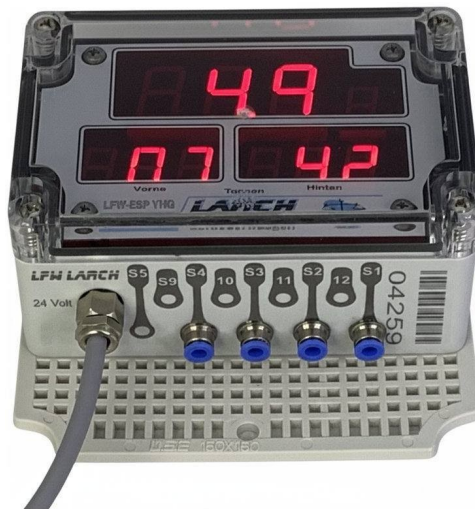


OPERATING AND INSTALLATION MANUAL

Air suspension scale

LFW-ESP-20

Model: truck and trailer (frame mounting)



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1 General description



The LFW-ESP-20 is a stand-alone weighing system for displaying axle loads. The measuring unit is supplied in a protective housing and mounted on the outside of the frame of the truck or trailer (tandem trailer, drawbar trailer, semi-trailer).

The pressure sensors are built into the measuring unit. The LED display shows the total weight and the axle loads in tonnes. Truck and trailer exchange their data via Wi-Fi (see section 2.3).

In principle, any measuring unit can be installed in the truck or in the trailer. What matters is the correct setting of the operating mode (section 2.5).

The unit is operated with the IR remote control. As a rule, the unit is configured for the vehicle's equipment before delivery, so the fitter does not have to change the configuration.

Scope of delivery

Depending on the configuration, the scope of delivery includes:

- Measuring unit with built-in pressure sensors
- Protective housing GHIII
- for leaf-sprung axles: displacement sensor with linkage or angle sensors (gyro)
- for tandem and centre-axle trailers: strain gauge sensor (DMS) with weld plates
- T-connector with reducer and 4 mm air line
- Connector plug for the power supply
- IR remote control
- Installation and operating manual

Connectable sensors

In the basic version, the measuring unit is supplied with two pressure sensors. The following sensors can be connected at most:

Quantity	Sensor type	Examples / range
5	Pressure sensors	0 – 10 bar
4	Analogue sensors	0 – 5 V (displacement sensor, hydraulic pressure sensor, angle sensor)
1	Strain gauge sensor (DMS)	Nose load on the drawbar (tandem and centre-axle trailers)
5	Angle sensors (gyro)	RS485

**Note**

The sensor equipment depends on the vehicle configuration. Please state the exact vehicle configuration when ordering. The correct settings are then made before delivery.

Display and settings via M5 and smartphone

An M5 as well as Android and iOS smartphones (app “LFW_V2”) can be connected to the system. They display the weights and are used to make further settings.

If the system is to be transferred to another vehicle or, for example, the warning weights have to be adapted to legal requirements, this is only possible via the app. Operation of the app is described in a separate manual.

2 Operation

2.1 IR remote control

The measuring unit has no control keys. On the unit itself, it is operated only with the IR remote control supplied, and additionally via M5 or smartphone (section 1). Point the remote control at the display when pressing a key.

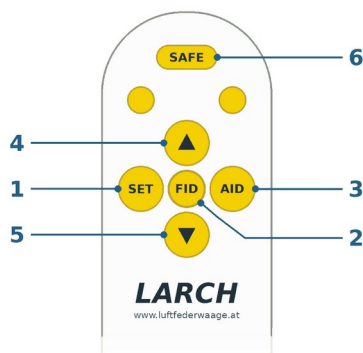


Fig. 1 – IR remote control with key numbers

Key	Label	Function
Key 1	SET	Open the calibration menu (sect. 5).
Key 2	FID	Set the company ID (sect. 2.4).
Key 3	AID	Set the trailer ID (sect. 2.4). At “L-H”: operating mode and network key (sect. 2.5).
Key 4	▲	Increase value. Calibration menu: “H” = loaded. Basic display > 10 s: zero the sensors (sect. 5.1).
Key 5	▼	Decrease value. Calibration menu: “L” = unloaded.
Key 6	SAFE	Save, confirmation “SAFE” on the display. In the settings menu: next menu item or exit menu.

FID = company ID, AID = trailer ID (see section 2.3 for an explanation).

2.2 Display during operation

During operation, the LED display automatically shows the total weight and the axle loads in tonnes.

Any axles or axle groups can be assigned to the two axle load displays.

During a setting, the info field at the bottom right of the display shows which value is currently being set (e.g. “F” for company ID, “A” for trailer ID, “H” or “L” during calibration, “S” for the operating mode, “C” for the network key).

2.3 Truck – trailer connection (company ID and trailer ID)

Each measuring unit has a built-in Wi-Fi module. Truck and trailer exchange their weight data through it. So that the truck finds “its” trailer, both are given the same identifier. Think of it like two radios: they can only talk to each other when they are set to the same channel.

The identifier consists of two parts:

- **Company ID (FID):** forms the first two digits of the network name, adjustable from 1 to 99
- **Trailer ID (AID):** forms the last two digits of the network name, adjustable from 1 to 99

From both together, the unit forms the name of the Wi-Fi network (SSID). It always begins with **LFW_**, followed by four digits, e.g. **LFW_0102** for company ID 01 and trailer ID 02.

Important

All devices of a truck combination (measuring units for truck and trailer, M5, smartphone) must be in the same network. Truck and trailer must therefore have the same company ID and the same trailer ID. In addition, the operating mode and the network key must be set correctly (section 2.5). Only then are the trailer weights shown on the display.



How to set up the network

- Always set up the network starting from the trailer.
- All trailers of a company are given the same company ID and each its own trailer ID (preferably in ascending order).
- When changing trailers, only the trailer ID on the truck is then changed to that of the new trailer. This makes the change quick.

Example

Combination	Measuring unit truck	Measuring unit trailer	Wi-Fi network
Truck 1	FID 01, AID 01	FID 01, AID 01	LFW_0101
Truck 2	FID 01, AID 02	FID 01, AID 02	LFW_0102

Optional equipment: external antenna

For a greater radio range, e.g. if poor reception of the trailer data is to be expected, the unit can be equipped with an external antenna.

For this, the unit is modified at the factory: the internal antenna is omitted and the unit is given a connection for the external antenna. Therefore, please specify the external antenna when ordering.

2.4 Setting the company ID and trailer ID

On delivery, the company ID and the trailer ID are set to 10. This setting should be adapted to the company during initial commissioning.

Setting the company ID

1. Briefly press key 2 (**FID**). “F” appears in the info field at the bottom right.
2. Set the desired company ID (1 – 99) with key 4 (**▲**) or key 5 (**▼**).
3. Save with key 6 (**SAFE**). “SAFE” appears on the display as confirmation.



Setting the trailer ID

1. Briefly press key 3 (**AID**). “A” appears in the info field at the bottom right.
2. Set the desired trailer ID (1 – 99) with key 4 (**▲**) or key 5 (**▼**).
3. Save with key 6 (**SAFE**). “SAFE” appears on the display as confirmation.

Note

The company ID and the trailer ID are set in the same way on the measuring unit of the truck and on the measuring unit of the trailer. On the trailer, a change is only necessary during the initial installation.

2.5 Setting the operating mode and network key

So that the devices can communicate with each other, each measuring unit must be set to where it is installed and what role it has in the network (operating mode). In principle, any measuring unit can be installed in the truck or in the trailer. Only the correct settings have to be made.

How the network works: The measuring unit in the truck works as an access point (AP). It sets up the Wi-Fi network, similar to a Wi-Fi router at home. All other devices (measuring unit in the trailer, M5, smartphone) connect to this unit.

Operating modes

Value	Installation location	Meaning
1	Truck (access point)	The measuring unit is installed in the truck and works as an access point. Other devices (trailer, M5, smartphone) connect to this unit.
2	Trailer	The measuring unit is installed in the trailer and connects to the measuring unit in the truck. A direct connection to the smartphone is not possible in this operating mode.
3	Trailer (access point)	The measuring unit is installed in the trailer and works as an access point itself. A smartphone can connect directly to this unit. The values are shown on the smartphone as trailer.
4	Wi-Fi off	Wi-Fi is switched off. There is no communication with other devices.

Network key (code)

The network key encrypts the Wi-Fi connection. It can be set from 0 to 999. At 0, the connection is not encrypted. All devices of a truck combination must have the same network key.



How to change the settings

1. Press key 1 (**SET**). "L-H" appears on the display.
2. Now press key 3 (**AID**, right key). "SET" appears briefly.
3. The main display now shows a number, the info field shows "S" (operating mode).
4. Set the operating mode 1 to 4 with key 4 (**▲**) or key 5 (**▼**) (see table above).
5. Save with key 6 (**SAFE**). The menu jumps to the network key, "C" (code) appears in the info field.
6. Set the network key 0 to 999 with key 4 (**▲**) or key 5 (**▼**).
7. Save with key 6 (**SAFE**). The menu is exited.

Connecting a smartphone with an active network key

When connecting with the smartphone, you are asked for the Wi-Fi password. To get it, pad the network key with leading zeros to 8 digits.

Example: network key on the scale = 25 → password on the smartphone = **00000025**

With the M5, the padding is done automatically.

Example for a truck combination

Measuring unit in the truck: operating mode 1, network key e.g. 25

Measuring unit in the trailer: operating mode 2, network key 25

In addition, the same company ID and trailer ID on both units (section 2.4).

2.6 Overload and sensor failure

An overload and a sensor failure are only shown in connection with an M5 or a smartphone (app “LFW_V2”). The LED display of the measuring unit does not show these messages.

- **Overload:** If a weight exceeds the set overload threshold, the value concerned is highlighted. The overload threshold is set in the app.
- **Sensor failure:** If a sensor fails, an exclamation mark with the number of the sensor is shown instead of the weight on the axle to which this sensor is assigned (e.g. “! / 4” if sensor S4 fails).

Caution

As long as a sensor failure is displayed, the weight of the axle concerned is not available. In this case, please contact customer service (section 7).

3 Installation

Caution: alignment of the sensors

Correct and precise alignment of the sensors is very important for the weighing system to work correctly. Even small deviations lead to incorrect weight readings.

Therefore always mount the sensors exactly as described in this manual.

3.1 Measuring unit

The measuring unit is supplied in a protective housing and is intended for outdoor mounting, on the truck as well as on the trailer. It is attached to the outside of the vehicle frame. After installation, set the operating mode to match the installation location (section 2.5). Normally the correct parameters are already preset.

- Choose the mounting location so that the measuring unit is not exposed to direct splash water.
- Make sure that Wi-Fi reception is affected as little as possible by metal parts. Do not mount the measuring unit on the inside of the frame.
- Align the display so that it is easy to read and can be reached with the remote control.



Fig. 2 – Measuring unit in protective housing GHIII (150 × 150 × 90 mm)

3.2 Power supply

The power supply is connected with the connector plug supplied:

- **Truck:** to terminal 15 (ignition) of the vehicle.
- **Trailer:** to a separate supply line. If there is no separate line for this in the trailer, the measuring unit is connected to the lighting. It then only works when the lighting is switched on.

Pin	Connection
1	+ 12/24 V (truck: terminal 15; trailer: separate line or lighting)
2	Ground (GND)



Fig. 3 – Connector plug for the power supply

3.3 Sensor equipment of the vehicle

In principle, every control circuit of the suspension must be sensed. Which sensor is used depends on the suspension of the respective axle:

Axle	Var.	Suspension	Sensor	Sect.
Front axle	1	Air	Pressure sensor in the measuring unit	3.4
Front axle	2a	Leaf	Displacement sensor	3.5
Front axle	2b	Leaf	Angle sensors (gyro) on the anti-roll bar	3.6
Front axle	2c	Leaf	Angle sensors (gyro) on the spring leaves	3.7
Rear axles	1	Air	Pressure sensors in the measuring unit	3.4
Rear axles	2	Leaf	Angle sensors (gyro) on the wishbones	3.8
Drawbar	–	–	Strain gauge sensor (tandem and centre-axle trailers)	3.9

How many sensors are needed:

- **Front axle:** one pressure sensor (air-suspended) or one displacement sensor or angle sensors (leaf-sprung).
- **2-axle vehicle:** one sensor each on the left and right of the rear axle.
- **Tandem and centre-axle trailers:** strain gauge sensor on the drawbar, only if the truck has no scale.

For 3-, 4- and 5-axle vehicles there are different requirements, depending on the vehicle manufacturer and equipment, as to where and how many sensors must be installed. Some examples:

Vehicle	Sensors
6×4 MAN, Mercedes, IVECO, DAF	2 sensors (left and right)
6×4 / 6×2 Scania	1 sensor on the 2nd axle, 1 sensor on the 3rd axle
6×4 / 6×2 Volvo	2 sensors left / right on the 2nd axle, 2 sensors left / right on the 3rd axle
Tridem MAN, Mercedes	2 sensors left / right on one of the drive axles and 2 sensors left / right on the tag axle

Note

Which variant and how many sensors are installed results from the vehicle configuration. Please state the exact vehicle configuration when ordering.

3.4 Air-suspended axles: pneumatic connection

Applies to the front axle (variant 1) and the rear axles (variant 1). The pressure sensors are built into the measuring unit and therefore do not have to be mounted on the vehicle.

To supply the pressure sensors, a 4 mm plastic line must be laid from each air suspension control circuit to the measuring unit.

- The connection to the air suspension circuit is made with T-push-in fittings and a reducer to 4 mm.
- Connect the lines to the ports of the measuring unit as printed on the label of the measuring unit (S1, S2 ...).
- Suitable T-pieces are included with every installation kit.

3.5 Leaf-sprung front axle (variant 2a): displacement sensor

The displacement sensor is clamped to the underside of the frame with the universal clamp holder. The linkage connects the lever of the sensor to the axle and is attached, if possible, in the middle of the axle.

- Choose the location so that the sensor does not collide with any vehicle parts, even when the vehicle is fully compressed.
- Adjust the length of the linkage so that the lever does not “snap over” when the chassis is fully extended.

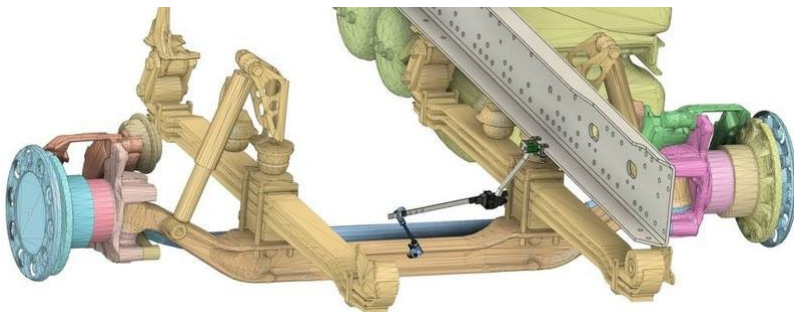


Fig. 4 – Displacement sensor on the leaf-sprung front axle

Measuring range

The measuring range of the sensor is 45° upwards and 45° downwards from the longitudinal axis.

3.6 Leaf-sprung front axle (variant 2b): angle sensors on the anti-roll bar

Two angle sensors (gyro) are used for indirect measurement of the spring travel on the front axle:

- **S0 – reference sensor:** mount on the vehicle frame, parallel to the measuring sensor S1.
- **S1 – measuring sensor:** mount centred on the torsion tube of the anti-roll bar with a hose clamp (parallel to the tube axis).

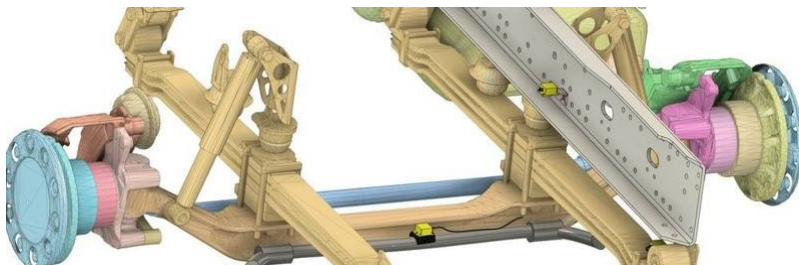


Fig. 5 – Angle sensors S0 (frame) and S1 (anti-roll bar)

Important mounting instructions

1. Avoid frame offsets: The reference sensor S0 must not be located in the area of frame bends or frame offsets, as the alignment of the sensor is not correct there and the measurement is falsified.
2. Check the alignment: Both sensors (S0 and S1) must be aligned transversely to the direction of travel. The cable outlets of S0 and S1 must point in opposite directions (antiparallel alignment for correct signal polarity).

3.7 Leaf-sprung front axle (variant 2c): angle sensors on the spring leaves

The angle sensors (gyro) are mounted with a holder directly on the spring leaves of the front axle, just in front of the spring eye.

Mount the sensors crosswise

1. The two sensors are mounted crosswise, i.e. diagonally opposite each other on the two spring leaves (see Fig. 6).
2. The cable outlets of the two sensors must point towards each other.

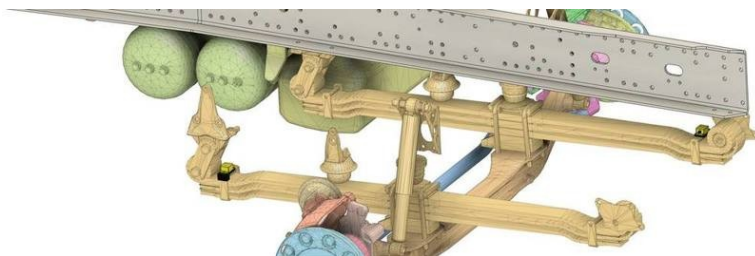


Fig. 6 – Angle sensors on the spring leaves (overview)

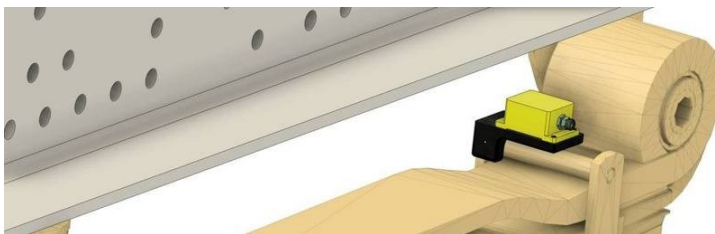


Fig. 7 – Angle sensor with holder on the spring leaf (detail)

3.8 Leaf-sprung rear axles (variant 2): angle sensors on the wishbones

The angle sensors S3 and S4 are mounted with hose clamps on the wishbones (triangular links) of the drive axles: S3 on the front drive axle, S4 on the rear drive axle.

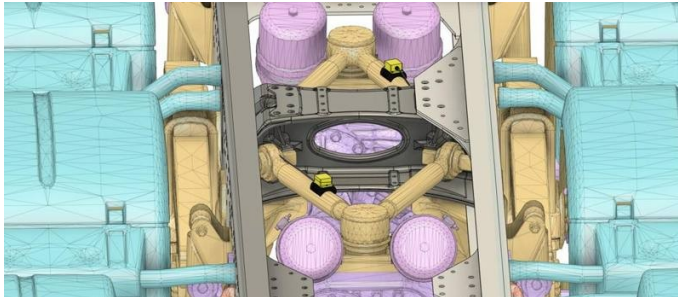


Fig. 8 – Position of the angle sensors S3 and S4 on the wishbones (top view)

Mount the sensors as shown

1. The cables of both sensors must point towards the cross member, i.e. towards each other.
2. The top of the sensors must be parallel to the road surface (transverse to the vehicle – horizontal). Check with a spirit level (see Fig. 9).

Checking the horizontal alignment

Place a small spirit level on the sensor transverse to the vehicle. The sensor is correctly aligned when the air bubble is exactly in the middle. Only then tighten the hose clamps firmly.



Fig. 9 – Checking the horizontal alignment with a spirit level

3.9 Tandem and centre-axle trailers: strain gauge sensor on the drawbar

With tandem and centre-axle trailers, part of the weight rests on the truck via the drawbar (nose load). This nose load is measured with a strain gauge sensor (DMS) on the drawbar tube.

Mounting

1. Weld the two weld plates onto the drawbar tube (see Fig. 10 and 11).
2. Screw the strain gauge sensor onto the weld plates. The sensor must be aligned in the longitudinal direction of the drawbar. It does not matter whether it sits on the top or the bottom of the drawbar tube.
3. Connect the sensor cable with the 4-pin M8 plug to the measuring unit in the trailer.



Fig. 10 – Strain gauge sensor on the drawbar tube



Fig. 11 – Weld plates and screw connection (detail)

When is a strain gauge sensor required?

The nose load only has to be measured if the trailer alone is equipped with a scale.

If a combination of truck and trailer scale is installed, no strain gauge sensor is needed: the nose load presses on the truck and is already measured by the truck scale.

Display and calibration

The strain gauge sensor is treated like an axle (axle 1). The nose load is included in the total weight and shown as a separate value in the front axle load display.

Calibration is carried out as for an axle (section 5): enter the previously determined nose load for axle 1. Zeroing with SensReset (section 5.1) also applies to the strain gauge sensor.

4 General notes on calibration

For the measuring unit to work correctly, each axle must be calibrated in the loaded and in the unloaded condition before commissioning.

To do this, determine the weight of each axle using axle weighing pads or a weighbridge. Immediately after weighing, enter the values into the measuring unit as described in section 5.

Requirements

- Vehicle free of tension: parking brake released, on the truck gearbox in neutral.
- Vehicle stands on a level surface.
- Any lift axles or pusher and tag axles are lowered.

These requirements also apply to every weighing during operation.

The accuracy of the system depends essentially on the care taken during calibration and on the condition of the mechanical parts of the vehicle.

Note

For calibration in the loaded condition, the vehicle should be loaded as fully as possible.

Caution

The system is not approved for legal-for-trade (verified) weighing!

5 Calibration with the remote control

The calibration is carried out once in the unloaded and once in the loaded condition. The order does not matter. First determine the current axle loads of the vehicle (see section 4 for the requirements). For tandem and centre-axle trailers with a strain gauge sensor, the nose load counts as axle 1 (section 3.9).

5.1 Zeroing the sensors (SensReset)

After installation and before the first calibration, the sensors (displacement sensor, angle sensors or strain gauge sensor) are brought into a defined state with the vehicle empty: the current sensor value is set to a fixed value.

1. Park the vehicle empty (see section 4 for the requirements).
2. Make sure that the measuring unit shows the basic display (no menu open).
3. Hold key 4 (▲) of the remote control pressed for more than 10 seconds. The sensors are zeroed.

Replacing a sensor

If a sensor has to be replaced during later operation, zeroing can be carried out again with the vehicle empty. A new calibration (sections 5.2 and 5.3) is then not strictly necessary.

5.2 Calibration unloaded (empty weight)

The vehicle is empty (unloaded).

1. Briefly press key 1 (**SET**).
2. At the prompt “L-H”, select “L” (unloaded) with key 5 (▼).
3. The info field alternately shows “L” and the number of the axle currently being set.
4. Enter the previously determined weight of the axle with key 4 (▲) or key 5 (▼). The value changes in 100 kg steps.
5. Save the value with key 6 (**SAFE**) and move on to the next axle.
6. Repeat steps 4 and 5 for all axles. After the last axle has been saved, “SAFE” is shown briefly. This completes the unloaded calibration.

5.3 Calibration loaded (full weight)

The vehicle is loaded, as fully as possible.

1. Briefly press key 1 (**SET**).
2. At the prompt "L-H", select "H" (loaded) with key 4 (▲).
3. The info field alternately shows "H" and the number of the axle currently being set.
4. Enter the previously determined weight of the axle with key 4 (▲) or key 5 (▼). The value changes in 100 kg steps.
5. Save the value with key 6 (**SAFE**) and move on to the next axle.
6. Repeat steps 4 and 5 for all axles. After the last axle has been saved, "SAFE" is shown briefly. This completes the loaded calibration.

Ready for operation

The system is only ready for operation once the calibration has been carried out in both the unloaded and the loaded condition.

The data remains stored even when the measuring unit is disconnected from power.

6 Technical data LFW-ESP-20

Feature	Value
Mounting	outside on the frame, in protective housing
Vehicle	truck and trailer
Axles	up to 5 on the truck, up to 4 on the trailer
Power supply	12/24 V DC; truck: terminal 15, trailer: separate line or lighting
Current consumption	< 300 mA
Display	LED, 20 mm digit height
Pressure sensors	max. 5 pressure sensors 0 – 10 bar, built into the measuring unit
Analogue sensors	max. 4 analogue sensors 0 – 5 V
Strain gauge (DMS)	1 strain gauge sensor (optional), 4-pin M8 connector
Angle sensors (gyro)	max. 5 angle sensors, RS485 (optional)
Communication	Wi-Fi
Optional equipment	external antenna for greater radio range (factory option: antenna connection instead of internal antenna)
Operation	IR remote control (no keys on the unit); display and settings also via M5 and smartphone app "LFW_V2"
Housing	protective housing GHIII, 150 × 150 × 90 mm

7 Contact



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