechnik, Form- und Zahnradmessgeräte, optische/taktile 3D Mess- geräte, Oberflächen- und Konturenmesgeräte, Spinnpumpen, Kugelführungen, Kalibrierservice (DKD)</p>
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 Nous **D- 37073 Göttingen** déclarons sous notre seule responsabilité que le produit
 Nosotros **Germany** declaramos con responsabilidad exclusiva que el producto
 Noi **Germany** dichiariamo con la responsabilità esclusiva che il prodotto

Bezeichnung: Small Interface-Box
 name: / nom: / nombre: / nome:

Typ: X 1715
 type: / type: / tipo: / tipo:

ab Lieferdatum oder Serien-Nr.: #1000/04
 from delivery date or serial number:
 à partir de date de livraison ou n° de série:
 a partir de fecha de entrega o núm. de serie:
 da data di consegna o numero di serie:

mit folgenden Normen übereinstimmt: DIN EN 61010-1: 2002-08+B1/B2
 is in conformity with the following standards: DIN EN 55011: 2003-08; group 1, class B
 est conforme aux normes: DIN EN 61000-6-2: 2006-03, level C
 está conforme con las normas siguientes:
 è conforme alle norme seguenti:

gemäß der Richtlinie(n): Niederspannungsrichtlinie 73/23/EWG, i.d.F. 93/68/EWG
 following the Directive(s):
 conformément à la Directive: Richtlinie Elektromagnetische Verträglichkeit 89/336/EWG,
 con arreglo a la Directiva: i.d.F. 93/68/EWG
 secondo alla Direttiva:

Ort u. Datum: Göttingen *24.7.08* Unterschrift: *G. A. Kochta* Prüfbeauftragter
 Place and date: Signature: Gerhard Kochta Inspector
 Lieu et date: Signature: Contrôleur en chef
 Lugar y fecha: Firma: Ingegnere collaudatore
 Luogo e data: Firma: Verificador jefe

Dokument-Id.-Nr.:
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 Stephan Gais
 Thomas Keidel

Sitz der Gesellschaft:
 Göttingen
 Registergericht
 HRB 2507
 UST-IDNR. DE115299942

Längenmess- und Steuer-
 geräte, Präzisions- Längen-
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