



KÖHLER

ELEKTRİK SAYAÇLARI SAN.ve TİC. A.Ş.

AEL.KC.020

AEL.KC.021

AEL.KC.020-1

AEL.KC.021-1

**THREE-PHASE ACTIVE REACTIVE AND
CAPACITIVE**

**ELECTRONIC ELECTRICITY METER
INTRODUCTION AND USER MANUAL**

CE 1783

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0. INTRODUCTION

This manual describes the technical data of the electronic electricity meters produced with advanced technology in compliance with the Technical Specification for Electronic Electricity Meters (TEDAŞ-MLZ/2017-062.B) issued by the Strategy Development Department of Türkiye Elektrik Dağıtım A.Ş. (TEDAŞ) and with Measuring Instruments Directive 2014/32/EU (MID) published by the EU under the new approach legislation. These meters measure active/reactive electrical energy and maximum demand, show these data on the LCD display, store the required data and programs in memory and allow them to be accessed on request.

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CAUTION!

READ THIS USER MANUAL CAREFULLY BEFORE INSTALLING THE METER.

- ✓ The meter must be installed only by **qualified expert personnel**.
- ✓ During installation, **live parts** must never be touched.
- ✓ During installation and removal of the meter, **the power must always be switched off**.
- ✓ KÖHLER Electronic Meters are a high-technology product. All technical data and documents are company property and may not be copied or used by third parties.
- ✓ This booklet provides summary information about the meter.
- ✓ Expert personnel must check that the meter type to be used suits the network and the installation. Otherwise the wrong meter selection or connection will damage your meter. **Meters in this condition are not covered by the warranty.**
- ✓ The information shown on the meter display is determined by TEDAŞ.
- ✓ Meter parameter settings and maintenance cannot be carried out by the user. Meter parameter settings and maintenance are performed only by authorised TEDAŞ personnel.

1. METER TECHNICAL SPECIFICATIONS

Meter Description	3-Phase, 4-Wire, 4-Tariff, Demand-Metering, Outdoor, Active– Reactive - Capacitive Electronic Electricity Meter	
Model Name	AEL.KC.020 AEL.KC.020-1	AEL.KC.021 AEL.KC.021-1
Uni- / Bi-directional	Uni-directional	Bi- or Uni-directional
Accuracy Class	Active: B or C, Reactive: 2 or 1	Active: B or C, Reactive: 2 or 1
Connection Type	Current and Voltage: Direct	
Reference Voltage (Un)	3x230/400 V	
Operating Voltage Range	3x35V / 60V (Minimum) - 3x420V / 727V (Maximum)	
Reference Frequency (Fn)	50 Hz ±5%	
Starting Current (Ist)	0.02A (0.04.Itr)	
Minimum Current (Imin)	0.15A	
Transitional Current (Itr)	0.5A	
Reference Current (In/Ib)	5A	
Maximum Current (Imax)	100A	
IP Class	IP54 (Outdoor)	
Protection Class	Two (2)	
Relative Humidity	95%	
Operating Temperature	-40 °C, +70 °C (3K7)	
Mechanical Environment	M1 (according to Directive 2014/32/EU)	
Electromagnetic Environment	E2 (according to Directive 2014/32/EU)	
Operating Environment	Non-condensing humidity	
Voltage Circuit Consumption	≤ 1W	
Current Circuit Power Consumption	≤ 1VA	
ESD Voltage Withstand	Contact: 8 kV; Air: 15 kV	
Impulse Voltage	6 kV	
LED Pulse Output	3 LEDs (Active, Inductive, Capacitive)	
Meter Constant (imp/kWh - imp/kvarh)	1,000 imp.	
LCD Display	6+3 Digits	
Optical Port	Yes (IEC 62056-21)	
RS485	Yes	
Communication Speed	300 - 19,200 Baud	
System Battery Life	≥ 10 years	
Real-Time Clock Battery Life	≥ 10 years	
Meter Shelf Life	≥ 4 years	
Clock Accuracy	0.5 s/day (at room temperature) (IEC-EN 61038)	
Data Storage Capacity	2 Years	
Relevant Standards	TS EN 50470-1, TS EN 50470-3, TS EN 62053-23	

Meter Error Limit under Reference Conditions (Active)

Current Range	Power Factor	Error Limit (%)	
		Class B	Class C
$I_{min} \leq I < I_{tr}$	1	± 1.5	± 1.0
$I_{tr} \leq I \leq I_{max}$	0.5 ind....1.....cap 0.8	± 1	± 0.5

Meter Error Limit under Reference Conditions (Reactive)

Current Range		Sin ϕ (Inductive or Capacitive)	Error Limit (%) (Class 2)
Directly connected meters	Transformer- connected meters		
$0.05 I_b \leq I < 0.1 I_b$	$0.02 I_n \leq I < 0.05 I_n$	1	± 2.5
$0.1 I_b \leq I \leq I_{max}$	$0.05 I_n \leq I < I_{max}$	1	± 2.0
$0.1 I_b \leq I < 0.2 I_b$	$0.05 I_n \leq I < 0.1 I_n$	0.5	± 2.5
$0.2 I_b \leq I \leq I_{max}$	$0.1 I_n \leq I \leq I_{max}$	0.5	± 2.0
$0.2 I_b \leq I \leq I_{max}$	$0.1 I_n \leq I \leq I_{max}$	0.25	± 2.5

2. MAIN FUNCTIONS

2.1. Measurement: The meter measures total active and reactive energy and demand across 4 tariffs.

2.2. Programming the Meter: Time zones and tariffs can be programmed. Eight time zones can be defined per day and each can be mapped to one of the 4 tariffs. Separate tariffs can also be set for weekdays, Saturdays and Sundays. Once the terminal cover has been opened, the date, time and tariff data can be changed only by authorised TEDAŞ personnel.

2.3. Reading the Meter: 24 months of billing data, total energy consumed, terminal cover opening data, 24 months of demand data and the main cover first opening date can be read from the meter via the optical port or the RS485 output.

2.4. Self-Diagnostics Feature: The meter constantly checks its internal circuits and shows fault types on the display. Fault indications are explained under "LCD DISPLAY INFORMATION".

2.5. Terminal Cover and Main Cover Open/Close Recording Feature: If the main cover is opened, the first opening date is recorded. If the terminal cover is opened, the first opening date of each month and the total number of openings that month are recorded. Cover opening dates and counts are kept in memory for the last 24 months.

2.6. Signal Output: LEDs on the meter indicate the active and reactive energy consumed. The number of flashes gives the meter's Imp/kWh and Imp/kVarh values.

1,000 Imp/kWh or Imp/kVarh : 1,000 flashes = 1kWh or 1kVarh

10,000 Imp/kWh or Imp/kVarh : 10,000 flashes = 1kWh or 1kVarh

2.7. Operating the Display During a Power Cut: When the power is cut, the required data can be called up on the LCD with the meter call button and read from the optical port.

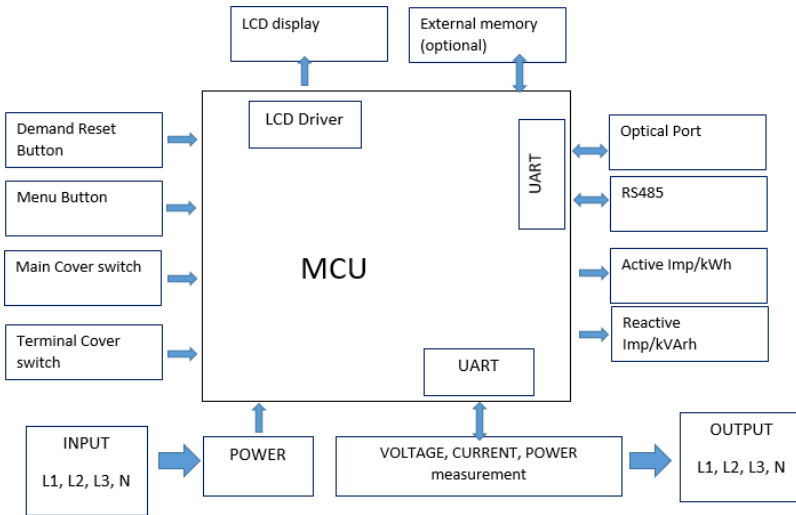
2.8. Communication: Data read through the optical port with an optical reader is transferred to a portable computer (handheld unit). The RS485 output supplied as standard on all combi meters also allows remote access to the meter data. The meter can use the optical port and RS485 output at the same time. No reading is possible from RS485 without power.

3. METER STRUCTURE AND OPERATING PRINCIPLE

3.1. Meter Structure

The meter body and covers are fully sealed to the IP54 Outdoor standard and made of high-grade flame-retardant plastic. All electronic components are mounted on a PCB fitted into the meter body. After factory calibration the main cover is screwed down and secured with the main cover seal. The terminal cover is sealed by authorised TEDAŞ personnel after the meter is installed.

3.2. Meter Block Diagram



4. OPERATING THE METER

Once the meter is installed and energised, it operates normally and the LCD display is activated.

4.1. Checking the Functions

When the meter is installed the electrical connections must be checked for correctness. Once the meter is correctly mounted, the terminal cover screw is tightened. The flashing 2nd lock symbol on the LCD will disappear after the first reading. If not, the terminal cover is not fitted properly or its screw is not tight.

4.2. Operation of the LCD Display

When the meter starts up, automatic menu mode is activated. Each menu of the mode stays on the display for 5 seconds and then moves automatically to the next information menu. When the button on the meter is pressed, button menu mode is activated. If no key is pressed for 30 seconds, the meter returns to automatic menu mode.

Holding the meter call button for 5 seconds activates the sub-menus. This menu generally contains data from previous months. Press the call button for 5 seconds again to return to the button menu.

5. LCD DISPLAY INFORMATION



The symbols and information on the LCD display are defined as follows:



Main Cover Open (lock no. 1)

This symbol shows the main cover opening status. If it flashes while the cover is closed, the cover has been opened before. If it is shown steadily, the main cover is open.



Terminal Cover Open (lock no. 2)

This symbol shows the terminal cover opening status. If it flashes while the cover is closed, the cover has been opened before. If it is shown steadily, the cover is open. The symbol disappears once the meter has been read via the optical port.



Clock Error: This symbol appears if the clock is not working normally.



System Battery: This symbol appears if the system battery voltage is low.



Clock Battery: This symbol appears if the clock battery voltage is low.



Shows whether phase R (L1), S (L2) and T (L3) are present. For example, if phase R has no voltage, only L2 L3 appears. If the L1 L2 L3 symbols all flash together, the phase sequence is wrong. The arrows above the phase icons show the direction of energy flow.



Magnetic field warning icon.



Indicates the current tariff. For example, if the current date/time falls within tariff T2, T2 is shown on the display. In the event of any fault in the meter clock, T1 is always active.



Reverse current direction warning icon for uni-directional meters.



Lights up to show data transfer while the meter is being read via the optical port or RS485. The indicator disappears when the reading ends.



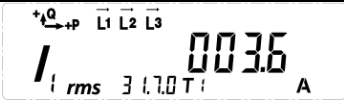
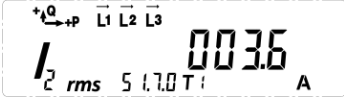
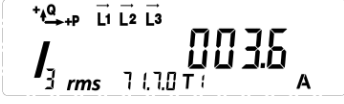
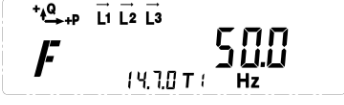
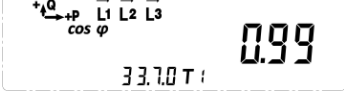
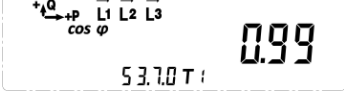
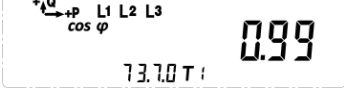
Indicates the characteristic of the energy flow in the system. For example, if energy flows from phase R in +P and +Q, from phase S in +P, and from phase T in +P and -Q, the arrows on the display will appear as shown.

5.1 Display List Example

Meter Date (YYYY-MM-DD)	
Meter Time (HH:MM:ss)	
Imported Active Energy, Total (+T)	
Imported Active Energy, Tariff 1 (+T1)	
Imported Active Energy, Tariff 2 (+T2)	
Imported Active Energy, Tariff 3 (+T3)	
Imported Active Energy, Tariff 4 (+T4)	
Exported Active Energy, Total (-T)	
Exported Active Energy, Tariff 1 (-T1)	

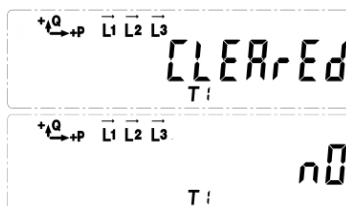
Exported Active Energy, Tariff 2 (-T2)	
Exported Active Energy, Tariff 3 (-T3)	
Exported Active Energy, Tariff 4 (-T4)	
Imported Inductive Reactive Energy (+Ri)	
Imported Capacitive Reactive Energy (+Rc)	
Exported Inductive Reactive Energy (-Ri)	
Exported Capacitive Reactive Energy (-Rc)	
Imported Active Maximum Demand (+P)	
Imported Active Maximum Demand (+P) Date (YYYY-MM-DD)	
Imported Active Maximum Demand (+P) Time (HH:MM)	
Exported Active Maximum Demand (-P)	

Exported Active Maximum Demand (-P) Date (YYYY-MM-DD)	$\begin{matrix} +I_0 \rightarrow +P & \overline{L1} & \overline{L2} & \overline{L3} \\ -P & 20230101 \\ 2.6.0 T1 \end{matrix}$
Exported Active Maximum Demand (-P) Time (HH:MM).	$\begin{matrix} +I_0 \rightarrow +P & \overline{L1} & \overline{L2} & \overline{L3} \\ -P & 12:08 \\ 2.6.0 T1 \end{matrix}$
Meter Serial Number	$\begin{matrix} +I_0 \rightarrow +P & \overline{L1} & \overline{L2} & \overline{L3} \\ 020043210 \\ 0.0.0 T1 \end{matrix}$
Main Cover Opening Date	$\begin{matrix} +I_0 \rightarrow +P & \overline{L1} & \overline{L2} & \overline{L3} \\ 20220302 \\ 96.70 T1 \end{matrix}$
Main Cover Opening Time	$\begin{matrix} +I_0 \rightarrow +P & \overline{L1} & \overline{L2} & \overline{L3} \\ 12:08 \\ 96.70 T1 \end{matrix}$
Terminal Cover Opening Date	$\begin{matrix} +I_0 \rightarrow +P & \overline{L1} & \overline{L2} & \overline{L3} \\ 20220302 \\ 96.71 T1 \end{matrix}$
Terminal Cover Opening Time	$\begin{matrix} +I_0 \rightarrow +P & \overline{L1} & \overline{L2} & \overline{L3} \\ 12:08 \\ 96.71 T1 \end{matrix}$
Software Version Number	$\begin{matrix} +I_0 \rightarrow +P & \overline{L1} & \overline{L2} & \overline{L3} \\ v0.100 \\ 0.2.0 T1 \end{matrix}$
Phase L1 Instantaneous Voltage	$\begin{matrix} +I_0 \rightarrow +P & \overline{L1} & \overline{L2} & \overline{L3} \\ V_{rms} & 230.4 & V \\ 32.7.0 T1 \end{matrix}$
Phase L2 Instantaneous Voltage	$\begin{matrix} +I_0 \rightarrow +P & \overline{L1} & \overline{L2} & \overline{L3} \\ V_{rms} & 230.4 & V \\ 52.7.0 T1 \end{matrix}$
Phase L3 Instantaneous Voltage	$\begin{matrix} +I_0 \rightarrow +P & \overline{L1} & \overline{L2} & \overline{L3} \\ V_{rms}^{cos \varphi} & 230.4 & V \\ 72.7.0 T1 \end{matrix}$

Phase L1 Instantaneous Current	
Phase L2 Instantaneous Current	
Phase L3 Instantaneous Current	
Grid Frequency	
Phase L1 Cosφ	
Phase L2 Cosφ	
Phase L3 Cosφ	

Manual Demand Reset Procedure:

A demand reset is performed by holding the Red Demand Reset Button on the meter for 3 seconds. It can be done only once a month. If successful, the display shows “CLEARED”. If a reset has already been made that month, “NO” appears. If no manual reset is made during the month, at month end the meter will carry out this operation automatically.

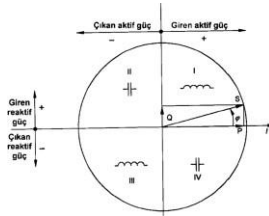


6. LOAD PROFILE

The meter can record a load profile for the past 180 days at 15-minute intervals. The recorded information is as follows.

- Index (indicates the position of the packet).
- Year-month-day-hour-minute
- Event records
- Imported Active Energy, Exported Active Energy, Imported Inductive Energy, Exported Inductive Energy, Imported Capacitive Energy, Exported Capacitive Energy (for each tariff)
- Maximum RMS Voltage, Minimum RMS Voltage (for each phase)
- RMS Current (for each phase)
- $\cos\phi$
- Frequency

Geometric Representation of Active and Reactive Power:



Note 1 – The diagram complies with IEC 60375 Clause 12 and Clause 14.

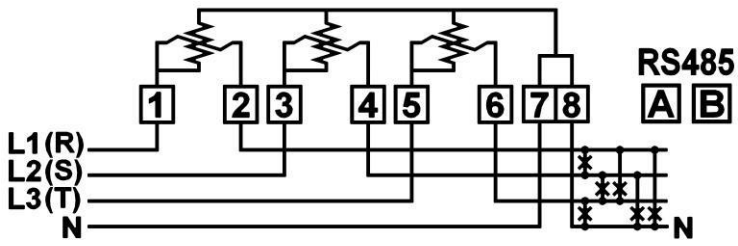
Note 2 – The reference of this diagram is the current vector (shown as the line on the right-hand side).

Note 3 – The voltage vector V varies in its own direction according to the phase angle ϕ .

Note 4 – The phase angle ϕ between voltage V and current I is taken as positive in the mathematical sense (anticlockwise).

Energy Registers of the Meter	Uni-directional Meter	Bi-directional Meter
Incoming Active Energy (+T)	1.8.0	1.8.0
Outgoing Active Energy (-T)	1.8.0	2.8.0
Quadrant I Incoming Inductive (+Ri)	5.8.0	5.8.0
Quadrant II Outgoing Capacitive (-Rc)	8.8.0	6.8.0
Quadrant III Outgoing Inductive (-Ri)	5.8.0	7.8.0
Quadrant IV Incoming Capacitive (+Rc)	8.8.0	8.8.0

7. CONNECTION DIAGRAM



CAUTION: (A) and (B) to the right of the terminal block are the RS485 outputs. Never apply power to them!

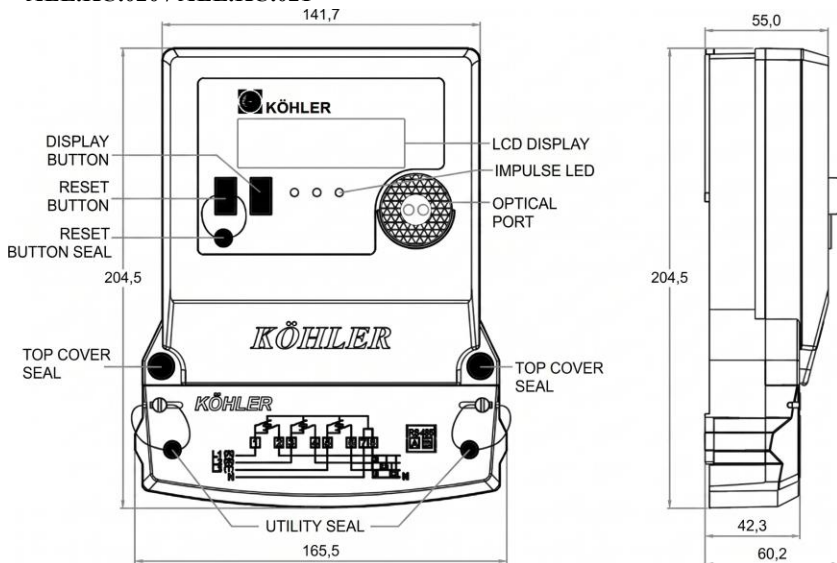
CAUTION: The current terminals of 3x5(100)A combi meters are 7 mm in diameter. Use at least 25 mm² cable on a 100A line.

The RS485 outputs of the meter allow it to be read in parallel. Up to 32 meters can be connected in parallel to an RS485 converter attached to a computer and read. Parallel connection is made by joining the A terminals together and the B terminals together.

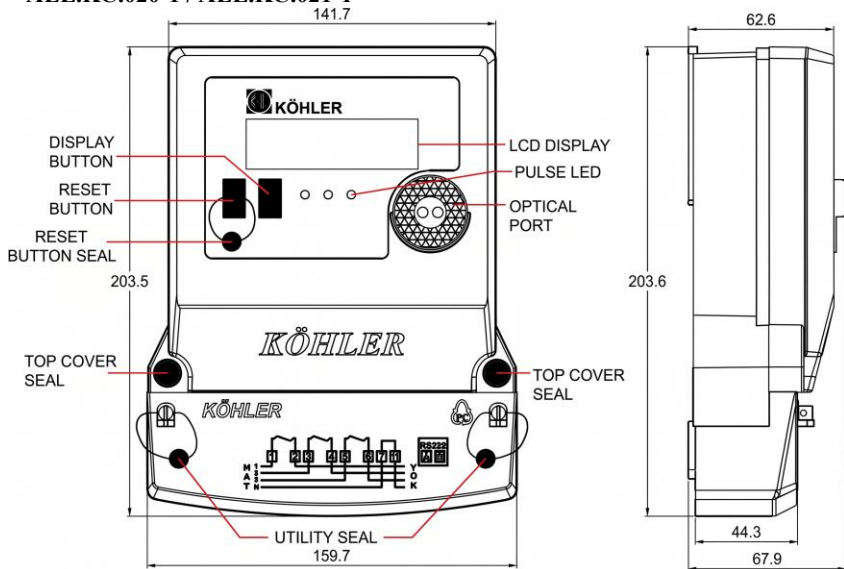
The serial numbers of the meters are used to reach more than one meter on the RS485 output. The structure /?XXXXXXXXX! (CR) (LF) is used for the query. XXXXXXXXXXX is the nine-digit meter serial number.

8. DIMENSIONS

AEL.KC.020 / AEL.KC.021



AEL.KC.020-1 / AEL.KC.021-1



9. EU DECLARATION OF CONFORMITY



EU DECLARATION OF CONFORMITY (AB UYGUNLUK BEYANI)

Manufacturer (Üretici)	: KÖHLER ELEKTRİK SAYAÇLARI SAN. VE TİC. A.Ş. Akçaburgaz Mahallesi 3055.Sokak No:3 Esenyurt – İSTANBUL / TÜRKİYE
Product Description (Ürün Tanımı)	: 3 Phase 4 Wire, 4 Tariff, Demand Measuring, Outdoor, Active-Reactive Electronic Energy Meter 3 Fazlı, 4 Telli, 4 Tarifeli, Demantmetreli, Bina Dışı, Aktif-Reaktif Elektronik Elektrik Sayacı
Model Name (Model Adı)	: AEL.KC.020 / AEL.KC.021 AEL.KC.020-1 / AEL.KC.021-1
Applicable Directives (Uygulanan Yönetmelikler)	: Measuring Instruments Directive (2014/32/EC) Ölçü Aletleri Yönetmeliği (2014/32/AB) Electromagnetic Compatibility Directive (2014/30/EC) Elektromanyetik Uyumluluk Yönetmeliği(2014/30/AB)
Applicable Standards (Uygulanan Standartlar)	: EN 50470-1 (TS EN 50470-1) EN 50470-3 (TS EN 50470-3) EN 62052-11 (TS EN 62052-11) EN 62053-21 (TS EN 62053-21) EN 62053-23 (TS EN 62053-23)
EC Approval Number (AT Onay No)	: 1783-MID-0170
Conformity Assessment Body For Module D (Modül D uygunluk değerlendirme kuruluşu)	: Türk Standartları Enstitüsü (NoBo ID No: 1783)

Bu uygunluk beyanı imalatçının sorumluluğu altında düzenlenmiştir.

We declare that the product stated above complies with the requirements of the standards and directives stated above.

(Yukarıda adı geçen ürünün yukarıda belirtilen yönetmelik ve standart hükümlerinin gereksinimlerini karşıladığını beyan ederiz).



CE 1783

İstanbul/TÜRKİYE
February 02, 2023
(02 Şubat 2023)

Declaration No: KHL/2022-02

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