microsonic

Operating Manual

Ultrasonic proximity switch with one switching output and IO-Link

pico+15/TF/F
pico+25/TF/F
pico+35/TF/F
pico+100/TF/F

Product description

The pico+ sensor offers a non-contact measurement of the distance to an object which must be positioned within the sensor's detection zone. The switching output is set conditional upon the adjusted detect distance.
The ultrasonic transducer surface of the pico+ sensors is laminated with a PTFE film. The transducer itself is sealed against the housing by a joint ring. This composition permits measurement in up to 0.5 bar over pressure. Via the Teach-in procedure, the detect distance and operating mode can be adjusted. Two LEDs indicate the state of the switching output.

IO-Link

The pico+ sensor is IO-Link-capable in accordance with IO-Link specification V1.1 and supports Smart Sensor Profile like Digital Measuring Sensor. The sensor can be monitored and parameterised via IO-Link.

Safety Notes

- Read the operating manual prior to start-up.
- Connection, installation and adjustments may only be carried out by qualified staff.
- No safety component in accordance with the EU Machine Directive, use in the area of personal and machine protection not permitted.

Proper Use

pico+ ultrasonic sensors are used for non-contact detection of objects.

Installation

➔ Mount the sensor at the place of fitting.
For the pico+100/TF/F/A we recommend not to use for mounting the first 5 mm of the M22 thread on the side of the transducer.
➔ Connect a connection cable to the M12 device plug, see Fig. 1.

		colour
1	$+U_B$	brown
3	$-U_B$	blue
4	F	black
2	–	white
5	Com	grey

Fig. 1: Pin assignment with view onto sensor plug and colour coding of the microsonic connection cables

Start-up

➔ Connect the power supply.
➔ Carry out sensor adjustment in accordance with Diagram 1.

Factory setting

- Detect point operation
- Switching output on NOC
- Detect distance at operating range
- Input »Com« set to »Teach-in«
- Filter at F01
- Filter strength at P00

Operating modes

Three operating modes are available for the switching output:

- **Operation with one switching point**
  The switching output is set when the object falls below the set switching point.
- **Window mode**
  The switching output is set when the object is within the window limits.
- **Two-way reflective barrier**
  The switching output is set when the object is between sensor and fixed reflector.

Synchronisation

If the assembly distance of multiple sensors falls below the values shown in Fig. 2, the internal synchronisation should be used (»Sync« must be switched on, see Diagram 1). For this purpose set the switching output of all sensors in accordance with Diagram 1. Finally interconnect each pin 5 of the sensors to be synchronised.

pico+15...	≥0.25 m	≥1.30 m
pico+25...	≥0.35 m	≥2.50 m
pico+35...	≥0.40 m	≥2.50 m
pico+100...	≥0.70 m	≥4.00 m

Fig. 2: Assembly distances.

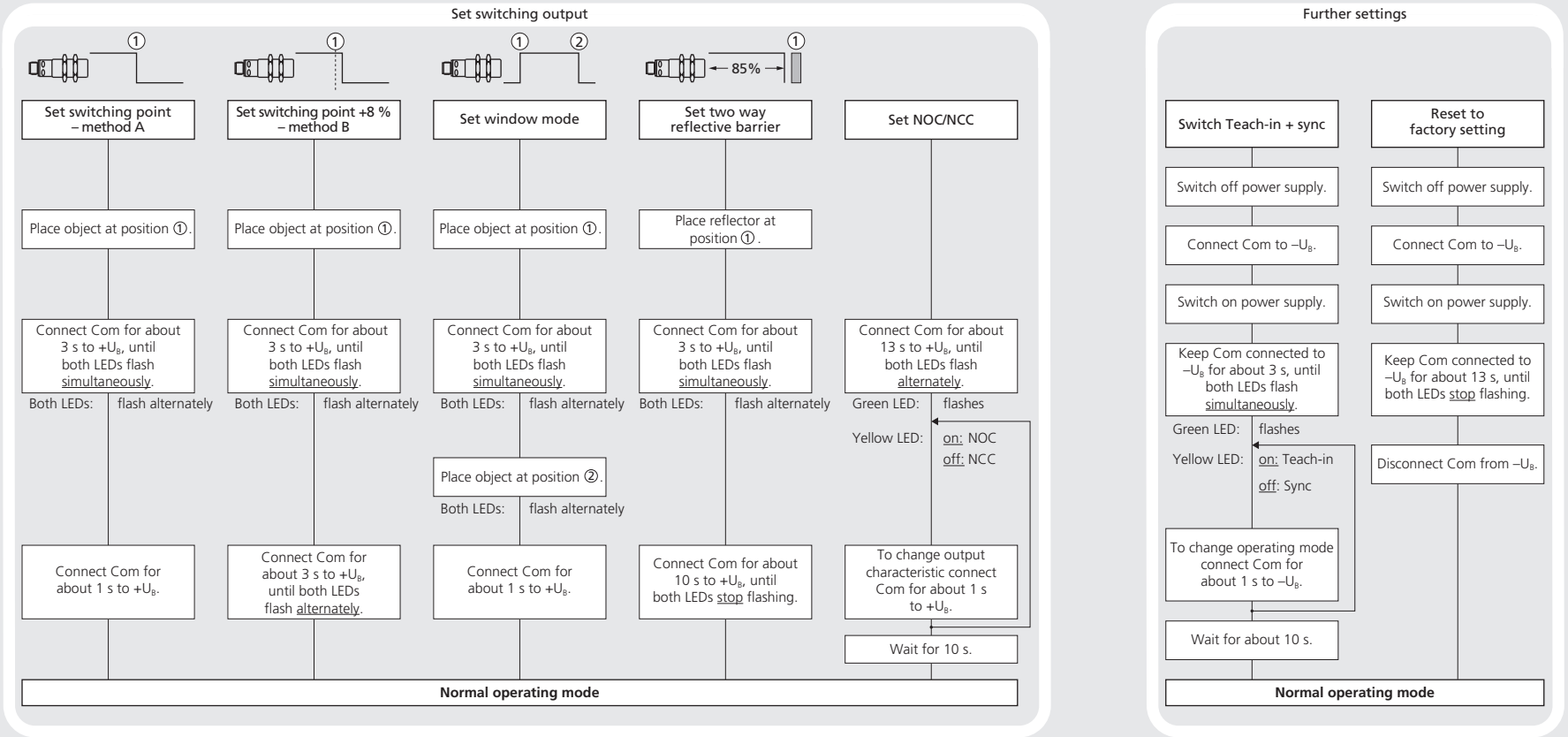
Maintenance

microsonic sensors are maintenance-free. In case of excess caked-on dirt we recommend cleaning the white sensor surface.

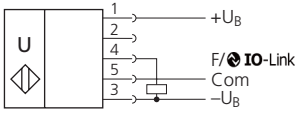
Notes

- The sensors of the pico+ family have a blind zone, within which a distance measurement is not possible.
- The pico+ sensors are equipped with an internal temperature compensation. Due to the sensors self heating, the temperature compensation reaches its optimum working-point after approx. 120 seconds of operation.
- In the normal operating mode, an illuminated yellow LED signals that the switching output is switched through.
- The pico+ sensors have a push-pull switching output.
- In the »Two-way reflective barrier« operating mode, the object has to be within the range of 0-85 % of the set distance.
- In the »Set detect point – method A« Teach-in procedure the actual distance to the object is taught to the sensor as the detect point. If the object moves towards the sensor (e.g. with level control) then the taught distance is the level at which the sensor has to switch the output (see Fig. 3).

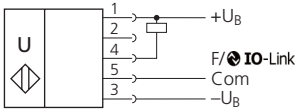
Diagram 1: Set sensor parameters via Teach-in procedure



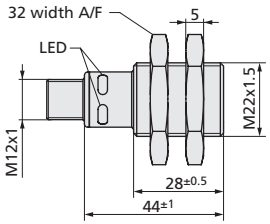
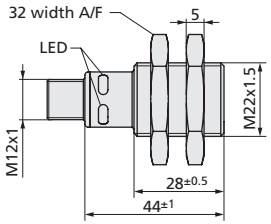
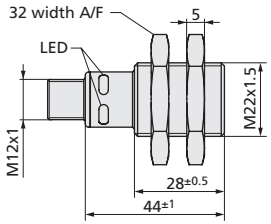
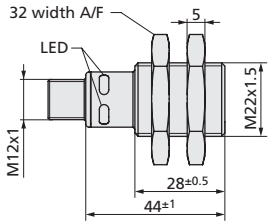
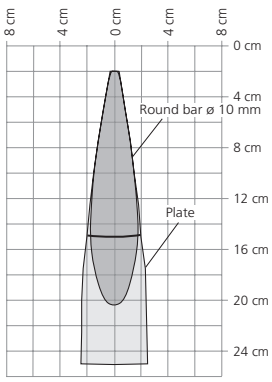
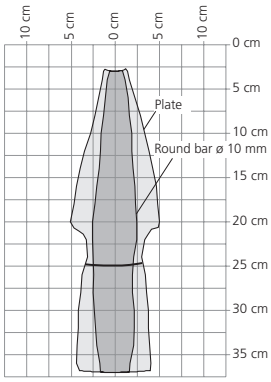
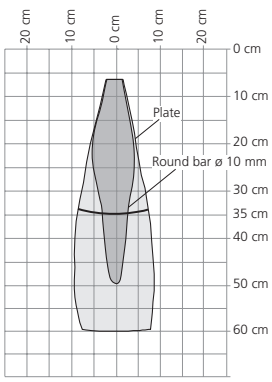
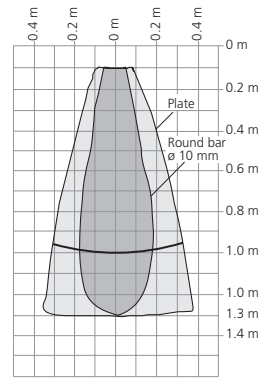
Technichal data



Push-Pull output in pnp circuit



Push-Pull output in npn circuit

	pico+15...	pico+25...	pico+35...	pico+100..
				
blind zone	20 mm	30 mm	70 mm	120 mm
operating range	150 mm	250 mm	350 mm	1,000 mm
maximum range	250 mm	350 mm	600 mm	1,300 mm
angle of beam spread	see detection zone	see detection zone	see detection zone	see detection zone
transducer frequency	380 kHz	320 kHz	400 kHz	200 kHz
resolution	0.069 mm	0.069 mm	0.069 mm	0.069 mm
reproducibility	±0.15 %	±0.15 %	±0.15 %	±0.15 %
detection zones for different objects: The dark grey areas represent the zone where it is easy to recognise the normal reflector (round bar). This indicates the typical operating range of the sensors. The light grey areas represent the zone where a very large reflector – for instance a plate – can still be recognised. The requirement here is for an optimum alignment to the sensor. It is not possible to evaluate ultrasonic reflections outside this area.				
accuracy	±1 % (temperature drift internally compensated)	±1 % (temperature drift internally compensated)	±1 % (temperature drift internally compensated)	±1 % (temperature drift internally compensated)
operating voltage U_B	10 to 30 V DC, reverse polarity protection	10 to 30 V DC, reverse polarity protection	10 to 30 V DC, reverse polarity protection	10 to 30 V DC, reverse polarity protection
voltage ripple	±10 %	±10 %	±10 %	±10 %
no-load current consumption	<40 mA	<40 mA	<40 mA	<40 mA
ambient pressure	up to 0.5 bar over pressure	up to 0.5 bar over pressure	up to 0.5 bar over pressure	up to 0.5 bar over pressure
housing	plastic parts: PVDF, PBT; ultrasonic transducer: PTFE, FFKM	plastic parts: PVDF, PBT; ultrasonic transducer: PTFE, FFKM	plastic parts: PVDF, PBT; ultrasonic transducer: PTFE, FFKM	plastic parts: PVDF, PBT; ultrasonic transducer: PTFE, FFKM
weight	30 g	30 g	30 g	30 g
class of protection per EN 60529	IP 67	IP 67	IP 67	IP 67
norm conformity	EN 60947-5-2	EN 60947-5-2	EN 60947-5-2	EN 60947-5-2
type of connection	5-pin M12 circular plug	5-pin M12 circular plug	5-pin M12 circular plug	5-pin M12 circular plug
max. tightening torque of nuts	1 Nm	1 Nm	1 Nm	1 Nm
controls	Teach-in via pin 5 (Com)	Teach-in via pin 5 (Com)	Teach-in via pin 5 (Com)	Teach-in via pin 5 (Com)
programmable	Teach-in, LinkControl, IO-Link	Teach-in, LinkControl, IO-Link	Teach-in, LinkControl, IO-Link	Teach-in, LinkControl, IO-Link
indicators	LED green, LED yellow	LED green, LED yellow	LED green, LED yellow	LED green, LED yellow
synchronisation	internal synchronisation up to 10 sensors	internal synchronisation up to 10 sensors	internal synchronisation up to 10 sensors	internal synchronisation up to 10 sensors
operating temperature	–25 to +70 °C	–25 to +70 °C	–25 to +70 °C	–25 to +70 °C
storage temperature	–40 to +85 °C	–40 to +85 °C	–40 to +85 °C	–40 to +85 °C
switching hysteresis [1]	2 mm	3 mm	5 mm	20 mm
switching frequency [1]	25 Hz	25 Hz	12 Hz	10 Hz
response time [1]	32 ms	32 ms	64 ms	80 ms
time delay before availability [1]	<300 ms	<300 ms	<300 ms	<300 ms
switching output	Push-Pull, U_B –3 V, –U_B +3 V, I_{max} = 100 mA switchable NOC/NCC, short-circuit-proof	Push-Pull, U_B –3 V, –U_B +3 V, I_{max} = 100 mA switchable NOC/NCC, short-circuit-proof	Push-Pull, U_B –3 V, –U_B +3 V, I_{max} = 100 mA switchable NOC/NCC, short-circuit-proof	Push-Pull, U_B –3 V, –U_B +3 V, I_{max} = 100 mA switchable NOC/NCC, short-circuit-proof
order no.	**pico+15/TF/F/A**	**pico+25/TF/F/A**	**pico+35/TF/F/A**	**pico+100/TF/F/A**

[1] Can be programmed via LinkControl and IO-Link.

- If the object to be scanned moves into the detection area from the side, the »Set detect point +8 % – method B« Teach-in procedure should be used. In this way the switching distance is set 8 % further than the actual measured distance to the object. This ensures a reliable switching distance even if the height of the objects varies slightly (see Fig. 3).

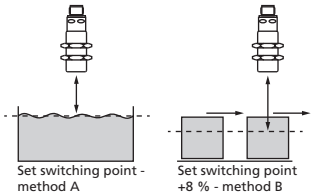


Fig. 3: Setting the switching point for different directions of movement of the object

- If synchronization is activated the Teach-in is disabled (see »Further settings«).
- The sensor can be reset to its factory setting (see »Further settings«).
- Using the LinkControl adapter (optional accessory) and the LinkControl software for Windows®, all Teach-in and additional sensor parameter settings can be optionally adjusted.
- The latest IODD file and informations about start-up and configuration of pico+ sensors via IO-Link, you will find online at: www.microsonic.de/en/pico+

IO-Link mode

IO-Link mode
The pico+ sensors are IO-Link capable in accordance with IO-Link specification V1.0.

Notes
- In IO-Link mode Teach-in, LinkControl and synchronisation via pin 5 are not available.
- In IO-Link mode, pin 5 must not be connected to any potential.

➔ For current information about IO-Link please contact the microsonic sales department.

Synchronisation in IO-Link mode
In IO-Link mode each sensor is synchronised on the protocol of the IO-Link master. In multiple sensor operation the sensors are synchronous if the master protocols are synchronous.

Process data
The pico+ cyclically transmits the measured distance value with a resolution of 0,1 mm and the state of the switching output.

Service data
The following sensor parameters may be set via IO-Link interface using the IO-Link device description (IODD).

Detect point 1
The switching output is activated when the distance to an object is under that of the present detect point.

Return detect point 1
The switching output is reactivated when the distance to an object is greater than the present return detect point (detect point + hysteresis).

Note
The return detect point 1 must always be greater than the detect point 1.

Detect point 2, return detect point 2
By programming these two detect distances the window mode is activated.

Note
The return detect point 2 must always be smaller than the detect point 2.

NOC/NCC operation
The NCC or NOC output function can be present for the switching output.

Measurement filter
pico+ ultrasonic sensors provide for a choice of 3 filter settings:
- F00:
  No filter, each ultrasonic measurement acts in an unfiltered manner on the output.
- F01:
  Standard filter, on the object continuously approaching the sensor, the ongoing interval is immediately taken on and the output correspondingly activated. The effect of the object abruptly moving away from the sensor is for the existing distance to be saved for a retaining time dependent on the filter strength and for the switching output state to be maintained.
- F02:
  Average value filter, forms the arithmetic mean across a number of measurements. The output is activated in keeping with the average value. The number of measurements, from which the average value is formed, depends on the selected filter strength.

Filter strength
A filter strength between 0 (weak filter effect) and 9 (pronounced filter effect) can be selected for each measurement filter.

Foreground suppression
Spurious reflections, caused by objects in the foreground of the sensor, may be blocked out by the foreground suppression.

Notes
➔ Check that the object in the foreground does not cause multiple reflections.

➔ Make sure that the sensor is not covered by the interfering object to such an extent that the detection range is influenced.

System commands
With 4 system commands the following settings may be carried out:
- Teach-in detect point – method A
- Teach-in detect point – method B
- Teach-in two way reflective barrier
- Reset sensor to factory settings

Notes
To achieve the maximum resolution the Master Cycle Time has to comply with the following requirements:
- Min Cycle Time ≤ Master Cycle Time ≤ Min Cycle Time + 1.2 ms.
- If this condition can not be fullfilled, sporadic discontinuities of the measurement value can occur. In this case the Master Cycle Time has to be increased in 400 µs steps until the discontinuities of the measurement disappear.

Note
If the pico+ sensor was set using Teach-in or LinkControl it is recommended to reset the sensor to the factory setting prior to using it in IO-Link mode (see »Further settings«).

IODD file
- The latest IODD file you will find on the internet under www.microsonic.de/en/IODD.
- For further informations on IO-Link see www.io-link.com.

IO-Link data

	pico+15...				pico+25...				pico+35...				pico+100..			
physical layer																
SIO mode support	yes				yes				yes				yes			
min cycle time	8.4 ms				8.4 ms				16 ms				20.4 ms			
baud rate	COM 2 (38.400 Bd)				COM 2 (38.400 Bd)				COM 2 (38.400 Bd)				COM 2 (38.400 Bd)			
format of process data	16 Bit, R, UNI16				16 Bit, R, UNI16				16 Bit, R, UNI16				16 Bit, R, UNI16			
content of process data	Bit 0: state of switching output; Bit 1-15: distance value with 0.1 mm resolution				Bit 0: state of switching output; Bit 1-15: distance value with 0.1 mm resolution				Bit 0: state of switching output; Bit 1-15: distance value with 0.1 mm resolution				Bit 0: state of switching output; Bit 1-15: distance value with 0.1 mm resolution			
service data IO-Link specific	**index**		**access**	**value**	**index**		**access**	**value**	**index**		**access**	**value**	**index**		**access**	**value**
Vendor name	0x10		R	microsonic GmbH	0x10		R	microsonic GmbH	0x10		R	microsonic GmbH	0x10		R	microsonic GmbH
Vendor text	0x11		R	www.microsonic.de	0x11		R	www.microsonic.de	0x11		R	www.microsonic.de	0x11		R	www.microsonic.de
Product name	0x12		R	pico+	0x12		R	pico+	0x12		R	pico+	0x12		R	pico+
Product ID	0x13		R	15/F;15/WK/F	0X13		R	25/F;25/WK/F	0X13		R	35/F;35/WK/F	0X13		R	100/F;100/WK/F
Product text	0x14		R	Ultraschall-Sensor	0x14		R	Ultraschall-Sensor	0x14		R	Ultraschall-Sensor	0x14		R	Ultraschall-Sensor
service data sensor specific	**index**	**format**	**access**	**range (dez)**	**index**	**format**	**access**	**range (dez)**	**index**	**format**	**access**	**range (dez)**	**index**	**format**	**access**	**range (dez)**
detect point 1	0x40	UINT16	R/W	306-3,609 (21-248 mm) [1]	0x40	UINT16	R/W	436-5,065 (30 - 348 mm) [1]	0x40	UINT16	R/W	946-8,704 (65 - 598 mm) [1]	0x40	UINT16	R/W	1,747-18,892 (120 - 1,298 mm) [1]
return detect point 1	0x41	UINT16	R/W	320-3,624 (22-249 mm) [1]	0x41	UINT16	R/W	451-5,080 (31 - 349 mm) [1]	0x41	UINT16	R/W	961-8,718 (66 - 599 mm) [1]	0x41	UINT16	R/W	1,761-18,907 (121 - 1,299 mm) [1]
detect point 2	0x47	UINT16	R/W	335-65,512 (23 - 250 mm) [1] > 3,638: window mode deactivated	0x47	UINT16	R/W	466-65,512 (32 - 350 mm) [1] > 5,094: window mode deactivated	0x47	UINT16	R/W	975-65,512 (67 - 600 mm) [1] > 8,733: window mode deactivated	0x47	UINT16	R/W	1,776-65,512 (122 - 1,300 mm) [1] > 18,922: window mode deactivated
return detect point 2	0x48	UINT16	R/W	320-65,512 (22 - 250 mm) [1] > 3.638: window mode deactivated	0x48	UINT16	R/W	451-65,512 (31 - 349 mm) [1] > 5,094: window mode deactivated	0x48	UINT16	R/W	961-65,512 (66 - 599 mm) [1] > 8,733: window mode deactivated	0x48	UINT16	R/W	1,761-65,512 (121 - 1,299 mm) [1] > 18,922: window mode deactivated
switching mode	0x42	UINT8	R/W	00: NCC, 02: NOC	0x42	UINT8	R/W	00: NCC, 02: NOC	0x42	UINT8	R/W	00: NCC, 02: NOC	0x42	UINT8	R/W	00: NCC, 02: NOC
filter	0x43	UINT8	R/W	00-02: F00 - F02	0x43	UINT8	R/W	00-02: F00 - F02	0x43	UINT8	R/W	00-02: F00 - F02	0x43	UINT8	R/W	00-02: F00 - F02
filter strength	0x44	UINT8	R/W	00-09: P00 - P09	0x44	UINT8	R/W	00-09: P00 - P09	0x44	UINT8	R/W	00-09: P00 - P09	0x44	UINT8	R/W	00-09: P00 - P09
foreground suppression	0x49	UINT16	R/W	0-1,878 (0-129 mm) [1]	0x49	UINT16	R/W	0-3,246 (0-223 mm) [1]	0x49	UINT16	R/W	0-4,236 (0-291 mm) [1]	0x49	UINT16	R/W	0-12,969 (0-891 mm) [1]
Teach-in via Pin 5 in SIO mode	0x4A	UINT8	R/W	00: deactivated, 16: activated	0x4A	UINT8	R/W	00: deactivated, 16: activated	0x4A	UINT8	R/W	00: deactivated, 16: activated	0x4A	UINT8	R/W	00: deactivated, 16: activated
system commands	**index**		**access**	**value**	**index**		**access**	**value**	**index**		**access**	**value**	**index**		**access**	**value**
Teach-in detect point – method A	0x02		W	161	0x02		W	161	0x02		W	161	0x02		W	161
Teach-in detect point – method B	0x02		W	162	0x02		W	162	0x02		W	162	0x02		W	162
Teach-in two way reflective barrier	0x02		W	164	0x02		W	164	0x02		W	164	0x02		W	164
reset to factory settings	0x02		W	168	0x02		W	168	0x02		W	168	0x02		W	168

[1] Distance values, e.g. detect points, are given as multiple of the internal resolution of the measurement value = 0,069 mm (example: 320 ≙ 22 mm). The values in the table are decimal.

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