



MANO GAUGE / MANO RECORD MR01 FOR HAZARDOUS AREAS

OPERATING MANUAL



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EEx ia IIC T6 or T5	
LCIE 01 ATEX 6001 X	
	0081



KELLER

LIST OF CONTENTS

GENERAL DESCRIPTION	PAGE 1
OPERATION	PAGE 2
MEASURING MODE / COMMAND STRUCTURE MANO-MODE	PAGE 3
SETTING NEW ZERO REFERENCE ZERO-MODE	PAGE 4
ADJUSTING THE MEASURING CYCLE MECY-MODE	PAGE 5
SELECTION OF DISPLAY DISE-MODE*	PAGE 6 *
SELECTION OF VALUES TO BE MEASURED SAVS-MODE*	PAGE 8 *
PREPARING THE STORAGE PARAMETERS REC-SEL-MODE*	PAGE 9 *
STARTING THE RECORDING REC-MODE*	PAGE 10 *
READ-OUT OF THE STORED VALUES	PAGE 11
NOTES	PAGE 12 PAGE 13
TECHNICAL DATA	PAGE 13
DECLARATION OF CONFORMITY	PAGE 14

* = *Mano Record* only

GENERAL DESCRIPTION

The KELLER *Intelligent Manometer* is a precise pressure measuring instrument. Its high accuracy, solid construction and its long battery life make it to an ideal measuring instrument, especially for measuring tasks where independence and flexibility are required.

In its standard version, the pressure transducer is built into the housing as shown below. The transducer is retained with a counternut.

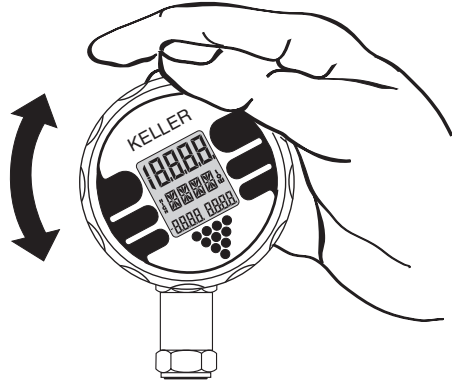
Mounting:

Screw the male port of the *Intelligent Manometer* into the female pressure port and tighten using the lower hexagon of the transducer.

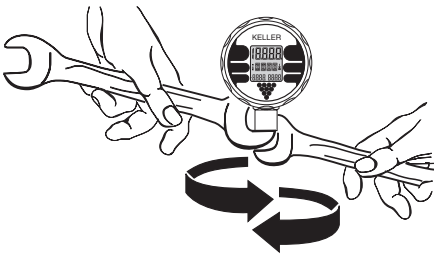
Adjusting the face:

Loosen the upper hexagon of the counternut and rotate the *Intelligent Manometer* to the desired position. Retighten.

The face of the *Intelligent Manometer* can be rotated through 355°. This feature allows the *Intelligent Manometer* to be mounted in all possible positions; vertical, horizontal or upside down.



The splash-proof cover of the *Intelligent Manometer* is sealed with an O-ring and may easily be removed by hand by turning the display ring beyond the limit stop (see “Battery Change” in Chapter “Notes” on page 12).



Attention: In hazardous areas, the connection to the interface (on the back side of the instrument) must not be plugged in or unplugged!

Depressing the front key (marked by a pointed triangle) sets the *Intelligent Manometer* into operation.

After turning on the instrument, all segments of the display flash three times for operational test.

It is possible that the intrinsically safe Intelligent Manometer will not start up completely by pressing the button the first time. This is shown by several beams on the display. In this case please press the front key once again! After that, the unit will start up correctly.

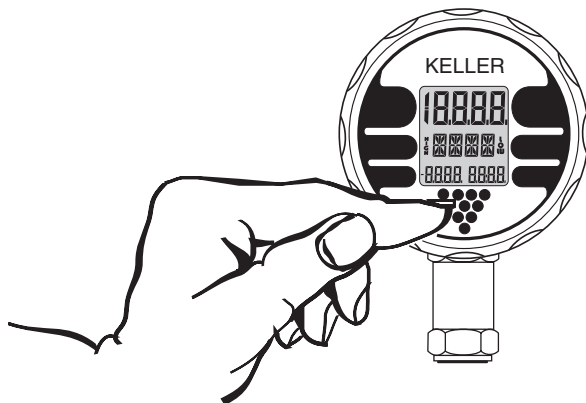
This behaviour is determined by the intrinsically safe version of the Intelligent Manometer. The unit is not defective.

Between the segment tests, the *Intelligent Manometer* displays:

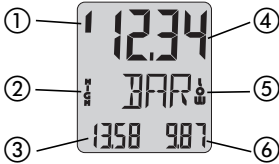
- the measuring range on the upper display (i.e. 20.00)
- the software program number on the middle display (MR 01)
- the year and calendar week of the program version (94:23) on the lower right display

After this test, the instrument will lead into the function from which the instrument was previously turned off.

All commands are selected with the front key. When the front key is depressed and held, all commands appear in succession. Releasing the front key executes the displayed command. This cycle (constantly depressing the front key and letting go the key at a desired command) is subsequently called **activation**.



The *Mano-Mode* is the standard mode of the *Intelligent Manometer*. Since the function of secondary displays can be selected (see *Dise-Mode*), the individual segments are described with the peak- and trough pressure display:



- ① = Sensor 1 is active
- ② = HIGH flashes, when maximum pressure is displayed
- ③ = Peak pressure
- ④ = Actual pressure
- ⑤ = LOW flashes, when minimum pressure is displayed
- ⑥ = Trough pressure

The arrow with a flashing minus sign represents a "1", i.e. at 10 bar in the over-pressure range (here 10.034 bar).



The two lower displays can also show the temperature or the time since turn on (more information see "*Dise-Mode*" on page 6/7).

The following commands, appearing in the shown order, can be activated from the *Mano-Mode*:

Mano-Mode

- ▼
- EXE** resets the peak- and trough values
- ▼
- OFF** turns off the instrument
- ▼
- EXE** resets the peak- and trough values
- ▼
- STEP *** leads into the *Record-Mode*
- ▼
- OFF** turns off the instrument
- ▼
- 10 / 11 / 12 / 13** (not programmed / no function)
- ▼
- DISE *** **DIS**play **SE**lect *
- ▼
- 16 / 17** (not programmed / no function)
- ▼
- ZERO** Permanent Zero Adjust
- ▼
- 20 / 21** (not programmed / no function)
- ▼
- RECS *** **REC**ord **SE**lect *
- ▼
- 24 / 25** (not programmed / no function)
- ▼
- SAVS *** **SAV**e **SE**lect *
- ▼
- 28 / 29** (not programmed / no function)
- ▼
- MECY** **ME**asure **CY**cle (Adjusting the measuring cycle)
- ▼
- 32 / 33 / 34 ...** (not programmed / no function)

(The numbers shown are home positions. Activating these numbers will not execute any command.)

* = *Mano Record* only

The zero of the system can be adjusted with the command *ZERO*.

Activate *ZERO*.

The display shows:

- Upper display: Actual pressure
- Lower left: ZEr0
- Lower right: The actual zero



The zero is now ready to be reset. Activate *ZERO* once more for permanent zero reset.

After setting the new zero, the *Intelligent Manometer* returns to the mode it was prior to activating the *ZERO*-command.

Note:

If the above setting was activated by mistake, turn off the instrument with the command *OFF*.

When restarting, the instrument will lead into the *Mano-Mode*.



The *Intelligent Manometer* may be supplied fitted with two sensors. Within *ZERO*, one has the possibility to switch back and forth between the two sensors with the command *EXE*. The arrow on the upper left display points upwards if sensor 1 is active, downwards if sensor 2 is active.

After the selection of the desired sensor, the zero of the corresponding sensor can now be reset by activating the command *ZERO*.

MECY (MEasure CYcle) = Adjusting the measuring cycle.

The measuring cycle can be adjusted between once per second up to once per hour (59:59). Longer measuring cycles extend the battery life.

Activating *RES* programmes the new selected measuring cycle and switches back to the *Mano-Mode*.

If the peak- and trough pressure are displayed, the time period set here has no meaning. When set in peak/trough mode, the instrument will always measure in a 1/2-second interval.



Activate *MECY*.
The display indicates *CYCL* and the lower right shows the time in minutes and seconds.



The first digit flashes.
EXE increases the digits (0, 1, 2,... 5).

STEP

STEP switches to the next digit.



The second digit flashes.
EXE increases the digits (0, 1, 2,... 9) etc.

DISE-MODE

(MANO RECORD ONLY)

DISE (Display SElect) = Selection of Display

Display Select enables the selection of the display position, and allocates the measured parameter to the chosen display.

There are three selectable display positions:
Upper Display / Lower Left / Lower Right.

These displays can be occupied by the following variables:

The selected configuration is valid for both the *Mano-Mode* and the *Record-Mode*.

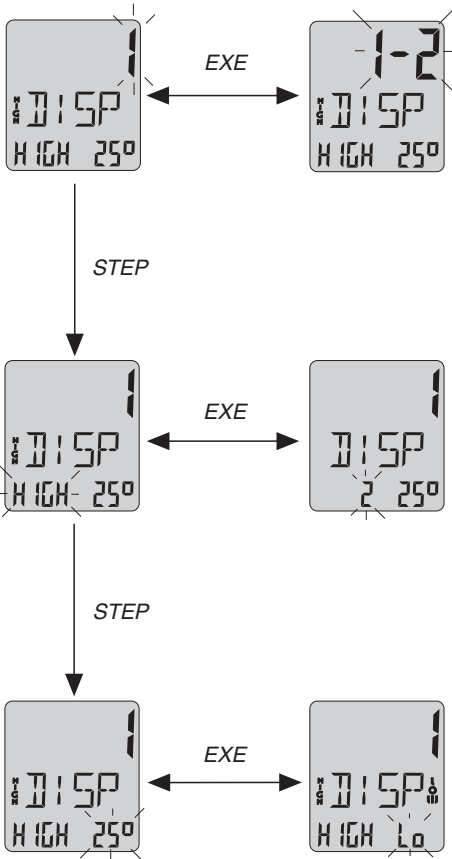
Please note that not all possible combinations are programmable.

Symbol	Variable
1	Sensor 1
2	Sensor 2 (only if two sensors are connected)
1-2	Difference (only if two sensors are connected)
HIGH	Peak Value for Sensor 1 *
LOW	Trough Value for Sensor 1 *
25°	Temperature
00:00	Time Meter
	 * If this variable is selected, the instrument will always measure in a 1/2-second interval, independent from the set measuring cycle.

DISE-MODE

(MANO RECORD ONLY)

Programming of the display:



After activating *DISE*, the instrument displays the actual settings. The display that is now flashing can be changed by activating *EXE*.

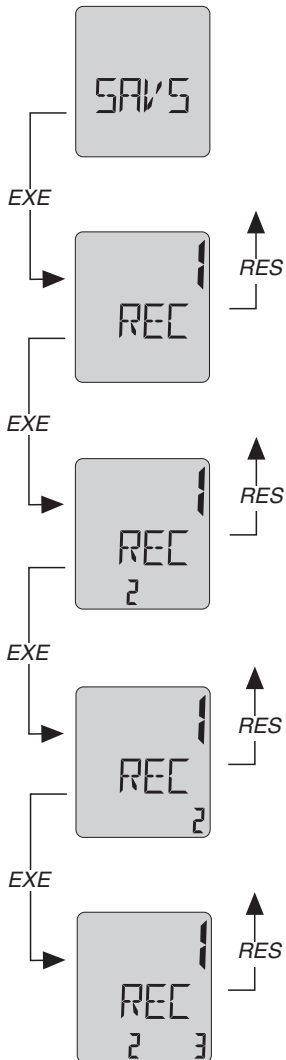
If another display possibility is to be adjusted, activate *STEP*.

When all possibilities are defined to your needs, you may return to the new configured *Mano-Mode* from any position within *DISE* by activating *RES*.

SAVS-MODE

(MANO RECORD ONLY)

SAVS (SAVe Select) = Selection of the values to be stored in the *Record-Mode*.



The settings programmed in *DISE*, which are now active, can be selected for storage under SAVS. Only the variables which are selected under SAVS will later actually be stored in the *Record-Mode*.

Four different combinations of variables are offered in the *Mano Record*. One of the following combinations can be selected with the command *EXE*:

1. Only the variable of the upper display
2. The variable of the upper display and the lower left display
3. The variable of the upper display and the lower right display
4. All three variables

Note that the operating hours will never be stored as an individual variable.

If you have nevertheless selected the operating hours for storage, they will be neglected during the storing cycle.

If peak- and trough measurements were selected for storage, the *Record-function* will reset the peak- and trough values after each measurement. Peak- and trough values are monitored every 1/2 second, the max./min. values occurring during the measurement interval are stored.

Attention:

Each selected variable requires one storage place! If, for example, three variables are to be measured, the available place will only last for 300 measurements (with three variables) instead of 900 measurements with one variable!

REC-SEL-MODE

(MANO RECORD ONLY)

RECS (REcord SElect) = Preparing the storage parameters

Activating **RECS** leads either to *Rec-Sel-* or to the *Rec-Cont-Mode*. The command **STEP** switches between these two modes. **EXE** initiates the selected function.

In the *Rec-Cont-Mode*, continuous, endless storage can be activated (ON) and deactivated (OFF). *Record Continuous=ON* means, that the once started recording can only be interrupted manually. *Record Continuous=OFF* means, that only the specified number of values will be stored.

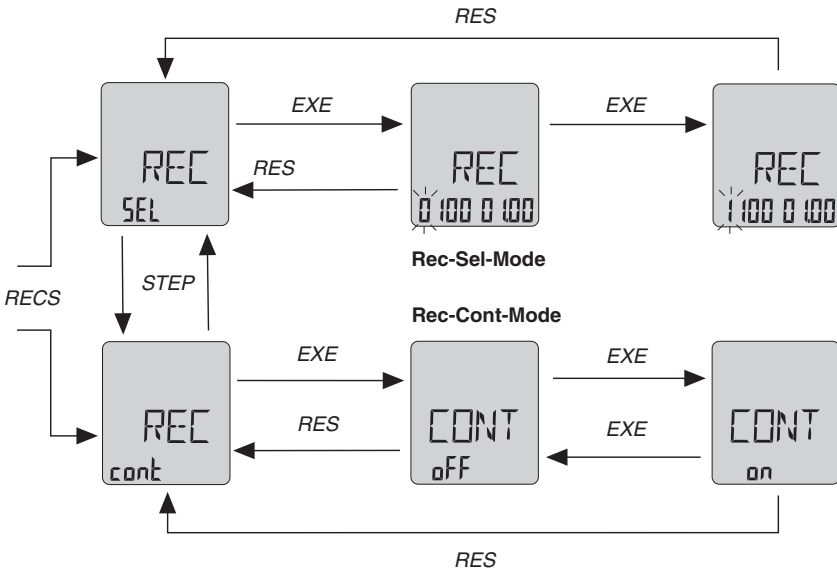
The *Rec-Sel-Mode* sets up the number of measurements to be stored and to adjust the recording interval. The lower left display indicates the number of measurements, the lower right display the recording interval in minutes and seconds.

The value of the flashing digit can be increased with the command **EXE**.

STEP switches to the next digit which may be increased with the command **EXE**, and so on.

When continuous, endless storage is active (*Rec-Cont=ON*), only the measuring cycle can be adjusted. The lower left display therefore indicates the message "cont" (for "continuous") instead of the numbers of values to be stored.

The command **RES** leads back to the *Mano-Mode*, both from the *Rec-Cont-Mode* and from the *Rec-Sel-Mode*. The new settings are now made and are active in the *Record-Mode*.



RECORD-MODE (MANO RECORD ONLY)

In the *Record-Mode*, the measured values can be stored. The measured parameters (see *SAVS-Mode*), the number of measurements and the interval (in minutes and seconds) are programmable (see *Rec-Sel-Mode*).

Recording of measuring values:

Activating *STEP* during the *Mano-Mode* first leads into the *Prep-Mode* (preparation mode) showing the actual pressure, on the lower left display the number of the values to be stored and on the lower right display the measuring cycle in minutes and seconds.

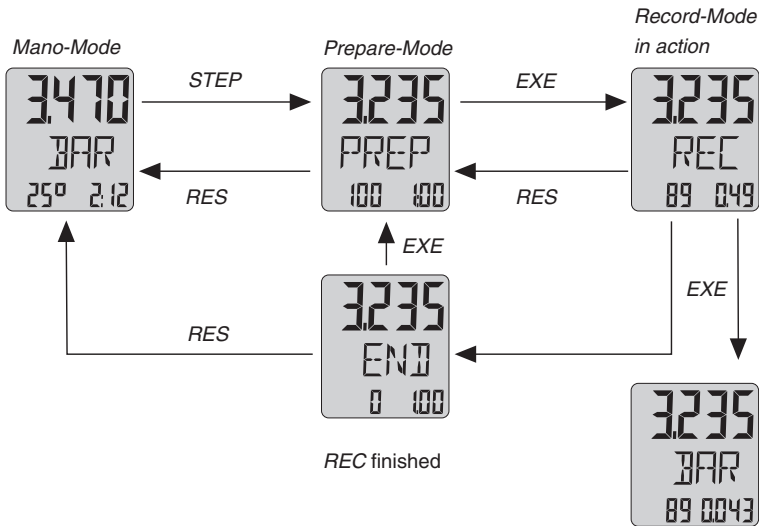
Activating *EXE* starts the recording of the measured values. During the recording, the lower left display indicates the number of values yet to be measured, the lower right display shows the time remaining to the next recording.

The actual measured values are not shown between two recordings. They can be displayed by activating *EXE*, without interrupting the recording.

The recording can be ended at any time by activating *RES*.

The display *END* indicates the end of the recording. Activate *EXE* to return to the *Prep-Mode* or *RES* to directly access the *Mano-Mode*.

The starting and ending of the continuous, endless recording (see *Rec-Sel* and *Rec-Cont*) takes place the same way. Except that such a recording can only be ended with the command *RES*.



READ-OUT OF THE STORED VALUES (MANO RECORD ONLY)

DATA TRANSFER TO PC

(only with Logger-Option):

In order to transfer the data from the *Intelligent Manometer* into the PC, the special cable K101 and special software is required. The transfer of data is accomplished over the RS232 serial interface connected to rear socket of the *Intelligent Manometer*.

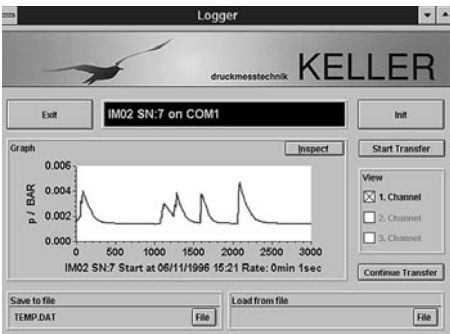
Attention: In hazardous areas, the connection to the interface (on the back side of the instrument) must not be plugged in or unplugged!

LOGGER 1.0 SOFTWARE

This software serves to transfer the data to a PC, offering many further processing possibilities of the read-out data.

The LOGGER-Software meets all the requirements of modern Windows-Software:

- Graphical Display
- Tabulated Display
- Export into other Windows-Programs



The transfer of the data always starts at the last recording and can be extended to read out the entire memory. The memory may be read out as many times as needed. A detailed manual for the LOGGER-Software is included when ordering with Logger-Option.

TIME ALLOCATION

After each recording the *Intelligent Manometer* writes the status of the *Manometer's* time meter into the memory. When transferring, the absolute time-axis is calculated from the time set in the PC, the time meter of the *Manometer* and the recorded time. The *Manometer* should therefore **not be turned off** between the recording and the transfer.

During the recording process, five additional recording locations for the storage of time are used for each complete recording cycle.

MEMORY

The function *REC* saves measured values into the memory of the *Intelligent Manometer*. New data is always archived after the last recorded value, continuously filling the memory. Since these instruments feature a ring-memory, new data will only overwrite the oldest data. This ensures that the maximum amount of most recent data is always at your disposal when the memory is full.

TOTAL STORAGE LOCATIONS

Standard: 900

Extended: 8000 (only with memory option)

RESTARTING THE INTELLIGENT MANOMETER

If the *Intelligent Manometer* program appears to be locked (the instrument will not respond to front key operations). This can be rectified by disconnecting the battery for a period of longer than 20 seconds. Follow the procedure for changing the battery. Then restart the instrument.

OVERFLOW/OVERPRESSURE LIMIT

The *Intelligent Manometer* displays the pressure until 5 to 10% above the rated pressure range. If this range is being exceeded, the display indicates "OVFL" (overflow). Do not increase the applied pressure any more!

If the pressure exceeds the indicated pressure range by more than 20%, the sensor may be destroyed.

BATTERY CHANGE

Turn the display ring beyond the limit stop. It will detach from the main housing. Remove the screws that hold the print for the batteries in place and change the batteries ensuring that the polarity of the batteries VARTA (2x CAAA 3 V Lithium 2 Ah) is correct. Set the display ring back in place.

Settings of *DISE*, *ZERO*, *RECS*, *SAVS* or *MECY* will be lost when the battery is disconnected. The *Intelligent Manometer* will revert to the original default/factory settings. This feature can be used to reset the instrument if necessary.

The *Intelligent Manometer* will not indicate a battery low. If the display starts to fade, it's an indication that the battery charge is weakening. At this point, we recommend changing the battery. The batteries can be acquired from KELLER.

After a battery change, it is possible that the recorded values cannot be interpreted correctly by the Logger-Software! We therefore recommend that all data is downloaded and safely stored on a PC before changing the battery.

SERVICE

KELLER Digital Manometers are maintenance-free. The cycle for recalibration depends on the application conditions. Recommended recalibration cycle: 1 year.

SAFETY INSTRUCTIONS

When installing and operating the digital manometer, attention should be paid to the corresponding national safety regulations and to the relative country regulations concerning the Ex-application.

Only mount the digital manometer onto unpressurized systems.

On pressure ranges > 30 bar, the pressure connections could show residual hydraulic oil.

Also note the corresponding data sheet.

Please note that temperatures outside of 0...50 °C could impair the readability of the display.

SPECIAL CONDITIONS FOR SAFE USE IN HAZARDOUS APPLICATIONS

The Intelligent Manometer is an "intrinsically safe apparatus"; it can be mounted in explosive atmospheres.

When the apparatus is mounted in dangerous area, equipment must not be connected to the terminal block.

When the apparatus is mounted in non dangerous area, the terminal block can be only connected to a certified intrinsically safe equipment which the electrical parameters do not exceed the following values:

$$U \leq 6,5 \text{ V} \quad I \leq 100 \text{ mA}$$

Operating ambient temperature:

$$T5: -10 \text{ °C to } +80 \text{ °C} \quad T6: -10 \text{ °C to } +65 \text{ °C}$$

TECHNICAL DATA

Total Accuracy of displayed Pressure ⁽¹⁾	typ. $\pm 0,1\%$ FS, ± 1 Digit (at 20 °C) max. $\pm 0,2\%$ FS, ± 1 Digit (from 0...50 °C)
Overpressure	FS + 20 %
Measurement Cycle	1 Measurement per Second
Displayed Temperature	Temperature of Reference Sensor in °C
Storage Temperature	-20...60 °C
Operating Temperature	0...50 °C
Compensated Temperature Range	0...50 °C
Air Humidity	5...95 % Relative Humidity
Memory	900 Storage Places (8'000 optional)
Power Supply of Electronics	2 x VARTA CRAA 3 V Lithium 2 Ah (or acc. EN 50020)
Battery-Life	> 200 Days at Continuous Operation
Total Weight, including Batteries	270 g
Media Compatibility	Pressure Transducer: Stainless Steel Diaphragm.
Protection	IP 65

(1) Includes linearity, repeatability, hysteresis, temperature error and resolution of the display

DECLARATION OF CONFORMITY

Herewith we declare, that the following products...



**Intrinsically Safe Digital Manometer
"Mano Gauge / Mano Record MR01"**

meet the basic requirements, which are established in the guidelines of the European Community:

Directive EMC 89/336/EEC
Directive ATEX 94/9/CE

As criteria, the following norms for this Intrinsically Safe Manometer are applied...

EN - 50081 - 1 / EN - 50081 - 2
EN - 50082 - 1
EN - 50014 (1997)
EN - 50020 (1994)

and the EC examination certificate under LCIE 01 ATEX 6001 X is given.

This declaration is given for the manufacturer

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CH-8404 Winterthur

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Jestetten, 31.1.02

H. W. Keller
Geschäftsführer / CEO

(with legally effective signature)

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