

# LMU210 SERIES

## LOAD MONITORING UNITS

MAGTROL's **LMU-Load Monitoring Units** are signal conditioners for strain gauge sensor applications. They provide the excitation voltage, amplify the output signal, and incorporate overload protection. The **LMU210 Series** are specifically designed to work with MAGTROL's Load Measuring Pins. The LMU209 is versatile and designed for conditioning and interfacing low amplitude signals to industrial programmable logic controllers (PLC). The LMU conditioners can easily be connected to the **GAD Series** and **AN Series** signal displays.

### FEATURES

- For use with full-bridge strain gauge transducers (sensitivity 0.5 to 4 mV/V)
- Voltage input for load summation or for individual use (without sensor)
- 2 to 4 level detectors with relay output contacts
- 0-20 mA or 4-20 mA DC current output
- $\pm 10$  V voltage output(s)
- Provides continuous detection of signal line failure and short circuits («OK» signals)
- Includes integrated test equipment (B.I.T.E.) with continuous power supply monitoring
- Compatible to CE Standards
- IP65 aluminum housing



Fig. 1: LMU217 | Load Monitoring Unit

### FEATURES OF LMU 216 ONLY:

- 4 level detectors with output contacts, 2 of them with programmable memory
- 4 voltage inputs with summation
- TARE function
- Optional balancing and comparator sub-module

### DESCRIPTION

The Magtrol Load Monitoring Unit is specially designed for strain gauge transducer applications. Specifically developed for use with Magtrol load measuring pins and load-force-weight sensors, the LMU Series provides excitation current and amplifies the output signal of full-bridge strain gauges.

Load Monitoring Units are flexible and fully configurable due to DIP-switches and jumpers which allow the unit to be easily installed - no solder connections are required. The level detectors and the outputs can be dedicated either to the full-bridge input, to the voltage input, or to the sum of both (see "Application Selection" at the top of page 4). A built-in auto-diagnostic system detects any short circuits or signal line failures, **thus allowing the system to be used in applications where safety is important.** If a problem is

detected, both relays are deactivated and the output voltage (respective current) changes to  $> 10$  VDC and  $> 20$  mA.

The LMU is fully compatible with European Community (CE) standards. Its IP65 aluminum housing allows the system to be used in harsh environments. Using SMD (surface mounted device) technology, the LMU allows the maximum performance/price ratio for strain gauge transducer monitoring.

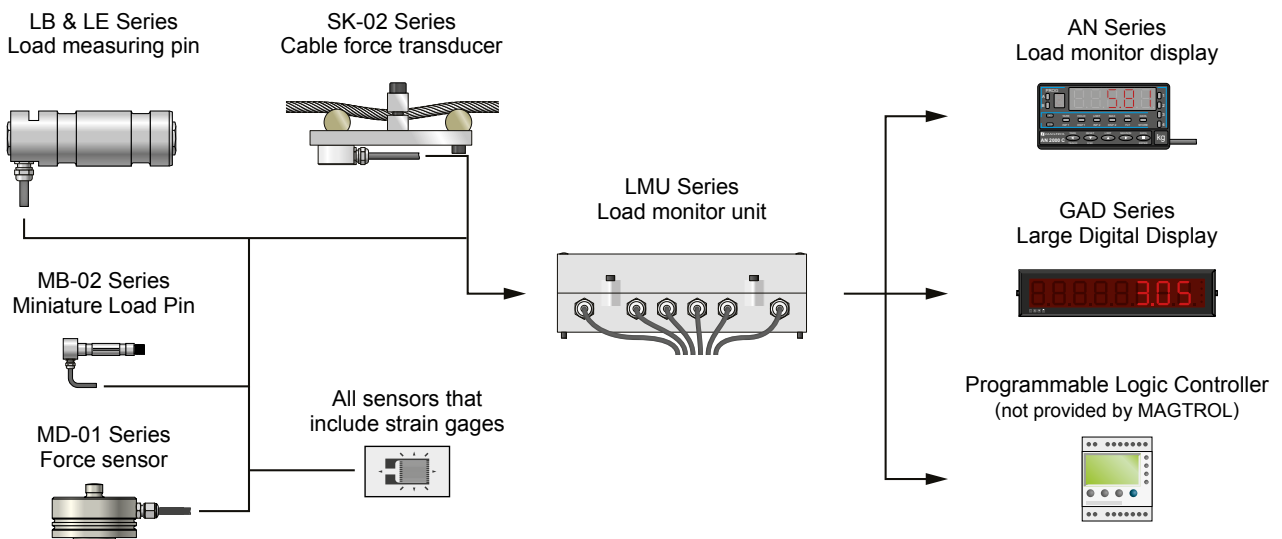
MODELS COMPARISON



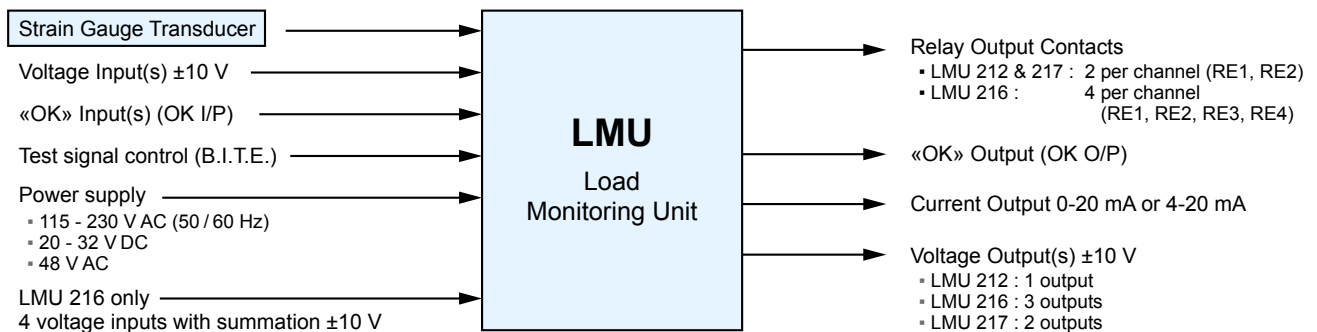
MODEL	LMU212	LMU216	LMU217
Technology	1 transducer input	1 transducer input	2 transducer inputs (2x LMU212)
Voltage Output	1 x 0-10V	3 x 0-10V	2 x 0-10V
Current Output	1 x 0-20 mA or 4-20 mA	1 x 0-20 mA or 4-20 mA	2 x 0-20 mA or 4-20 mA
Relays	2	4	4
Summation	2 signals	4 signals	3 signals
Weight	~2 kg	~4 kg	~3.75 kg

SYSTEM CONFIGURATION

The LMU Load Monitoring Unit offers many configuration possibilities. As it is not possible to describe all of them and in order for our solution to be perfectly configured to your needs, we recommend that you contact our technical sales advisers.



BLOCK DIAGRAM



**SPECIFICATIONS**
**INPUT CHARACTERISTICS**
**Power Supply**

Voltage	<ul style="list-style-type: none"> <li>115 - 230 VAC &amp; 20 - 32 VDC jumper selectable</li> <li>48 VAC fixed</li> </ul>	
Max. Current	<b>Current</b>	<b>Fuse rating</b>
	70 mA for 230 VAC	80 mA
	150 mA for 115 VAC	160 mA
	250 mA for 20 VDC	400 mA
350 mA for 48 VAC		

**Bridge signal**

Supply Voltage	10 VDC
Max. Possible Current	140 mA
Sensitivity	0.5 - 4 mV/V
Max. Dynamic Component of Bridge Signal	±45 mVDC
Max. Common Mode Voltage on Input	±10 V

**Voltage Input for Summation of Another Load**

Input Impedance	70 kΩ
Max. Input Signal (dynamic)	±10 V
Signal Division by 2	DIP - switch selectable
Use Without Transducer	Jumper selectable

**Input for Auto-diagnostic Feature (OK I/P)**

Type	Active if short circuited
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**OUTPUT CHARACTERISTICS**
**Relay Outputs**

Number of Relays	LMU212: 2 LMU217: 4 (2 per input) LMU216: 4
Relay Behavior	Configurable with DIP-switch
Max. Current per Contact	4A @ 250 VAC 3A @ 30V (0.5A @ 48VDC)
Max. Voltage per Contact	AC: 250 V <sub>eff</sub> / DC: 48 VDC
Contact Rating	90 W or 1000 VA
Insulation Voltage	Contact-contact: 750 V <sub>eff</sub> Contact-coil: 1.5 kV <sub>eff</sub>
Lifetime	min. 10 <sup>5</sup> (@ 4A, 250 VAC) 10 <sup>8</sup> (unloaded)
Contact Resistance	<20 mΩ

**Current Output**

Output Type	Current generator
Nominal Current Range	0 - 20 mA
Max. Current Range	0 - 25 mA
Max. Load	<500 Ω for I <sub>max</sub> = 20 mA
Output Impedance	>50 kΩ

**Voltage Output**

Max. Dynamics	±10 V ≡ EM
Max. Load	≥10 kΩ (ε≤0.5%) [≥1 kΩ (ε≤5%)] <sup>a)</sup>
Output Impedance	50 Ω (in series)

**Output for Auto-diagnostic Feature (OK O/P)**

Type	Open collector
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**TRANSFER CHARACTERISTICS**
**Voltage Transfer Ranges (ΔU<sub>I/P</sub> / ΔU<sub>O/P</sub>)**

Range	1	2	3
Bridge Sensitivity [mV/V]	0.42-0.78 (0.6)	0.7-1.3 (1)	1.2-2.2 (1.7)
Voltage Transfert (gain)	2380 - 1280 (1670)	1428 - 769 (1000)	833 - 455 (588)
Adjustment Range	±30 %		

Range Selection	Selectable using DIP-switches
Signal Division by 2	DIP-switch selectable (the available sensitivities then moves from 0.84 to 4.4 mV/V according to the selected range)
Measuring Chain Zero Adjustment	Coarse adjustment using multi-turn potentiometer: equivalent to ±10V/output for range 3 Fine adjustment using multi-turn potentiometer: 5% of the coarse adjustment
Temperature drift of the transfer function	≤200 ppm/°C
Temperature drift of the measuring chain zero value	≤200 ppm (of FSD)/°C for 0.5 mV/V at the input ≡ ≤1 μV/°C

**Current transfer range**

Sensitivity Range with Multi-turn Potentiometer	±20 % of FSD on U <sub>O/P</sub>
Nominal Current Range	0 to 20 mA
Max. Current Range	0 to 25 mA
Zero Adjustment Range	±5 mA for I <sub>O/P</sub> ≥5 mA

**Selectable low-pass filter**

Filter Type	Butterworth
Filter Order	2
Cut-off Frequency (-3dB)	Selectable using DIP-switches (0.3Hz, 1Hz, 3Hz, 10Hz, 100Hz)

**Level detectors**

Number of Detectors	1 per relay
Level Adjustment Range	-10 to +10 VDC using multi-turn potentiometer (measured on voltage output)
Hysteresis	<0.5 % or ≈5 % (DIP-switch selectable)
Detection Indication	< or > (DIP-switch selectable)

a) To guarantee precise calibration, the impedance of the connected unit must be indicated at time of order. If this value is unknown, an impedance of 1 MΩ will be used for calibration. The resulting deviation will be ≤5 % with an impedance of ≥2 kΩ or ≤1 % with ≥10 kΩ.

**TRANSFER CHARACTERISTICS (Continues)**
**Switching Delay**

Delay Adjustment Range	0.01 to 4.25 seconds (adjustment for every relay by multi-turn potentiometer)
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**Application selection**

Output specific application:

REL1 det.	REL2 det.	U <sub>O/P</sub>	I <sub>O/P</sub>
A, B or A+B	A, B or A+B	A, B or A+B	A, B or A+B

A = bride signal; B = voltage input

**MECHANICAL CHARACTERISTICS**
**Housing**

Material	Aluminum
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**Stuffing glands**

Type and number	LMU212: 3x PG 11 LMU216 & 217: 6x PG 11
Material	Nickel-plated brass

**Terminal strip**

Type	MK8 (screw and connection at 45°)
Max. Area of Connecting Wire	AWG 20 to 16 Cross section: 0.5 to 1.5 mm <sup>2</sup> (0.00077 to 0.0023 in <sup>2</sup> )

**ADDITIONAL LMU216 SPECIFICATIONS**
**SUMMATION**

Number of Inputs	4 (UA, UB, UC and UD)
Input Voltage	± 10V
Output Voltage	UE1 = (UA + UB ± UC ± UD)X X adjustable between 0.25 and 10

**LATCHING**

Control	Using DIP-switches
Reset Signal	RESET REL3, RESET REL4

**ENVIRONMENTAL CHARACTERISTICS**

Operating Temperature	-40 °C to +80 °C
Storage Temperature	-45 °C to +85 °C
Protection Class	IP65
Vibration and Shock	According to IEC 68.2
EMC	According to EN61326-1 and EN61326-2-3

**SAFETY CHARACTERISTICS**
**B.I.T.E. test signal (Built In Test Equipment)**

Signal type	Load simulation on request (calibrated during the installation)
Control	Logic signal, active low, CMOS/TTL compatible

**Reliability**

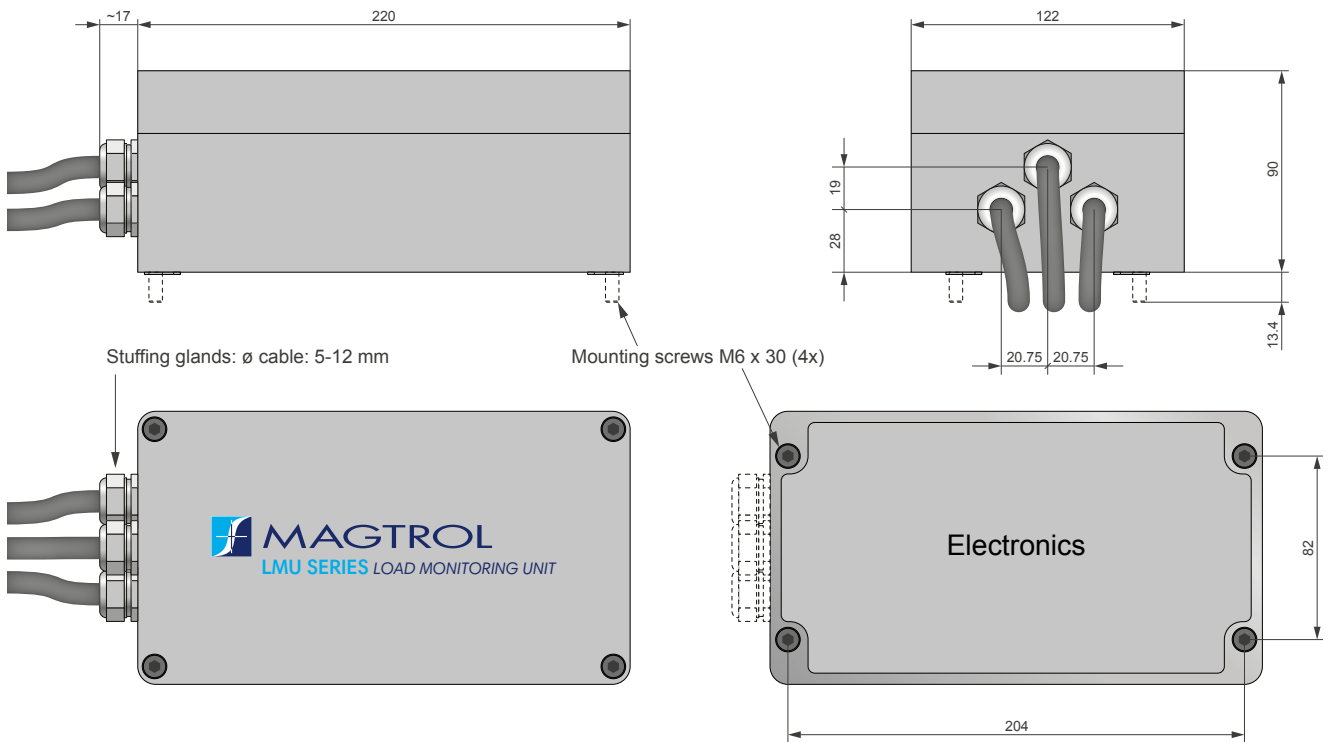
MTBF	> 1 500 000 hours
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**CALIBRATION CIRCUIT**

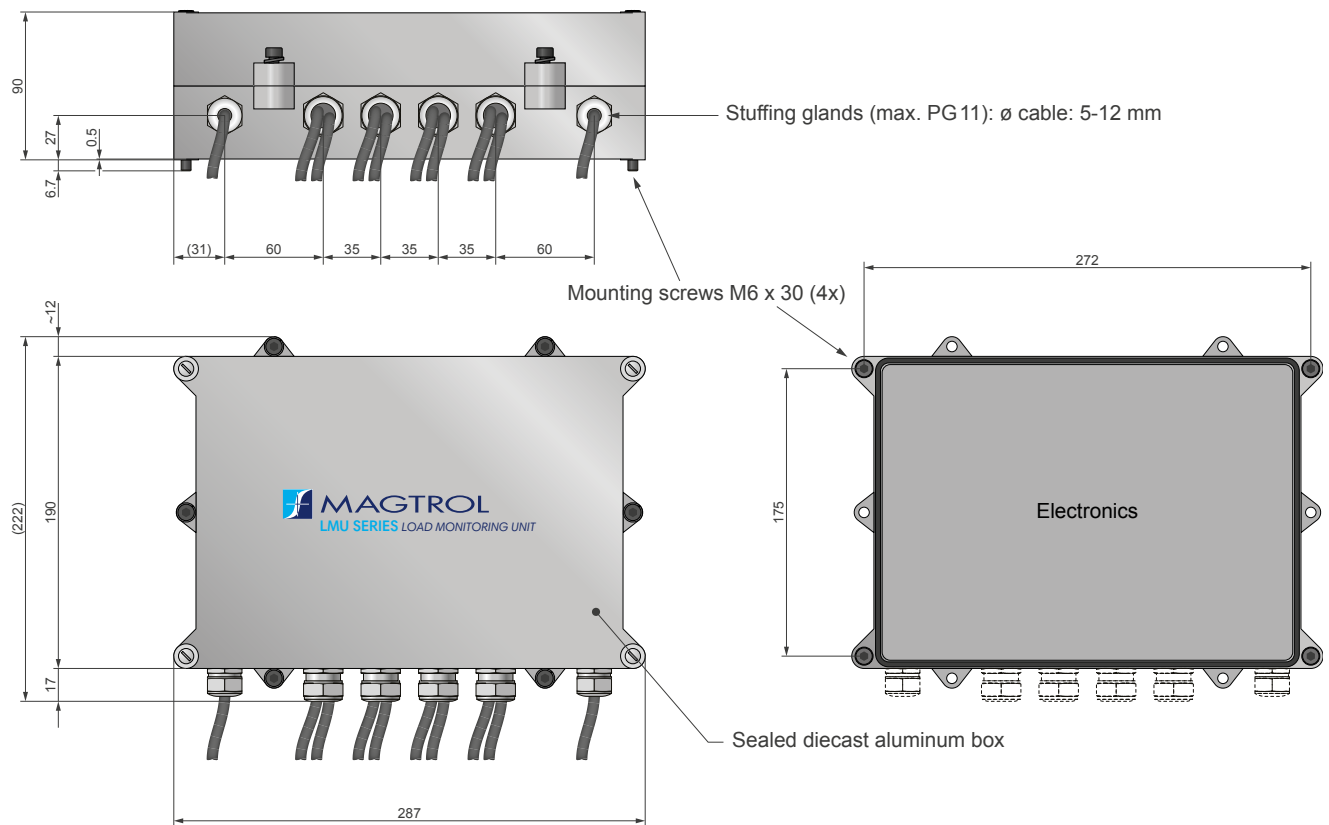
Principle	Volatile digital memory at 12 bits (memory reset at startup), the stored digital value is subtracted from the input signal after D/A conversion <sup>a)</sup>
Resolution	1/4096 of the selected range
Storing Time	< 2s
Output Impedence	< 200 Ω
Acceptable Load Resistance	≤ 20 kΩ

a) Current interruptions lasting for less than 30 ms do not lead to the loss of the stored calibration value

**DIMENSIONS LMU 212**



**DIMENSIONS LMU 216 & LMU 217**



**NOTE:** 3D STEP files of most of our products are available on our website: [www.magtrol.com](http://www.magtrol.com) ; other files are available on request.

**ORDERING INFORMATION**

ORDERING NUMBER	LMU	---	/	-	---	-
<b>212, 216, 217</b> : Model LMU						
<b>0</b> : Supply 115-230VAC (50/60Hz) or 20-32VDC						
<b>4</b> : Supply 48VAC (50/60Hz)						
<b>11</b> : No balancing comparator option						
<b>61</b> : Balancing comparator option (only for LMU 216)						
<b>Blank</b> : No configuration & calibration (standard)						
<b>C</b> : Configuration & calibration <sup>a)</sup>						

a) According to application and MAGTROL configuration and calibration protocol

Example: LMU210Series Monitoring Unit, model 212, supply 230VAC, without balancing option and with calibration would be ordered as follows: **LMU212/011C**

LMU201 Series Monitoring Unit, model 216, supply 48VAC, with balancing option and no calibration would be ordered as follows: **LMU216/461**

**RELATED PRODUCTS**

**LB & LE SERIES - LOAD MEASURING PINS**

LB & LE Series Load Measuring Pins are used to measure load and force and to provide overload protection. The pins are mounted into machines in place of normal shafts and fitted with strain gauges, allowing them to produce a signal proportional to the measured load. Manufactured in Switzerland, Magtrol's Load Pins are rugged with high resistance stainless steel and tight construction, designed specifically for use in hostile industrial environments.

LB & LE Series Load Pins are used for load measuring devices and overload protection on cranes, hoisting gear, elevators, winches, and force measurement for regulation processes in industrial installations and machinery production. Moreover it is an ideal transducer to detect and measure forces in harsh, tropical, offshore, marine and harbor environments.



Fig. 2: **LB210 & LB217** Load Measuring Pins

**AN SERIES - LOAD MONITOR DISPLAY WITH INTEGRATED SIGNAL CONDITIONER**



Fig. 3: **AN 1500 M** | Load Monitor Display with integrated signal conditioner

The AN Series Load Monitor is designed to process and display signals coming from various types of transducers (weight, load, pressure, torque, etc.) that use standard strain-gauge bridges.

The basic instrument is a soldered assembly composed of a main board, a tri-color programmable display and a power circuit. Standard features include the reading of the input variable as well as remote hold, reading and memorization of max and min values (peak / valley), tare and reset function.

**GAD SERIES - LARGE DIGITAL DISPLAYS**



Fig. 4: **GAD 6** | Large Digital Display - digits height 102mm

These high quality, large character digital displays can be used for crane weight display, process weight display, and all other remote weighing applications. They use microprocessor based technology for high reliability and have a non-volatile memory to store all the calibration data.

Magtrol Large Digital Displays are used with Load Monitoring Units (LMUs) or signal conditioners (AN Series), as part of a complete measurement system. Magtrol load measuring pins, which measure load and force to provide overload protection, are available for a wide range of Load-Force-Weight, and in various executions and accuracy classes. Combined, these products constitute an ideal safe measurement system for continuous overload monitoring.