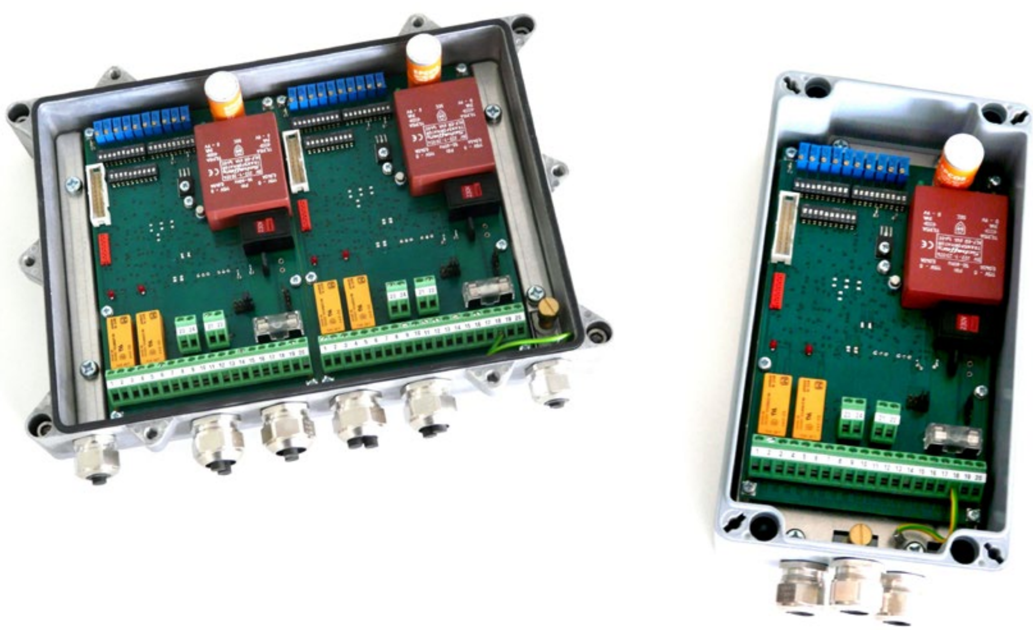
MAGTROL

# Load Monitoring Units

# LMU 212 and LMU 217



# User's manual

First Edition, rev. B – September 2014

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# Revisions To This Manual

The contents of this manual are subject to change without prior notice. Should revisions be necessary, updates to all Magtrol User's Manuals can be found at Magtrol's web site at http://www.magtrol.com/support/manuals.htm

Please compare the date of this manual with the revision date on the web site, then refer to the manual's Table of Revisions for any changes/updates that have been made since this edition..

## TABLE OF REVISIONS

| DATE | EDITION | CHANGES | SECTION |
|---|---|---|---|
| 09/12/2014 | First Edition rev. B | Configuration and Calibration Report updated | A.2 |
| 07/01/2009 | First Edition rev. A | 0% hysteresis changed to <0.5% | 2.4.4.1 and 2.4.4.2 |
| 03 2009 | First Edition | - | - |

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# Preface

## PURPOSE OF THIS MANUAL

This manual has all the necessary information regarding the installation, connection, calibration and use of Magtrol's LMU 212 and LMU 217 load monitoring unit. To achieve maximum capability and ensure proper use of the system, please read this manual in its entirety before operating. Keep the manual in a safe place for quick reference whenever a question should arise.

## WHO SHOULD USE THIS MANUAL

This manual is for users who want to install and use the load monitoring unit LMU 212 or LMU 217 for processing data generated by load measuring pins. The user should have suitable technical training in mechanics and electronics so as to allow him to install and use this load monitoring unit without risk.

## MANUAL ORGANIZATION

This section gives an overview of the structure of the manual and the information contained within it. Some information has been deliberately repeated in different sections of the document to minimize cross-referencing and to facilitate understanding through reiteration.

Summary of the different chapters :

Chapter 1 : INTRODUCTION – Contains the technical data sheet of the load monitoring units LMU 212 and LMU 217 and gives its technical characteristics as well as a brief overview of the application fields.

Chapter 2 : INSTALLATION / CONFIGURATION – Contains the mounting and configuration explanations for the load monitoring unit LMU 212 or LMU 217.

Chapter 3 : CALIBRATION – Describes the calibration procedures of the zero, sensitivity and relays detection level of the load monitoring unit as well as of test signal level (B.I.T.E.).

Chapter 4 : APPLICATIONS – Describes examples of applications for one or several load monitoring units. Explains the use of the test signal (B.I.T.E.).

Chapter 5 : REPAIR – Contains solutions to problems encountered with LMU series load monitoring units.

Appendix A : CONFIGURATION AND CALIBRATION REPORT – Contains the configuration and calibration report of the LMU 212 and LMU 217 which must be filled in with great care when installing the load monitoring unit.

Appendix B : CE CONFORMITY DECLARATION – Contains the CE conformity declaration of the MAGTROL LMU series load monitoring units.

## WARNINGS

CAUTION

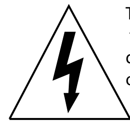
RISK OF ELECTROCUTION

**WARNING** : THE INSTALLATION AND THE CALIBRATION IS RESERVED TO THE QUALIFIED STAFF. PLEASE CONSULT THIS MANUAL BEFORE ANY MANIPULATION AND FOLLOW ATTENTIVELY THE INSTRUCTIONS.

THE CABLING MUST BE DONE WITH POWER SUPPLY SWITCHED OFF.

THE CALIBRATION REQUIRES TO OBSERV SECURIZED ELECTRICAL WORKING METHODS.

PLEASE PAY ATTENTION IN DESCRIPTIVE PRESENT ON THE DEVICE



The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the user to the presence of uninsulated dangerous voltage within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point symbol within an equilateral triangle is intended to alert the user to the presence of operating and maintenance instructions in the literature accompanying the appliance.

## SYMBOLS USED IN THIS MANUAL

The following symbols and type styles may be used in this manual to highlight certain parts of the text:

Note: This is intended to draw the operator's attention to complementary information or advice relating to the subject being treated. It introduces information enabling the correct and optimal function of the product.

CAUTION: THIS IS USED TO DRAW THE OPERATOR'S ATTENTION TO INFORMATION, DIRECTIVES, PROCEDURES, ETC. WHICH, IF IGNORED, MAY RESULT IN DAMAGE TO THE MATERIAL BEING USED. THE ASSOCIATED TEXT DESCRIBES THE NECESSARY PRECAUTIONS TO TAKE AND THE CONSEQUENCES THAT MAY ARISE IF THESE PRECAUTIONS ARE IGNORED.


**WARNING! THIS INTRODUCES DIRECTIVES, PROCEDURES, PRECAUTIONARY MEASURES, ETC. WHICH MUST BE EXECUTED OR FOLLOWED WITH THE UTMOST CARE AND ATTENTION, OTHERWISE THE PERSONAL SAFETY OF THE OPERATOR OR THIRD PARTY MAY BE AT RISK. THE READER MUST ABSOLUTELY TAKE NOTE OF THE ACCOMPANYING TEXT, AND ACT UPON IT , BEFORE PROCEEDING FURTHER.**

# 1. Introduction

## 1.1 GENERAL INFORMATION

The LMU series load monitoring units have been specially designed for applications using load pins with strain gauge sensors. This range of monitoring units offer a large flexibility for the implementation of load measuring systems.

Three models of load monitoring units are available :

- LMU 212 : basic model
- LMU 217 : model combining two LMU 212 placed side by side
- LMU 216 : model combining one LMU 212 and a control module.

☞ Note : Only the two first models - the LMU 212 and LMU 217 - will be described in this manual. The LMU 216 is the subject of one manual entirely dedicated to this unit.

The specially robust design of these units allows monitoring load limits in the most challenging environments.

## 1.2 DATA SHEET

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**LMU**
**Data Sheet**

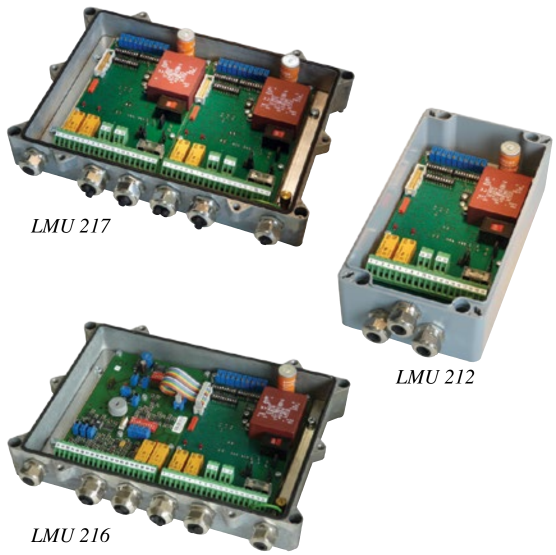
# LMU Series
# Load Monitoring Units

### 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
- ±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
- IP 65 aluminum housing

**Features of LMU 216 only:**

- 4 level detectors with output contacts, 2 of them with programmable memory
- Summer with 4 inputs
- 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 3*). 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 IP 65 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.

### MODEL COMPARISON

| | LMU 212 | LMU 217 | LMU 216 |
|---|---|---|---|
| Description | 1 transducer input | 2 transducer inputs (2 × LMU 212) | 1 transducer input |
| Voltage Output | 1 × 0–10 V | 2 × 0–10 V | 3 × 0–10 V |
| Current Output | 1 × 0–20 mA or 4–20 mA | 2 × 0–20 mA or 4–20 mA | 1 × 0–20 mA or 4–20 mA |
| Relays | 2 | 4 | 4 |
| Summation | 2 signals | 3 signals | 4 signals |

# Specifications LMU

| INPUT CHARACTERISTICS | | |
|---|---|---|
| **Power Supply** | | |
| Voltage | • 115–230 VAC and 20–32 VDC jumper selectable<br>• 48 VAC fixed | |
| Maximum Current | Current | Fuse rating |
| | 70 mA for 230 VAC | 80 mAT |
| | 150 mA for 115 VAC | 160 mAT |
| | 250 mA for 20 VDC | 400 mAT |
| | 350 mA for 48 VAC | 400 mAT |

| | |
|---|---|
| **Bridge signal** | |
| Supply Voltage | 10 VDC |
| Max. Possible Current | 140 mA DC |
| Sensitivity | 0.5 to 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 |

| OUTPUT CHARACTERISTICS | |
|---|---|
| **Relay Outputs** | |
| Number of Relays | LMU 212: 2<br>LMU 217: 4 (2 per input)<br>LMU 216: 4 |
| Relay Behavior | Configurable with DIP-switch |
| Max. Current per Contact | 4 A at 250 V AC<br>3 A at 30 V (0,5 A at 48 V DC) |
| Max. Voltage per Contact | AC : 250 $V_{eff}$<br>DC : 48 VDC |
| Contact Rating | 90 W or 1000 VA |
| Insulation Voltage | Contact-contact: 750 $V_{eff}$<br>Contact-coil: 1.5 $kV_{eff}$ |
| Lifetime | min. $10^5$ (at 4 A, 250 V AC)<br>$10^8$ (unloaded) |
| Contact Resistance | < 20 mΩ |
| **Current Output** | |
| Output Type | Current generator |
| Nominal Current Range | 0 to 20 mA DC |
| Max. Current Range | 0 to 25 mA DC |
| Max. Load | < 500 Ω for $I_{max}$ = 20 mA |
| Output Impedance | > 50 kΩ |
| **Voltage Output** | |
| Max. Dynamics | ±10 V ≡ EM |
| Max. Load | ≥10 kΩ (ε≤0.5%) [≥1 kΩ (ε≤5%)] * |
| Output Impedance | 50 Ω (in series) |
| **Output for Auto-diagnostic Feature (OK O/P)** | |
| Type | Open collector |

**TRANSFER CHARACTERISTICS**

**Voltage Transfer Ranges ($\Delta U_{I/P}$ / $\Delta U_{O/P}$)**

| Range | 1 | 2 | 3 |
|---|---|---|---|
| Bridge Sensitivity [mV/V] | 0.42 to 0.78 (0.6) | 0.7 to 1.3 (1) | 1.2 to 2.2 (1.7) |
| Voltage Transfer (gain) | 2380 to 1280 (1670) | 1428 to 769 (1000) | 833 to 455 (588) |
| Adjustment Range | ±30% | ±30% | ±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 ±10 V/output for range 3<br>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 $U_{O/P}$ |
| Nominal Current Range | 0 to 20 mA DC |
| Max. Current Range | 0 to 25 mA DC |
| Zero Adjustment Range | ± 5 mA DC for $I_{O/P}$ ≥ 5 mA DC |
| **Selectable low-pass filter** | |
| Filter Type | Butterworth |
| Filter Order | 2 |
| -3 dB Cut-off Frequency | Selectable using DIP-switches (0.3 Hz, 1 Hz, 3 Hz, 10 Hz, 100 Hz) |
| **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%<br>(DIP-switch selectable) |
| Detection Indication | < or > (DIP-switch selectable) |
| **Switching Delay** | |
| Delay Adjustment Range | 0.01 to 4.25 seconds (adjustment for every relay by multi-turn potentiometer) |

** NOTE: 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.*

2 MAGTROL

# Specifications LMU

| TRANSFER CHARACTERISTICS (cont.) | |
|---|---|
| **Application selection** | |

*Output specific application:*

| REL1 det. | REL2 det. | $U_{O/P}$ | $I_{O/P}$ |
|---|---|---|---|
| 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 |
| **Stuffing glands** | |
| Type and number | LMU 212: 3 × PG 11<br>LMU 216 and 217: 6 × PG 11 |
| Material | Nickel-plated brass |
| **Terminal strip** | |
| Type | MK8 (screw and connection at 45°) |
| Max. Area of Connecting Wire | AWG 20 to 16<br>Cross section: 0.5 to 1.5 $mm^2$<br>(0.00077 to 0.0023 $in^2$) |

| ENVIRONMENTAL CHARACTERISTICS | |
|---|---|
| Operating Temperature | -40° C to +80° C |
| Storage Temperature | -45° C to +85° C |
| Protection Class | IP 65 |
| Vibration and Shock | According to IEC 68.2 |
| EMC | According to EN 61326-1 and EN 61326-2-3 |
| **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 |

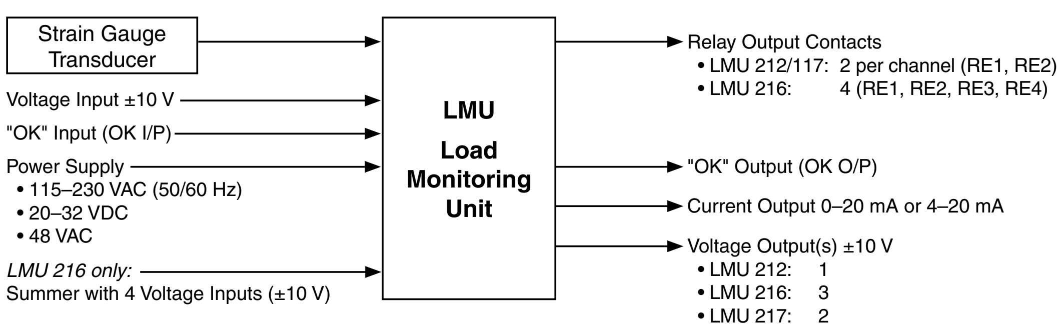
## ADDITIONAL LMU 216 FUNCTIONS

| SUMMER | |
|---|---|
| Number of Inputs | 4 (UA, UB, UC and UD) |
| Input Voltage | ±10 V |
| Output Voltage | UE1 = (UA + UB ± UC ± UD)X<br>X adjustable between 0.25 and 10 |
| **LATCHING** | |
| Control | Using DIP-switches |
| Reset Signal | RESET REL3, RESET REL4 |

| CALIBRATION CIRCUIT | |
|---|---|
| Principle | Volatile* digital memory at 12 bits (memory reset at startup), the stored digital value is substracted from the input signal after D/A conversion<br>* *Current interruptions lasting for less than 30 ms do not lead to the loss of the stored calibration value* |
| Resolution | 1/4096 of the selected range |
| Storing Time | < 2 s |
| Output Impedence | < 200 Ω |
| Acceptable Load Resistance | ≤ 20 kΩ |

## BASIC CONFIGURATION

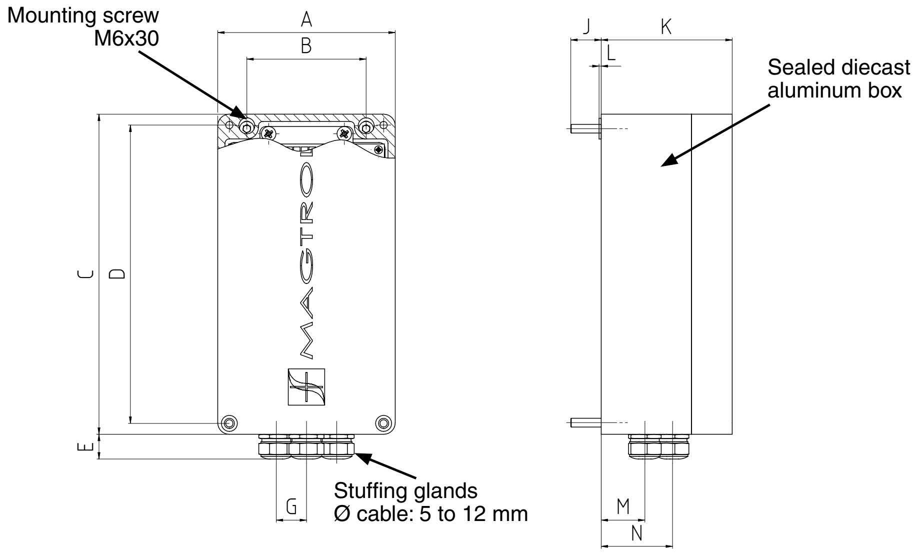
The LMU Load Monitoring Unit offers unlimited configuration possibilities. It is impossible to list them all in this data sheet. Please contact Magtrol or one of its subsidiaries or sales agents to discuss your specific applications.



# Dimensions

**LMU**

## LMU 212

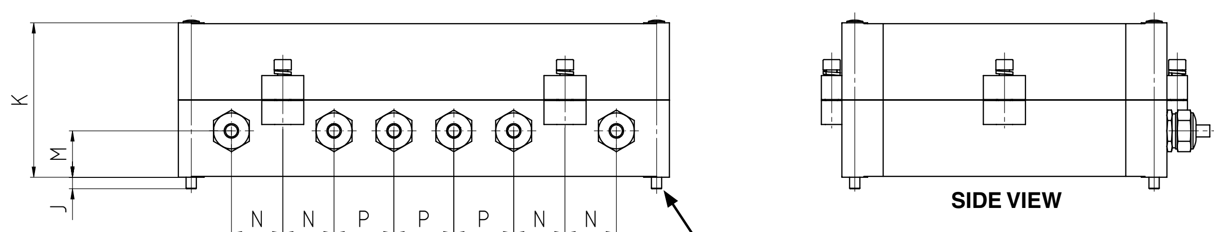



**OVERHEAD VIEW** **SIDE VIEW**

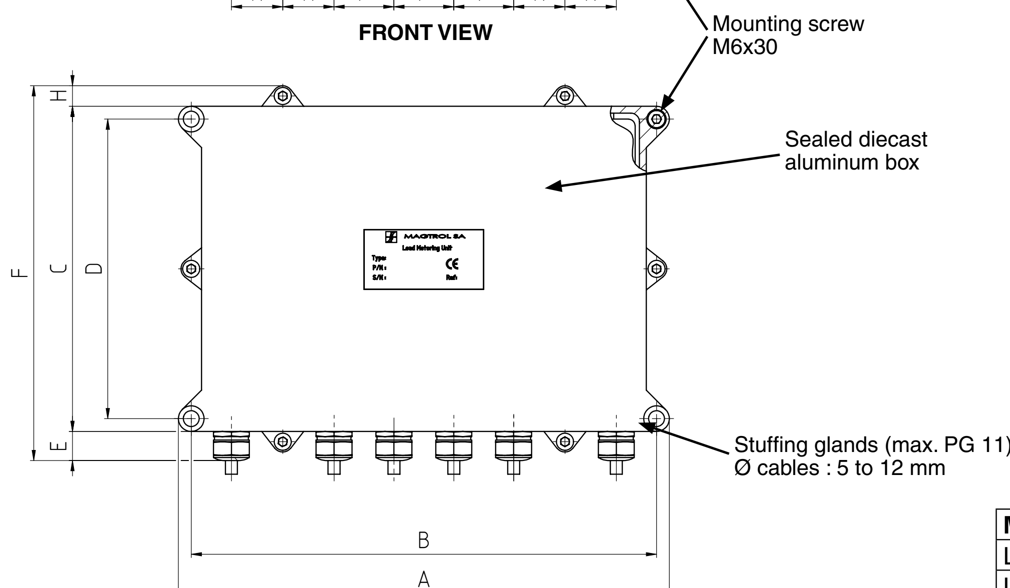
| | *mm* |
|---|---|
| **A** | 122 |
| **B** | 82 |
| **C** | 220 |
| **D** | 204 |
| **E** | ≈16 |
| **G** | 20.75 |
| **J** | 13.4 |
| **K** | 90 |
| **L** | ≈1.5 |
| **M** | 28 |
| **N** | 47 |

| Model | Weight |
|---|---|
| LMU 212 | 2 kg |

## LMU 216 AND LMU 217




**FRONT VIEW** **SIDE VIEW**




**OVERHEAD VIEW**

| | *mm* |
|---|---|
| **A** | 287 |
| **B** | 272 |
| **C** | 190 |
| **D** | 175 |
| **E** | ≈18 |
| **F** | ≈220 |
| **H** | 12 |
| **J** | 10 |
| **K** | 90 |
| **M** | 27 |
| **N** | 30 |
| **P** | 35 |

| Model | Weight |
|---|---|
| LMU 216 | 4 kg |
| LMU 217 | 3.750 kg |

# Ordering Information LMU

## ORDERING INFORMATION

**LOAD MONITORING UNIT** P/N 224 - □□□-000-□□□□

**Model**
- LMU 212 (1 input) — 212
- LMU 216 (1 input) — 216
- LMU 217 (2 inputs) — 217

**Supply**
- 115–230 VAC (50/60 Hz) or 20–32 VDC — 0
- 48 VAC (50/60 Hz) — 4

**Balancing comparator option** *(only for LMU 216)*

LMU 216:
- No — 11
- Yes — 61

LMU 212:
- No (not available) — 11

LMU 217:
- No (not available) — 11

**Configurated and calibrated?**
- No (standard) — *(blank)*
- Yes (according to application and Magtrol Configuration and Calibration Protocol) — C

*Due to the continual development of our products, we reserve the right to modify specifications without forewarning.*



**MAGTROL INC**
70 Gardenville Parkway
Buffalo, New York 14224 USA
Phone: +1 716 668 5555
Fax: +1 716 668 8705
E-mail: magtrol@magtrol.com

**MAGTROL SA**
Centre technologique Montena
1728 Rossens/Fribourg, Switzerland
Phone: +41 (0)26 407 3000
Fax: +41 (0)26 407 3001
E-mail: magtrol@magtrol.ch

**Subsidiaries in:**
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LMU-US 04/10

# 2. Installation / Configuration

## 2.1 GENERAL INFORMATION

It is essential to follow and apply the installation and configuration procedure described in this chapter to avoid any perturbation of the measuring signal processed by an incorrectly installed LMU 212 or LMU 217.

☞ Note : The procedures described in this chapter do not cover all mounting and connection possibilities. However, they can be used as a guide for further customer specific applications. In case of doubt, the user should not hesitate to contact Magtrol's customer service to find a solution offering the best guaranty for optimal measuring accuracy.

## 2.2 INSTALLATION OF THE LMU 212 AND LMU 217 LOAD MONITORING UNITS

☞ Note : For optimal operation, the load monitoring unit should be run at temperatures between -40° C and +80° C.

Both load monitoring units LMU 212 and LMU 217 being structurally very close to each other, their mounting and the connection procedures are very similar :

1. Select a suitable mounting place free of vibrations. An instrument support, for instance, offers excellent results.
2. Trace the location of the 4 screw taps on the mounting surface.
3. Drill and tap the 4 holes for the M6 mounting screws. The taps depth must be approximately 15 mm.
4. Remove the cover of the load monitoring housing. The LMU 212 cover is being fixed with 4 screws, the LMU 217 cover with 6 screws (see *figures 2-1* and *2-2)*.
5. Position the housing on the mounting surface and fasten the 4 M6 x 30 mounting screws by applying a fastening torque corresponding to the type of screw used.
6. Configure and calibrate the load monitoring unit if not already done according to the procedure described in this chapter.
7. Carry out the necessary electrical connection and make sure that the housing stuffing glands are water-tight.
8. Insert a copy of the calibration protocol (see Appendix A) into the load monitoring unit housing before placing the cover back onto the housing and fastening its screws.

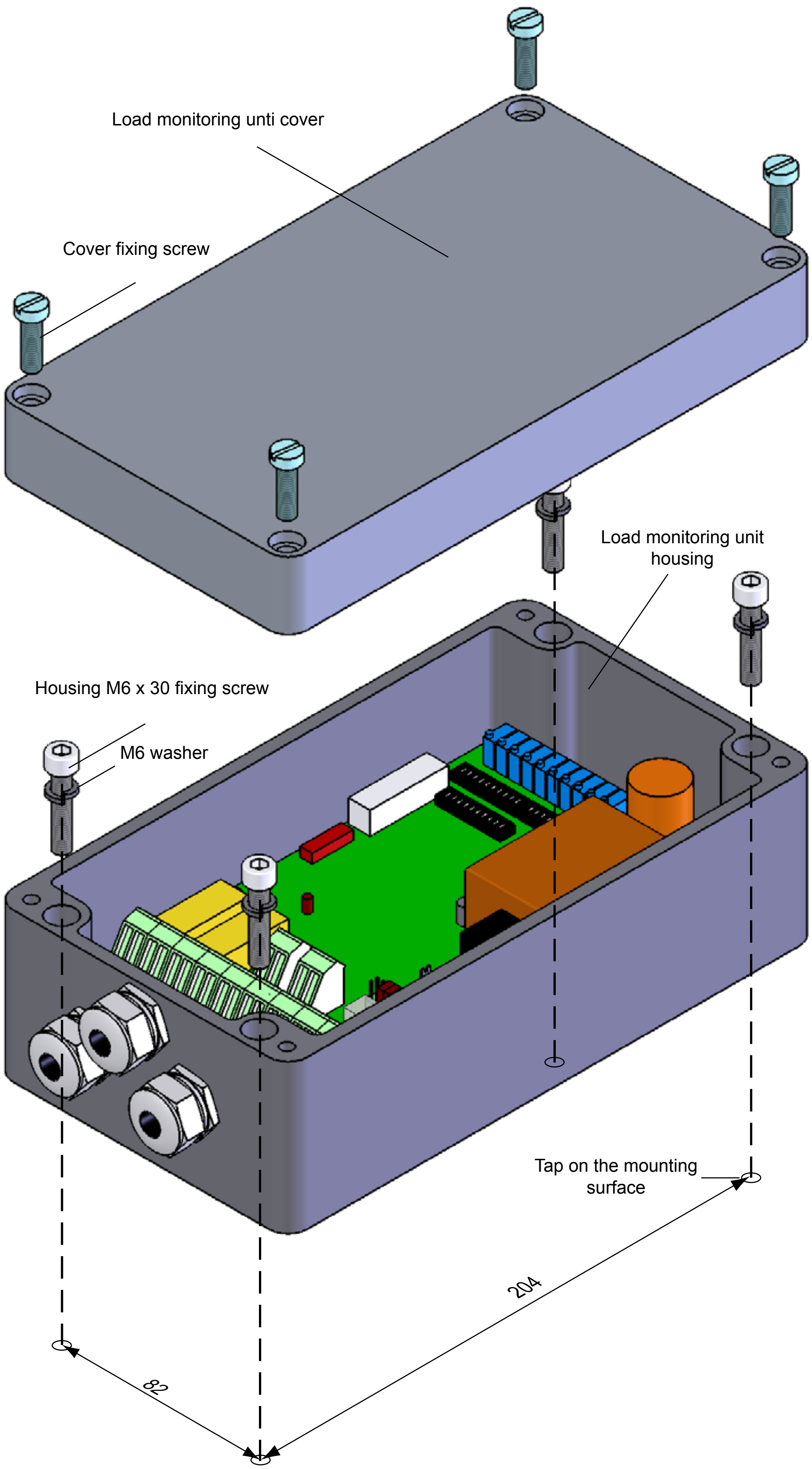


*Fig. 2–1 Installation of the LMU 212 load monitoring unit*

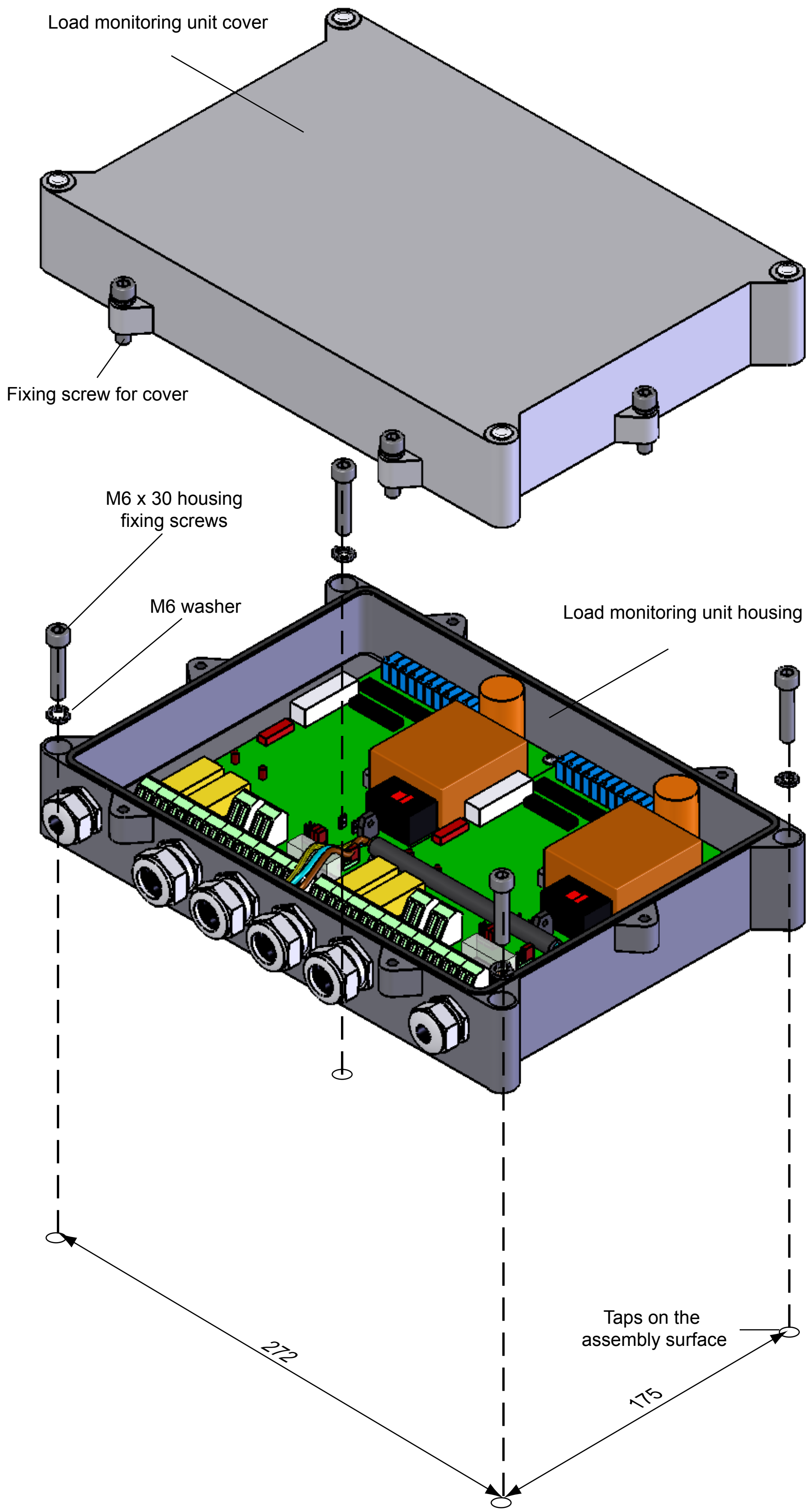


*Fig. 2–2 Installation of the LMU 217 load monitoring unit*

## 2.3 CONNECTION OF THE LMU 212 AND LMU 217 LOAD MONITORING UNITS

The LMU 212 and LMU 217 load monitoring units are fitted with stuffing glands maintaining the connection cables and securing the tightness of the unit's housing. To pass the cables through the stuffing glands simply apply the following procedure :

1. Uninsulate the conductors of the different cables.
2. Remove the housing cover after having unscrewed the fixing screws.
3. Pass the cables through the stuffing glands as shown on *figure 2–3* :
    a. Unscrew the hex nut ① by rotating it counterclockwise. The main body of the stuffing gland ⑤ should not be removed from the unit's housing.
    b. Extract the internal ② and external gasket ③ from the hex nut ①. Both gaskets are used to compensate for the different cable diameters. Push the internal gasket ② to extract it from the external gasket ③.
    c. Pass the cable through the hex nut ①, the internal gasket ② (when used), the external gasket ③, the sealing ring ④ and the main body ⑤.
    d. Reassemble the stuffing gland and coat the front part of the external gasket ③ with silicone (see *figure 2–3)* before screwing the hex nut ① onto the main body ⑤. Tighten the hex nut ① in such a way that the internal gasket ② and/or the external gasket ③ protrudes, so as to provide the degree of watertightness required.
    e. Ensure also that the cable is held firmly in the stuffing gland.

CAUTION : DO NOT DAMAGE THE GASKETS WITH CUTTING OBJECTS. CHECK THAT NO FOREIGN BODIES HAVE SLID BETWEEN THE ELEMENTS OF THE STUFFING GLAND. DEGREASE THE SURFACE OF THE CABLE WHICH WILL COME INTO CONTACT WITH THE GASKET. THE SEAL OF THE STUFFING GLAND CANNOT BE GUARANTIED IF THESE INSTRUCTIONS ARE NOT FOLLOWED.

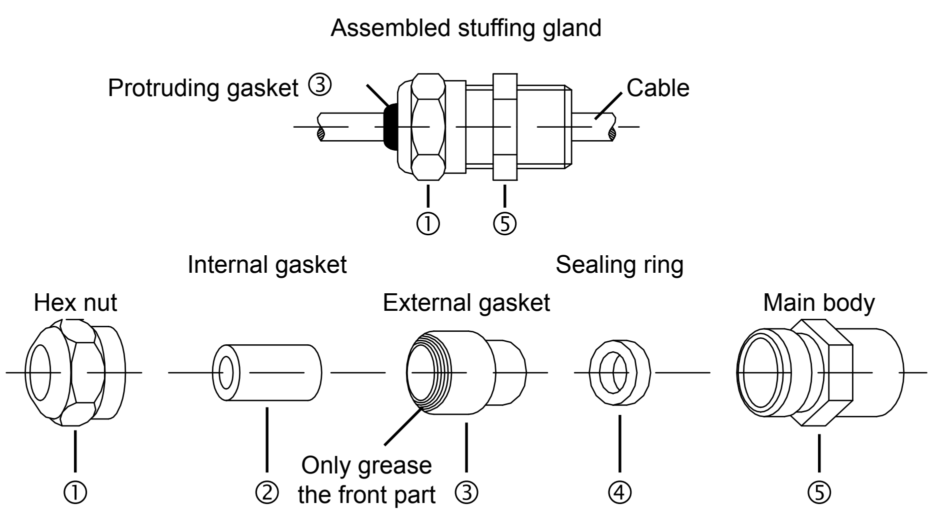


*Fig. 2–3 Stuffing gland (overall and exploded view)*

4. Connect the conductors of the various cables to the load monitoring unit terminals.
5. Put the cover back on the load monitoring unit and tighten up its six screws.

## 2.4 CONFIGURATION OF THE LOAD MONITORING UNIT

Note : The asterisks (✫) correspond to the standard configuration of the LMU 212 version 0XX and LMU 217 version 0XX, that is to say the basic uncalibrated modules.

The configuration of the LMU 212 and LMU 217 load monitoring units include all start-up operations which are necessary to achieve a trouble free operation. This ranges from the supply voltage to the selection of the application, the sensor connection, the energising mode of the relays and their delay time, the selection of the pass-band and the sensor sensitivity. As a reminder: the LMU 217 is composed of two LMU 212.

### 2.4.1 ADAPTATION OF THE MONITOR TO THE AVAILABLE SUPPLY UNIT

#### 2.4.1.1 Supply voltage

Before connecting the LMU 212 or LMU 217 load monitoring unit, select its operating voltage by correctly positioning the jumper (DC or AC voltage) and then, in case of an AC supply, choosing the correct voltage by means of the switch. Finally choose the supply fuse rating.

**WARNING! THE MONITORING UNIT CAN BE SERIOUSLY DAMAGED IF NOT DESTROYED, IF THIS ADVICE IS NOT FOLLOWED.**

The information given in *figures 2–4* to *2–6* and in the table on the next page allows the user to select the operating voltage of the load monitoring unit, to choose the supply fuse and to assign the supply terminals.

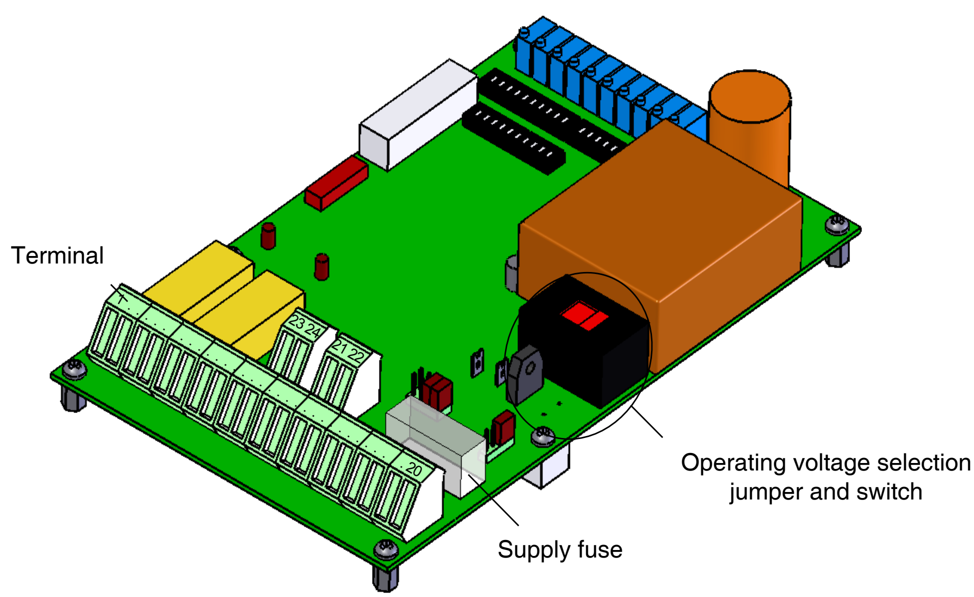


*Fig. 2–4 Load monitoring unit board with location of the selection elements*

1. Place the jumper according to the selected supply mode (see *figure 2–5*) :
   - 'DC' for a DC type supply with a voltage between 20 and 32 VDC
   - 'AC' for an AC type supply (230 VAC, 115 VAC or 48 VAC)

2. In case of an AC supply position the switch on (see *figure 2–5*) :
   - '230 V' for an AC voltage of 230 VAC
   - '115 V' for an AC voltage of 115 VAC
   - for operating voltages of 48 VAC or 20 to 32 VDC the position of the switch is irrelevant.

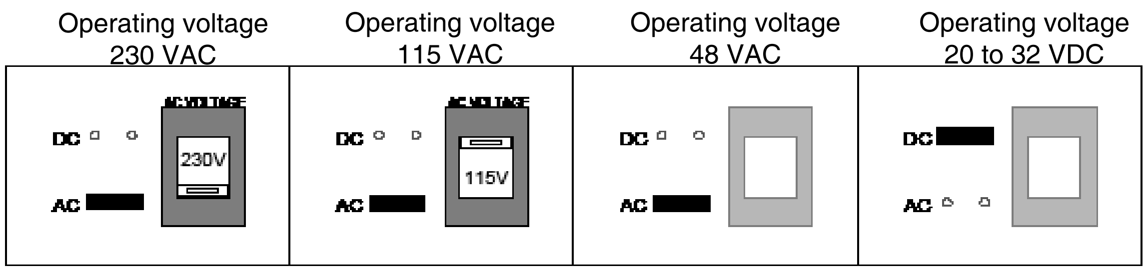


*Fig. 2–5 Jumper and switch configuration*

3. Check the rating of the fuse inserted in its support according to the following table:

| Operating voltage | Supply terminals | | | Fuse | Switch |
|---|---|---|---|---|---|
| | 0 V (18) | N (19) | P (20) | | |
| ☆ 230 VAC | earth | neutral | phase | 80 mAT | 230 V |
| 115 VAC | earth | neutral | phase | 160 mAT | 115 V |
| 48 VAC | earth | neutral | phase | 400 mAT | irrelevant |
| 20 - 32 VDC | 0 V | — | 20 - 32 V | 400 mAT | irrelevant |

A fuse of each rating is supplied with each load monitoring unit.

**WARNING! FOR SAFETY REASONS IT IS IMPORTANT TO SECURE THE STABILITY OF THE SUPPLY UNIT USED AND RESPECT THE OPERATING VOLTAGE SELECTED ON THE LMU.**

Note : Do not forget to report the designation of the collected external signals connected to the supply terminal on the configuration and calibration form (see *Appendix A*).

4. When using a 230 VAC, 115 VAC or 48 VAC supply always connect the LMU to the ground as shown on *figure 2–6* :

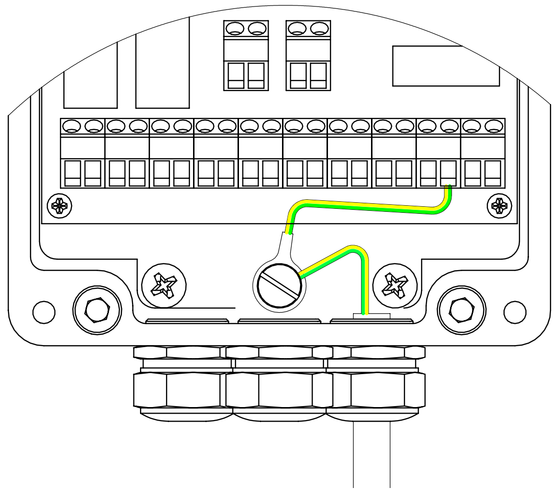

*Fig. 2–6 LMU grounding when using a 230, 115 or 48 VAC supply*

Connect the earth wire to the ground screw and the LMU terminal n° 18 to the ground screw.


**WARNING! WHEN USING A 48 / 115 / 230 VAC SUPPLY ALWAYS MAKE SURE THAT THE LMU HOUSING IS ADEQUATELY CONNECTED TO THE GROUND!**

### 2.4.2 Selection of the type of wiring to the strain gauge

The choice of the type of wiring depends on the length of the cable between the LMU and the strain gauge transducer, on the impedance of the transducer and the linear resistance of the cable.

If the linear resistance of the cable is ≤0,1 Ω/m, the impedance of the strain gauge transducer is ≥200 Ω and the length of the cable is ≤100 m, the wiring of type 1 can be selected (see *figure 2–7*).

The wiring of the type 2 of *figure 2–7* applies to cable lengths of more then 100 m or when the cable length has been changed after the calibration of the load monitoring unit.

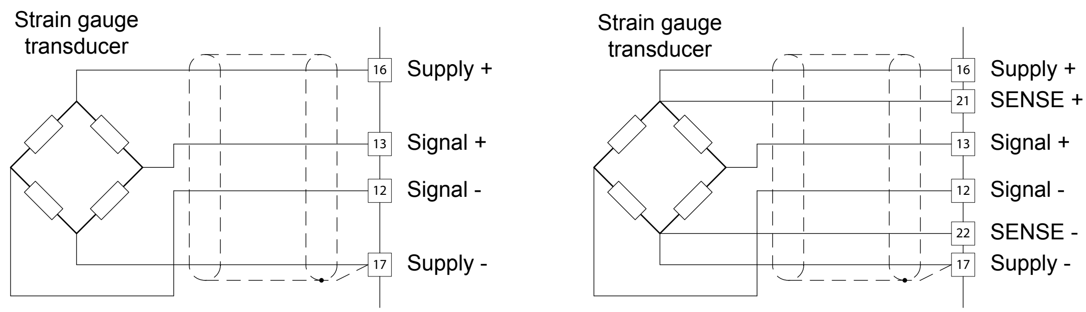


*Fig. 2–7 Wiring types*

For applications in conformity with the TÜV standard detecting short-circuits and/or failure of a conductor in the connecting cable is compulsory. In this case no signal must be sent on terminals 21 (SENSE+) and 22 (SENSE-).

☞ Note : Record the length of the cable between the transducer and the LMU as well as its type on the configuration and calibration form (see *Appendix A*).

### 2.4.3 Designation of the voltage and current inputs/outputs

The LMU load monitoring unit is fitted with a voltage input ($U_{I/P}$) and also with two outputs, one for voltage ($U_{O/P}$) and one for current ($I_{O/P}$).

☞ Note : Record the designation of the external signals linked with $U_{I/P}$, $U_{O/P}$ and $I_{O/P}$ on the configuration and calibration form (see *Appendix A*).

### 2.4.4 Configuration of the detection chains

The load monitoring unit relays are used to detect under- and overloads. In case of an overload, the relay is de-energised when the output voltage $U_{O/P}$ is lower than the threshold voltage $U_{level}$. In case of an underload the output voltage must be higher than the threshold voltage to de-energise the relay. We shall come back on the adjustment of the threshold voltage when calibrating the load monitoring unit.

### 2.4.4.1 Detection chain for relay 1 (REL1)

*Figure 2–11* indicates the location of the SWA micro-switches on the load monitoring unit board.

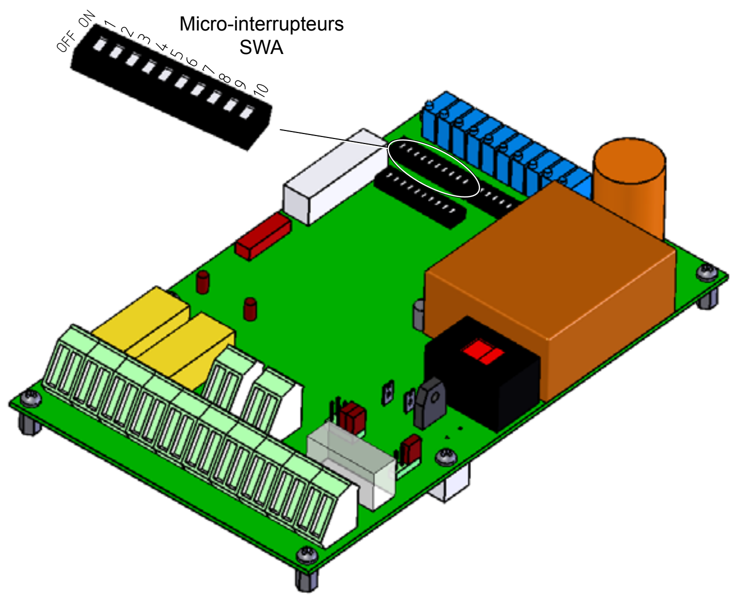


*Fig. 2–8 Location of the SWA micro-switches*

The following table allows the user to select the energising mode and the hysteresis value for the relay REL1.

| | Condition | Configuration | | | Effect |
|---|---|---|---|---|---|
| | | SWA4 | SWA5 | SWA6 | |
| | REL1 de-energised for $F < F_{level1}$ | ON | OFF | — | Detection for $U_{O/P} < U_{level1}$ |
| ☆ | REL1 de-energised for $F > F_{level1}$ | OFF | ON | — | Detection for $U_{O/P} > U_{level1}$ |
| ☆ | Hysteresis < 0.5% | — | — | OFF | Hysteresis < 50 mV measured on $U_{O/P}$ |
| | Hysteresis ≈ 5% (FSD) | — | — | ON | Hysteresis ≈ 500 mV measured on $U_{O/P}$ |

☞ Note : Record the value $F_{level1}$ and the configuration of the micro-switches SWA4, SWA5 and SWA6 on the configuration and calibration form (see *Appendix A*).

This table allows the user to select the configuration of the micro-switches according to the state of the relay REL1.

| State of relay REL1 | Contact REL1A - REL1C | Contact REL1A - REL1B |
|---|---|---|
| REL1 energised | Closed | Open |
| REL1 de-energised | Open | Closed |

The relay REL1 also operates as a line check relay and is de-energised in case of short-circuit or line failure.

☞ Note : Record the designation of the external signals linked to REL1A, REL1B and REL1C on the configuration and calibration form (see *Appendix A*).

### 2.4.4.2 Detection chain for relay 2 (REL2)

*Figure 2–8* on the previous page indicates the location of the SWA micro-switches on the load monitoring unit board. The following table allows the user to select the energising mode and the hysteresis value for the relay REL2.

| | Condition | Configuration | | | Effect |
|---|---|---|---|---|---|
| | | SWA7 | SWA8 | SWA9 | |
| ☆ | REL2 de-energised for $F < F_{level2}$ | ON | OFF | — | Detection for $U_{O/P} < U_{level2}$ |
| | REL2 de-energised for $F > F_{level2}$ | OFF | ON | — | Detection for $U_{O/P} > U_{level2}$ |
| ☆ | Hysteresis < 0.5% | — | — | OFF | Hysteresis < 50 mV measured on $U_{O/P}$ |
| | Hysteresis ≈ 5% (FSD) | — | — | ON | Hysteresis ≈ 500 mV measured on $U_{O/P}$ |

☞ Note : Record the value $F_{level2}$ and the configuration of the micro-switches SWA7, SWA8 and SWA9 on the configuration and calibration form (see *Appendix A*).

This table allows the user to select the configuration of the micro-switches according to the state of the relay REL2.

| State of relay REL2 | Contact REL2A – REL2C | Contact REL2A – REL2B |
|---|---|---|
| REL2 energised | Closed | Open |
| REL2 de-energised | Open | Closed |

The relay REL2 also operates as a line check relay and is de-energised in case of short-circuit or line failure.

☞ Note : Record the designation of the external signals linked to REL2A, REL2B and REL2C on the configuration and calibration form (see *Appendix A*).

### 2.4.4.3 Adjusting the switching delay

The switching delay corresponds to the time passing between the moment when the detection level is reached at the voltage output of the LMU ($U_{O/P}$) and the moment when the relay is de-energized (see *figure 2–12*). On the other hand, the switching delay on tripping of the relay in relation to the voltage output of the LMU ($U_{O/P}$) is instantaneous.

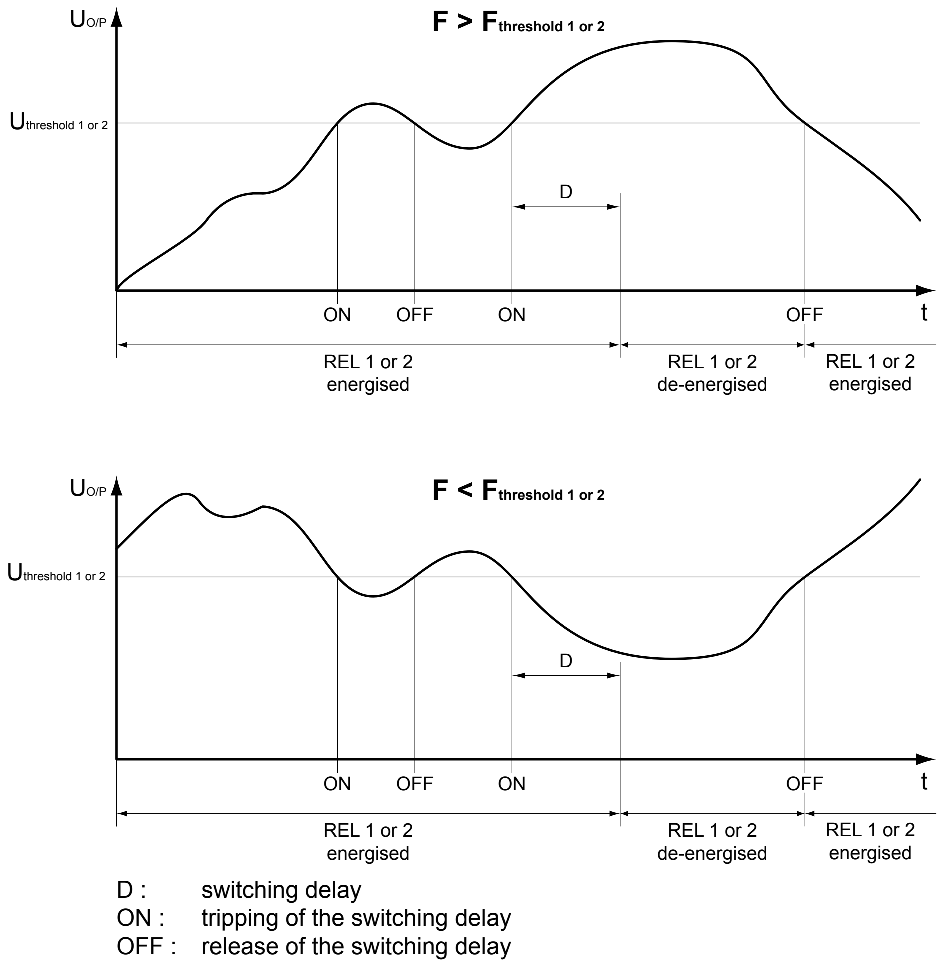


*Fig. 2–9 Examples of switching delays*

To set the switching delay to be applied on relays REL1 and REL2, adjust potentiometer P1 and P2. *Figure 2–10* shows the user where the potentiometers are located on the load monitoring unit board.

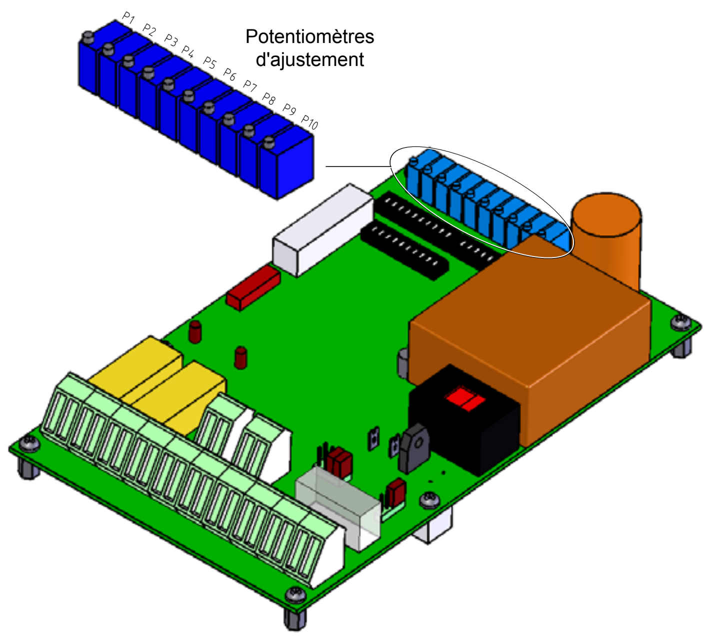


*Fig. 2–10 Potentiometer location on the load monitoring unit board*

The switching delays D1 and D2 are applied to the relays REL1 and REL2. The method of adjustment is as follows :

To determine the switching delay value, calculate the number of turns to be applied to the potentiometers using the following formula :

$$N = \frac{D - 0{,}01}{0{,}170}$$

with N = number of turns to be applied to the potentiometer.

D = switching delay required for the relay in seconds.

$D_{min}$ = 0,01 s

$D_{max}$ = 4,25 s

Apply the calculated number of turns (N) by counting them starting at 0 (the potentiometer at its limit stop in the anti-clockwise sense) and by turning the potentiometer clockwise.

To reach the limit stop, make more than 30 turns anti-clockwise.

Note : Record the switching values of D1 and D2 on the configuration and calibration form (see *Appendix A*).

### 2.4.5 Selection of the pass band

*Figure 2–11* indicates the location of the SWB micro-switches on the load monitoring unit board.

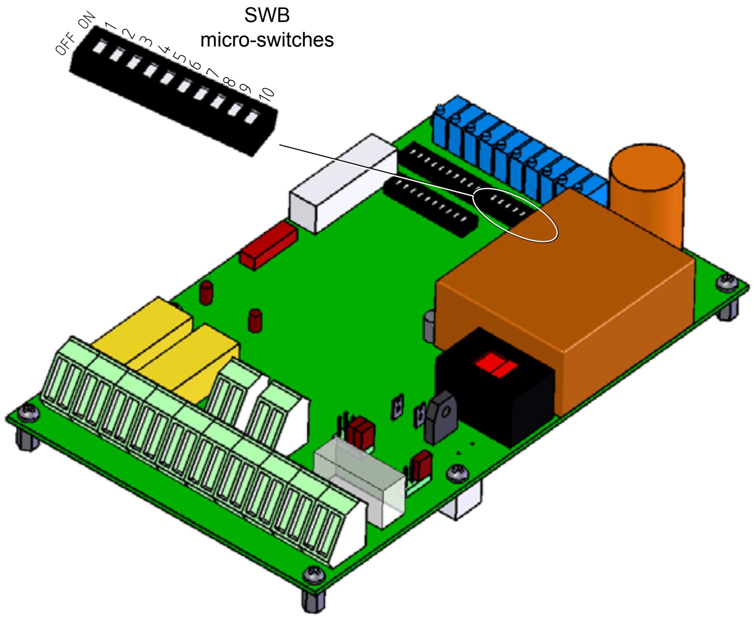


*Fig. 2–11 Location of the SWB micro-switches on the load monitoring unit board*

The following table allows the user to select the pass band of the output signal.

| | $f_C$ frequency range | SWB1 | SWB2 | SWB3 | SWB4 | SWB5 | SWB6 | SWB7 | SWB8 |
|---|---|---|---|---|---|---|---|---|---|
| | DC to 100 Hz | OFF | OFF | OFF | OFF | OFF | OFF | ON | ON |
| ☆ | DC to 10 Hz | OFF | OFF | OFF | OFF | ON | ON | OFF | OFF |
| | DC to 3 Hz | OFF | OFF | ON | ON | OFF | OFF | OFF | OFF |
| | DC to 1 Hz | ON | ON | OFF | OFF | OFF | OFF | OFF | OFF |
| | DC to 0,3 Hz | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF |

☞ Note : Record the value of the cut-off frequency $f_c$ and the configuration of the micro-switches SWB1, SWB2, SWB3, SWB4, SWB5, SWB6, SWB7 and SWB8 on the configuration and calibration form (see *Appendix A*).

### 2.4.6 Selection of the sensitivity range

*Figure 2–18* indicates the location of the SWA micro-switches on the load monitoring unit board. *Figure 2–11* indicates the location of the SWB micro-switches.

The following table allows the user to select the sensitivity range of the strain gauge transducer.

| | Strain gauge sensitivity [mV/V] | SWA1 | SWA2 | SWB10 |
|---|---|---|---|---|
| | 0,42 to 0,78 | OFF | OFF | ON |
| ☆ | 0,7 to 1,3 | ON | OFF | ON |
| | 1,2 to 2.2 | ON | ON | ON |

With a strain gauge transducer connected to the load monitoring unit featuring a higher sensitivity than listed on the above table it is possible to use the function dividing the signal by two (and therefore use transducers with up to 4.4 mV/V sensitivity). See chapter *2.4.8, "Division of the transducer signal or the input voltage* $U_{I/P}$ *by two"*.

☞ Note : Record the selected strain gauge sensitivity as well as the configuration of the micro-switches SWA1, SWA2 and SWB10 on the configuration and calibration form (see *Appendix A*).

### 2.4.7 Selection of the application

The LMU load monitoring unit can be operated on its own or connected to one or several LMUs according to the desired application. In this case, the LMU output signal can be added to the signal of another LMU. The output signals $U_{O/P}$ and/or $I_{O/P}$ of the last monitoring unit correspond to the sum of its own signals and the signals of other connected LMUs. The detection thresholds can be added following the principle.

*Figure 2–12* indicates the location of the SWC micro-switches on the load monitoring unit board.

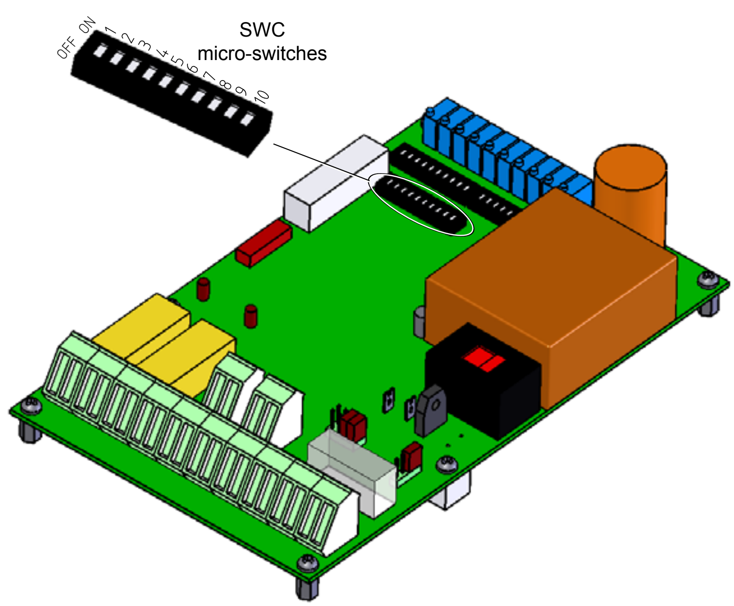


*Fig. 2–12 Location of the SWC micro-switches on the load monitoring unit board*

The following table allows the user to select the desired application independently for each output and relay by means of the SWC micro-switches. **A** corresponds to the strain gauge signal and **B** corresponds to the monitor input voltage.

| | $I_{O/P}$ | SWC1 | SWC5 |
|---|---|---|---|
| ☆ | A | ON | OFF |
| | B | OFF | ON |
| | A + B | ON | ON |

| | $U_{O/P}$ | SWC2 | SWC6 |
|---|---|---|---|
| ☆ | A | ON | OFF |
| | B | OFF | ON |
| | A + B | ON | ON |

| | Detection level REL1 | SWC3 | SWC7 |
|---|---|---|---|
| ☆ | A | ON | OFF |
| | B | OFF | ON |
| | A + B | ON | ON |

| | Detection level REL2 | SWC4 | SWC8 |
|---|---|---|---|
| ☆ | A | ON | OFF |
| | B | OFF | ON |
| | A + B | ON | ON |

☞ Note : Record the SWC micro-switch configuration on the configuration and calibration form (see *Appendix A*).

### 2.4.8 Division of the transducer signal or the input voltage $U_{I/P}$ by two

The LMU load monitoring unit allows the user to divide the transducer signal or/and the voltage input $U_{I/P}$, by two.

This can for instance happen:

- in the case of an application A + B (with A as the transducer signal and B as the voltage $U_{I/P}$), with the signal at its maximum, the sum will generate an output voltage $U_{O/P}$ exceeding 10 VDC
- when the transducer signal is too big (between 2 and 4 mV/V), the load monitoring unit gain can be divided by two.

*Figure 2–8* indicates the location of the SWB micro-switches on the load monitoring unit board. *Figure 2–11* indicates the location of the SWC micro-switches.

| | Transducer signal (A) | SWB10 |
|---|---|---|
| | Divided by 2 (:2) | OFF |
| ☆ | Full (:1) | ON |

| | Voltage input $U_{I/P}$ (B) | SWC10 |
|---|---|---|
| | Divided by (:2) | ON |
| ☆ | Full (:1) | OFF |

As a reminder: the input signal $U_{I/P}$ must remain within -10 VDC and +10 VDC.

☞ Note : Record the SWB and SWC micro-switch configuration on the configuration and calibration form (see *Appendix A*).

### 2.4.9 Use without transducer

The LMU load monitoring unit can be operated without transducer, just by using its voltage input $U_{I/P}$. This can be useful when the user wants to take advantage of the voltage-current converter or relays functions.

1. Activate the transducer presence simulation (to avoid any internal fault detection in relation with the transducer) according to *figure 2–13* and the following table:

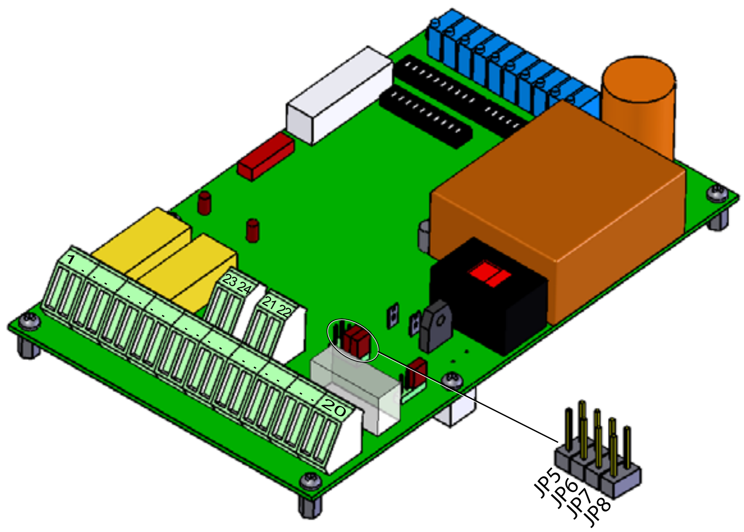


*Fig. 2–13 Location of the transducer presence simulation jumpers*

| | Transducer presence simulation jumper: | Jumper on: |
|---|---|---|
| | Activated | JP5, JP6 |
| ☆ | Deactivated | JP7, JP8 |

2. If necessary, adjust zero on the voltage $U_{O/P}$ or current $I_{O/P}$ output (see chapter *3.1.1 "Zero adjustment on the voltage output"*, respectively chapter *3.1.2 "Zero adjustment on the current output"*.

3. Configure the relays detection thresholds according to chapter *3.5 "Adjustment of the* $U_{level1}$ *and* $U_{level2}$ *detection thresholds"*.

☞ Note : Record the position of the jumpers JP5 to JP8 on the configuration and calibration form (see *Appendix A*).

# 3. Calibration

Two types of calibration are available on the LMU 212 and LMU 217:

- Standard electrical calibration (see *paragraph 3.1*)
- Quick calibration with reference loads (see *paragraph 3.2*).

*Paragraph 3.3* handles the calibration of the built-in test equipment B.I.T.E.

## 3.1 ELECTRICAL CALIBRATION (STANDARD)

### 3.1.1 ZERO ADJUSTMENT ON THE VOLTAGE OUTPUT

The following conditions are required for the zero adjustment on the voltage output:

- No load must be applied on the transducer.
- The micro-switch SWB9 (see *figure 3–3*) must be OFF.
- The micro-switch SWC2 (see *figure 3–2*) must be ON.

Proceed as follows to carry out the zero adjustment:

1. Connect a digital millivoltmeter between terminals 15 ($U_{O/P}$) and 9 (0 V) of the load monitoring unit.
2. Adjust the potentiometers P6 and P7 to get a reading of 0 V ±10 mV on the millivoltmeter. *Figure 3–1* indicates the location of the potentiometers P1 to P10.

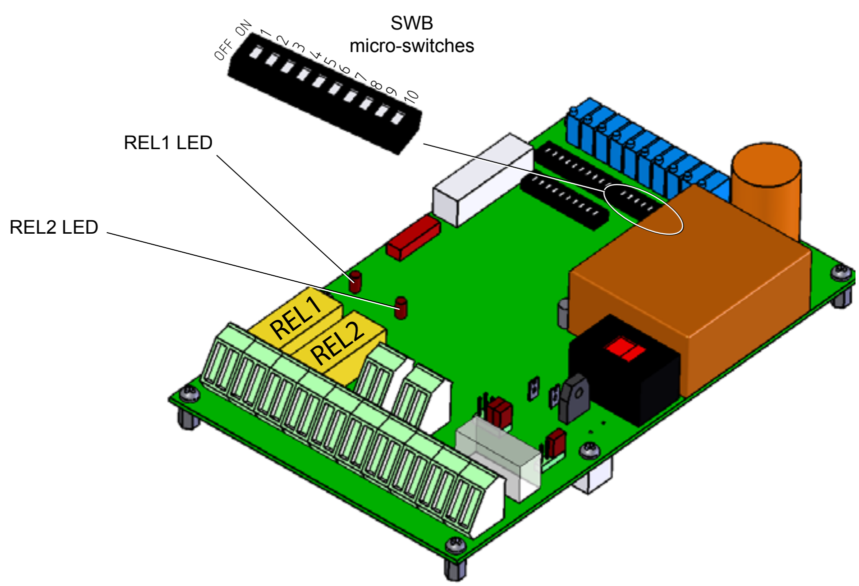


*Fig. 3–1 Location of the potentiometers on the load monitoring unit board*

### 3.1.2 Zero adjustment on the current output

The following condition is required to adjust the zero on the current output :

- The micro-switch SWA10 (see *figure 3–2*) must be OFF.

In this configuration the current output does not depend on the applied load. This allows the user to carry out an accurate adjustment on the current output.

Proceed as follows to carry out the zero adjustment:

1. Connect a digital milliampermeter between terminals 10 ($I_{O/P}$) and 9 (0 V) of the load monitoring unit.
2. Adjust the potentiometer P8 to get the initial value with an accuracy of ±50 µA, for instance 4 mA ±50 µA, on the milliampermeter. *Figure 3–1* indicates where the potentiometer P8 is located.

### 3.1.3 Sensitivity adjustment on the voltage output

To adjust the sensitivity on the voltage output ($U_{O/P}$, terminal 15), carry out the following operations:

1. Apply a known load $F_{known} > ½ \cdot F_{nominal}$ on the transducer:
   $F_{nominal} \equiv U_{O/P\ nominal} = 10\ V\,DC$
   $U_{O/P\ known} \equiv F_{known}$
2. To determine the rating of the voltage output, carry out the following calculation:

$$U_{O/P\ known} = \frac{10\ V \times F_{known}}{F_{nominal}}$$

3. Connect a numerical milliampermeter between terminals 15 ($U_{O/P}$) and 9 (0 V) of the load monitoring unit.
4. Adjust the potentiometer P4 to get a reading of $U_{O/P\ known}$ with an accuracy of ±10 mV. *Figure 3–1* indicates where the potentiometer P4 is located.

### 3.1.4 Sensitivity adjustment on the current output

To adjust the sensitivity on the current output ($I_{O/P}$, terminal 10) maintain the load $F_{known}$ on the transducer. First carry out the procedures described in the *paragraphs 3.1.1 to 3.1.3* and then proceed as follows:

1. To determine the rating of the current output make the following calculation:

$$I_{O/P\ known} = \frac{16\ mA \times F_{known}}{F_{nominal}} + 4\ mA$$

2. Connect a numerical milliampermeter between terminals 10 ($I_{O/P}$) and 9 (0 V) of the load monitoring unit.
3. Position the micro-switches SWC1 and SWA10 and ON so as the current output depends on the applied load.
4. Adjust the potentiometer P10 to get a reading of $I_{O/P\ know}$ with an accuracy of de ±50 µA. *Figure 3–1* indicates where the potentiometer P10 is located.

**WARNING:** THE LOAD MONITORING UNIT WILL ONLY BE OPERATIONAL WHEN THE MICRO-SWITCH SWA10 IS ON.

### 3.1.5 Adjustment of the detection thresholds

The following conditions are required to adjust the detection thresholds:

- No load must be applied to the strain gauge transducer.
- The micro-switch SWB9 (see *figure 3–3*) must be ON to activate the test signal.
- To adjust the detection thresholds $U_{level1}$ and $U_{level2}$ place the micro-switches SWC3 and SWC4 (see *figure 3–2*) on ON.

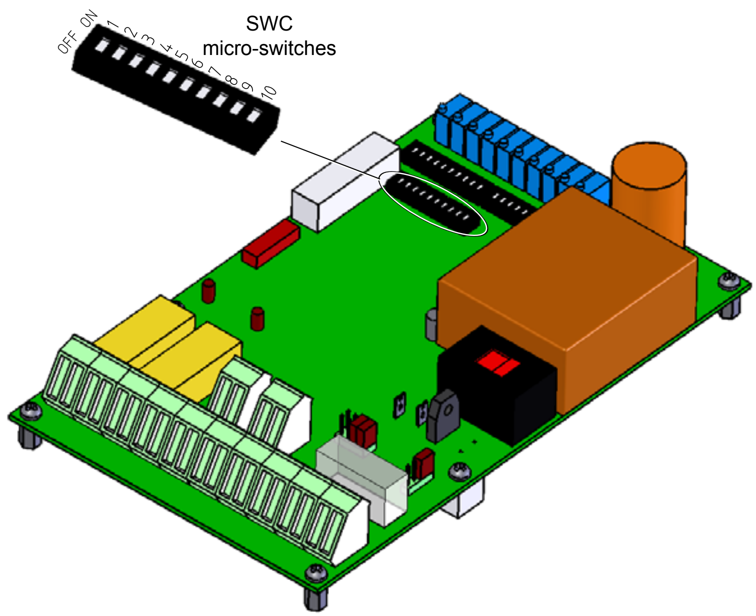


*Fig. 3–2 Location of the micro-switches SWC3 and SWC4 on the load monitoring unit board*

Calculate the threshold voltages in relation to the voltage output $U_{O/P}$ :

$$U_{O/P\ level} = \frac{10\ V \times F_{level}}{F_{nominal}}$$

#### 3.1.5.1 Adjustment of the detection threshold $U_{level1}$

1. Connect a digital millivoltmeter between terminals 15 ($U_{O/P}$) and 9 (0 V) of the load monitoring unit.
2. Adjust the potentiometer P9 to obtain a reading of $U_{O/P\ level1}$ with an accuracy of ±20 mV. *Figure 3–1* indicates where the potentiometers P1 to P10 are located.
3. Turn the potentiometer P3 until the LED on REL1 goes on. *Figure 3–3* indicates the location of this LED.
4. Turn the potentiometer P3 slowly until the LED of REL1 goes off: the detection level will then be switched off.

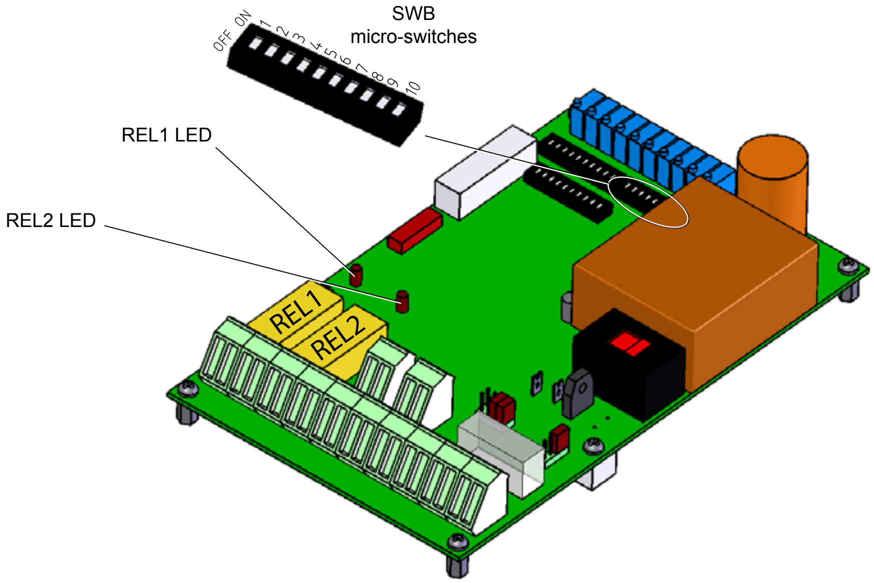


*Fig. 3–3 Location of the relays REL1 and REL2 on the load monitoring unit board*

Note : Record the values $U_{O/P\ level1}$ and $F_{level1}$ on the configuration and calibration form (see *Appendix A*).

### 3.1.5.2 Adjustment of the detection threshold $U_{level2}$

1. Connect a digital millivoltmeter between terminals 15 ($U_{O/P}$) and 9 (0 V) of the load monitoring unit.
2. Adjust the potentiometer P9 to obtain a reading of $U_{O/P\ level2}$ with an accuracy of ±20 mV. *Figure 3–1* indicates where the potentiometers P1 to P10 are located.
3. Turn the potentiometer P5 until the LED on REL2 goes on. *Figure 3–3* indicates the location of this LED.
4. Turn the potentiometer P5 slowly until the LED of REL2 goes off: the detection level will then be switched off.

Note : Record the values $U_{O/P\ level2}$ and $F_{level2}$ on the configuration and calibration form (see *Appendix A*).

WARNING :
- AFTER HAVING ADJUSTED THE DETECTION THRESHOLDS PLACE THE MICRO-SWITCH SWB9 ON OFF.
- THE LOAD MONITORING UNIT WILL ONLY BE OPERATIONAL WHEN THE MICRO-SWITCH SWA10 IS ON.

## 3.2 QUICK CALIBRATION

When the electric calibration is not easy to carry out (environment, time constraints) quick calibration with reference loads is a must.

### 3.2.1 Operations preceding a quick calibration

1. Requested signal of 0 - 10 V for „0 load“ – „overload“
2. Relay 1 = overload
3. Relay 2 = underload (slack of cable)
4. The relays switch off in case of overshooting.

---

Note : When other devices such as display units are connected, the output signal of the LMU 212 must correspond to the input signal of the said devices.

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### 3.2.2 Calibration procedure

The calibration is carried out in four steps as follows:

1. Zero
2. Nominal load
3. Overload threshold
4. Underload (slack of cable).

#### 3.2.2.1 Zero

1. Completely unload the axis / the crane hook.
2. Measure the output voltage between terminals 15 and 9.
3. Adjust the output voltage to 0 V with the potentiometers P6 and P7.

#### 3.2.2.2 Nominal load

1. Load the axis /the crane hook with the nominal load.
2. Adjust the voltage between the terminals 15 and 9 to 10 V with the potentiometers P4.

#### 3.2.2.3 Overload threshold

1. Keep the axis / the crane hook loaded with the nominal load.
2. Select the overload function F>FL for relay 1 (SWA4=OFF/SWA5=ON).
3. Turn the potentiometer P3 (for the level 1) until the relay switches off (the LED will go off).
4. Finely turn the potentiometer P3 until the relay switches on.

#### 3.2.2.4 Underload (slack of cable)

1. Unload the axis / the hook or the cable hoist.
2. Select the underload function F<FL for relay 2 (SWA7=ON/SWA8=OFF).
3. Turn the potentiometer P5 (for the level 2) until the relay switches off (the LED will go off).
4. Finely turn the potentiometer P5 until the relay switches on.

## 3.3 CALIBRATION OF THE BUILT-IN TEST EQUIPMENT (B.I.T.E.)

The built-in test equipment (B.I.T.E.) is based on a signal simulating a fictitious load passing through the complete signal amplification chain. At each call of the B.I.T.E. function the user will be able to check on the various outputs (voltage $U_{O/P}$ and current $I_{O/P}$) as well as on the relays REL1 and REL2 that the load monitoring unit reacts to this fictitious load as if it would be a real load.

The calibration requires the following conditions:

- The load monitoring unit calibration according *paragraph 3.1* or *paragraph 3.2* must already have been carried out.
- No load must be applied to the transducer.
- The micro-switch SWB9 (see *figure 3–3*) must be on position ON.

The calibration is carried out as follows:

1. Connect a digital millivoltmeter between terminals 15 ($U_{O/P}$) and 9 (0 V) of the load monitoring unit (for the voltage calibration) or the milliampermeter between terminals 10 ($I_{O/P}$) and 9 (0V) (for the current calibration).

2. Adjust the potentiometer P9 to obtain a reading of $U_{O/P}$ with an accuracy of ±20 mV for the voltage calibration or a reading of $I_{O/P}$ with an accuracy of ±50 µA for the current calibration.

WARNING : Adjust the B.I.T.E. to get $U_{O/P}$ between -10 VDC and +10 VDC. If this output is not within these limits turn the potentiometer P9 back to its half-way position and carry out a fine adjustment.

*Figure 3–1* shows where the potentiometers P1 to P10 are located.

3. Put the micro-switch SWB9 back on OFF.

# 4. Applications

## 4.1 USING ONE OR SEVERAL LOAD MONITORING UNITS

A load monitoring unit can be used as a stand-alone or combined with other load monitoring units. In the second case the different measuring signals are cascaded and their sum appears on the output of the load monitoring unit at the end of the chain. It is however possible to pick up the measuring signal at the level of each element of this chain.

### 4.1.1 USING ONE SINGLE LOAD MONITORING UNIT LMU 212

In this application the single load monitoring unit runs with only one transducer. The micro-switches SWC1 to SWC8 of the load monitoring unit must be configured as shown on *figure 4–1*.

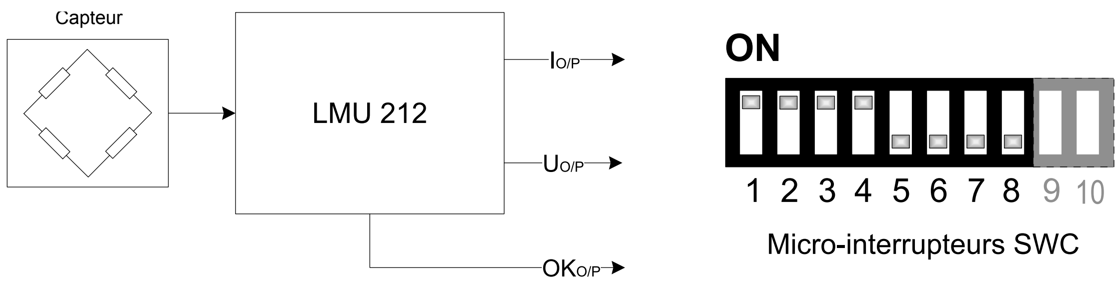



*Fig. 4–1 Using one single load monitoring unit LMU 212*

### 4.1.2 Using one single load monitoring unit LMU 217

Note : A LMU 217 type load monitoring unit is composed of two LMU 212 load monitoring units placed side by side in a common housing.

In this application both load monitoring units are used and connected together. The measuring signal of the transducer A is processed by the first load monitoring unit. Its voltage output is then sent to the voltage input of the second unit. The measuring signal of the transducer B is processed by the second load monitoring unit and added to the input voltage. To carry out this operation the micro-switches of the load monitoring units must be configured as shown on *figure 4–2*.

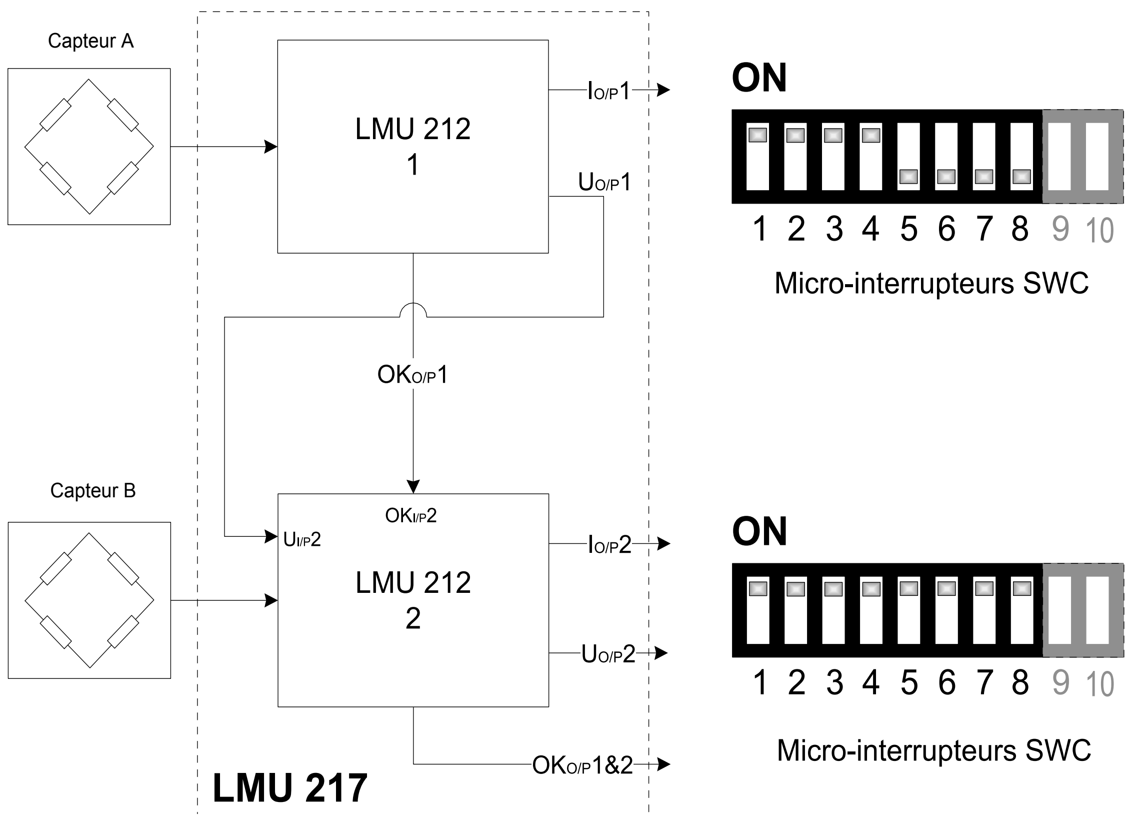



*Fig. 4–2 Using one single load monitoring unit LMU 217*

### 4.1.3 Using three load monitoring units LMU 212

In this application three load monitoring units are used and connected together. The signal of the transducer A is processed by the first load monitoring unit, the signal of the transducer B by the second and the signal of the transducer C by the third. The voltage output of the first unit is connected to the voltage input of the second unit and added to the processed measuring signal of the transducer B. The voltage output of the second unit is connected to the voltage input of the third unit and finally added to the processed measuring signal of the transduce C. To carry out this operation the micro-switches of the load monitoring units must be configured as shown on *figure 4–3*.

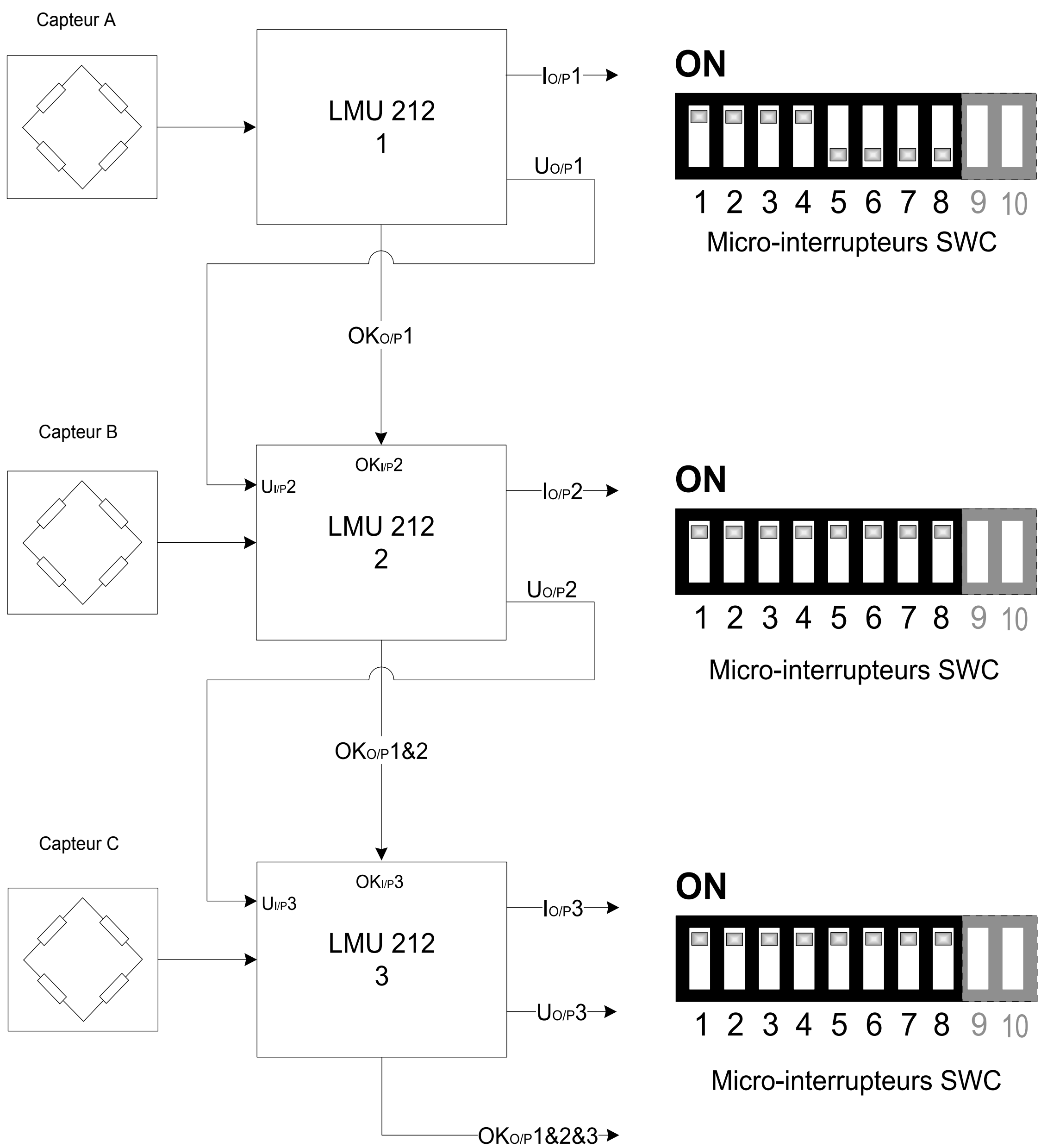



*Fig. 4–3 Using three load monitoring units LMU 212*

## 4.2 USING TRANSDUCERS IN PARALLEL

By using up to four transducers per load monitoring unit in parallel an average signal can be obtained. They can be connected to the connexion box JB 113 for two transducers or JB 114 for up to four transducers. The box is then connected to the transducer input of the load monitoring unit. The latter operates as if it would just have to process the signal of only one transducer(see *figure 4–4*).

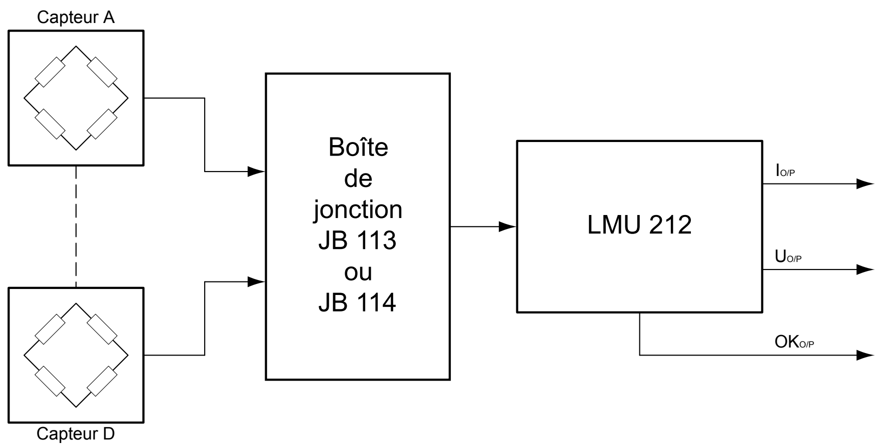



*Fig. 4–4  Using one single load monitoring unit LMU 212*

The number of transducers to be connected to a load monitoring unit is limited to four and the impedance of the resulting chain must be greater than 75 Ω.

## 4.3 OPERATIONAL CHECK OF THE MEASURING CHAIN ("OK")

Each load monitor is fitted with an "OK" input ($OK_{I/P}$) and output ($OK_{O/P}$) for the operational check of the signal processing and transmission.

### 4.3.1 CHECKING THE TRANSDUCER SIGNAL TRANSMISSION TO THE LOAD MONITORING UNIT

A short circuit or a signal transmission line failure will have the following effects :

- The relays REL1 and REL2 will be de-energised.
- The output current $I_{O/P}$ will be > 20 mA.
- The output voltage $U_{O/P}$ will be > 10 V DC.
- The output $OK_{O/P}$ will switch to error mode (low impedance).

A failure of the line connected to the voltage input UI/P of the load monitoring unit will have the following effects :

- The current output $I_{O/P}$ will be > 20 mA.
- The voltage output $U_{O/P}$ will be > 10 V DC.

CAUTION : IF THE VOLTAGE INPUT $U_{I/P}$ SIGNAL DIVISION BY TWO IS ACTIVATED (I.E. WHEN THE MICRO-SWITCH SWC10 IS ON), NO LINE FAILURE WILL BE DETECTED ON THIS INPUT.

### 4.3.2 "OK" PHILOSOPHY

When using simultaneously several load monitoring units, the "OK" inputs and outputs allow the user to cascade the operational checks of the different units and obtain overall control of the measuring chain.

If the output signal "OK" ($OK_{O/P}$) of a load monitor indicates a fault (low impedance), either the transmission between the transducer and the load monitoring unit is interrupted or short-circuited, or the load monitoring unit is defective.

If several load monitoring units are cascaded, the unit causing potentionally a problem sends this information to all following monitoring units. So, all effects described in the previous chapter *4.3.1* will be displayed on the LMU outputs and on all downstream load monitoring units connected to the measuring chain. In case of a defect inspect the output voltages $U_{O/P}$ [terminal (15)– grounding (7), voltage >10 VDC] or the current output $I_{O/P}$ [terminal (10)– grounding (7), current >20 mADC].

Another method of localising a default is to interrupt the line $OK_{I/P}$ – $OK_{O/P}$ between the load monitoring units and then short-circuit terminal (8) and (11) of the suspected LMU(s). If the voltage measured between terminal (8) and the ground (7) is less than 1 VDC, something must be wrong with the LMU. If the voltage is around 24 VDC, the LMU is ok. Remove the short circuit after having carried out the measurements.

## 4.5 PERMANENT SUPPLY CHECK

The load monitoring unit LMU is fitted with a device, which permanently checks the internally generated voltage supplies. Any drop of one of these voltages causing a problem on the LMU will force the LMU to switch to error mode with the following effects:

- The relays REL1 and REL2 will be de-energised.
- The LED shown on *figure 4–5* will go off.

As far as possible (the basic supply units must still remain operational) the voltage and current outputs ($U_{O/P}$ respectively $I_{I/P}$) indicate the problem:

- The $OK_{O/P}$ will go on error mode (low impedance).
- Current output $I_{O/P}$ > 20 mA.
- Voltage output $U_{O/P}$ > 10 V DC.

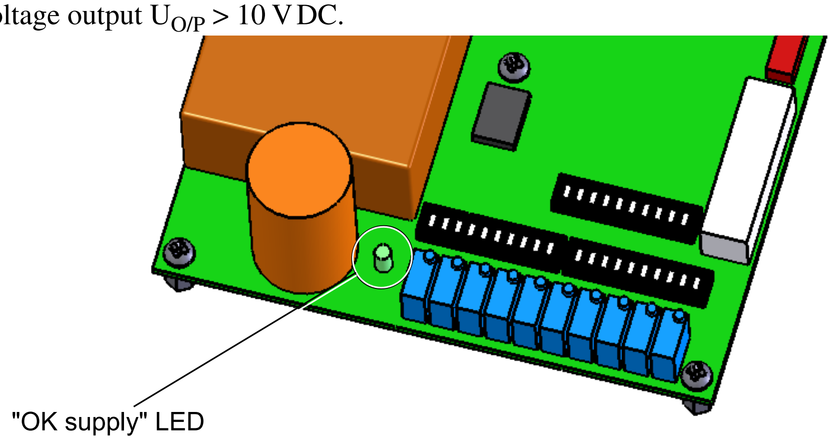



*Fig. 4–5 Permanent supply check LED*

If an error is detected, the user will have to check:

- the wiring in general (short-circuits or disconnected cables) and specially the transducer connections and impedance (must be less than 75 Ω),
- if the LMU supply configuration is correct (see *chapter 2.4.1*)
- the state and the rating of the LMU fuse.

If after having checked these points the problem is still present the LMU may be defective.

## 4.6 USING B.I.T.E. SIGNAL

The load monitoring unit LMU is fitted with system testing the amplification chain of the signal generated by the transducer. The B.I.T.E. test signal simulating a load must be calibrated when installing the LMU (see *chapter 3.3*).

To activate the function two possibilities are available :

- connect the B.I.T.E. control input (terminal 23) to the ground (terminal 24), see *figure 4–6.*
- send a "low active" CMOS/TTL compatible control signal (see following table) on the B.I.T.E. (signal on terminal 23, ground on terminal 24):

| **B.I.T.E. function** | **Necessary logic state** | **B.I.T.E. input terminals condition (23-24)** |
|---|---|---|
| Activated | Low | "Low" level input voltage (VIL) : 0 to +0,5 VDC |
| Deactivated | High | "High" level input voltage (VIH) : +0,7 to +25 VDC |

**WARNING!** **HAVING ACTIVATED THE B.I.T.E. FUNCTION, THE VARIOUS OUTPUTS ($U_{O/P}$, $I_{O/P}$ AND RELAYS) WILL NO LONGER BE REPRESENTATIVE OF THE REAL LOAD APPLIED TO THE TRANSDUCER. NO SAFETY CHECKS WILL BE CARRIED OUT!**

**TO PREVENT ANY RISK, ONLY ACTIVATE THE B.I.T.E. WHEN THE APPLIED LOAD IS ZERO AND WHEN THE SYSTEM REPRESENTS NO RISK.**

**THE B.I.T.E. FUNCTION MUST ONLY BE USED AS A PERIODICAL CHECK. DO NOT HAVE IT ACTIVATED DURING NORMAL USE OF THE LOAD MONITORING UNIT.**

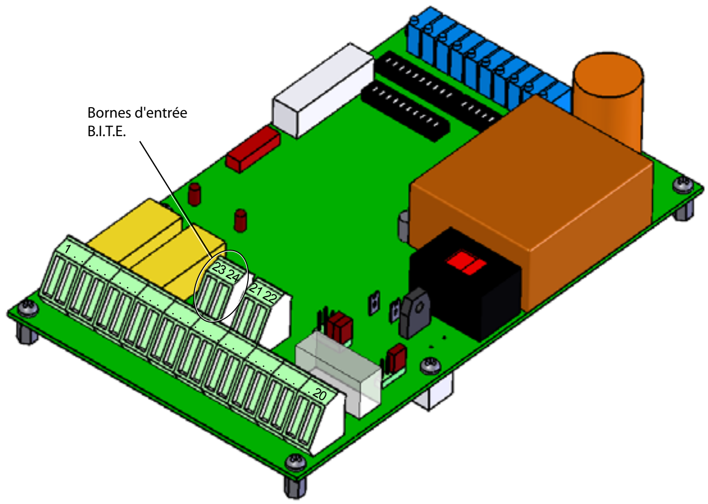



*Fig. 4–6 B.I.T.E. control input terminals*

Procedure:

1. Make sure that no load is applied on the transducer and that the activation of the B.I.T.E. function does not endanger the application.
2. Activate the B.I.T.E. function.
3. Wait until the final voltage has settled (up to approximately 7 s if the LMU has been configured with a 0,3 Hz filter).
3. Check the correct operation of the relays REL1 and/or REL2 (depending on the setting). Measure the voltage $U_{O/P}$ and the current $I_{O/P}$ (by means of a measuring instrument connected to the corresponding outputs).
4. Compare the measured signal to the calibrated signal (see installation).
5. Deactivate the B.I.T.E. function.

The signal obtained on the load monitoring outputs when the B.I.T.E. function is activated must correspond to the signal after calibration.

# 5. Repair

## 5.1 TROUBLE-SHOOTING

In case of a defect requiring a repair it is very important to include the product defect report and the following information:

- Model number, part number, serial number, order number and date of purchase.
- Description of the defect and the conditions in which it appeared.
- Configuration and calibration report.
- Description of the test bench (drawing, photographs, sketches, etc.).
- Description of the tested object (drawing, photographs, sketches, etc.).
- Description of the test cycle.

To allow Magtrol to complete the work in the best possible time, follow the procedure outlined below:

- Carefully pack the load monitoring unit.
- Attach the product defect report indicating the problems encountered.

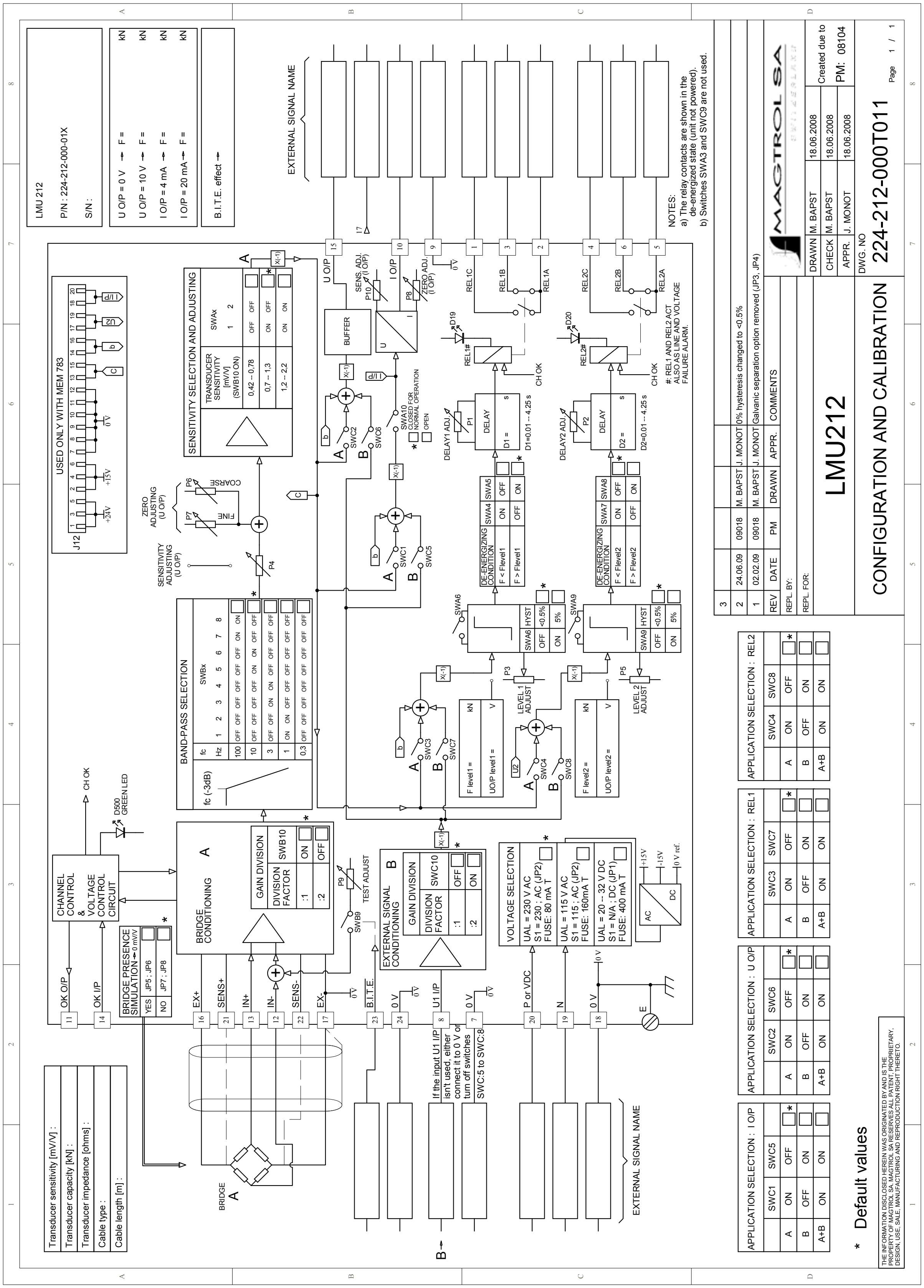
Note : Do not hesitate to contact Magtrol's after-sales service for additional information.

# Appendix A : Configuration and Calibration Report

The configuration and calibration reports for the LMU 212 (224-212-000T011) and LMU 217 (224-217-000T011) load monitoring units joined in this appendix have to be filled-in with the utmost care and placed in the load monitoring unit housing under its cover.

When the unit needs repairing, attach a copy of this report. This will allow the engineers to carry out the work in the shortest possible time.

# A.1 LMU 212


LMU 212
P/N : 224-212-000-01X
S/N :
U O/P = 0 V → F = kN
U O/P = 10 V → F = kN
I O/P = 4 mA → F = kN
I O/P = 20 mA → F = kN
B.I.T.E. effect →
USED ONLY WITH MEM 783
EXTERNAL SIGNAL NAME
SENSITIVITY SELECTION AND ADJUSTING
BAND-PASS SELECTION
CHANNEL CONTROL & VOLTAGE CONTROL CIRCUIT
BRIDGE CONDITIONING
EXTERNAL SIGNAL CONDITIONING
VOLTAGE SELECTION
UAL = 230 V AC
S1 = 230 ; AC (JP2)
FUSE: 80 mA T
UAL = 115 V AC
S1 = 115 ; AC (JP2)
FUSE: 160mA T
UAL = 20 -- 32 V DC
S1 = N/A ; DC (JP1)
FUSE: 400 mA T
Transducer sensitivity [mV/V] :
Transducer capacity [kN] :
Transducer impedance [ohms] :
Cable type :
Cable length [m] :
If the input U1 I/P isn't used, either connect it to 0 V or turn off switches SWC:5 to SWC:8
NOTES:
a) The relay contacts are shown in the de-energized state (unit not powered).
b) Switches SWA3 and SWC9 are not used.
# REL1 AND REL2 ACT ALSO AS LINE AND VOLTAGE FAILURE ALARM.
APPLICATION SELECTION : I O/P
APPLICATION SELECTION : U O/P
APPLICATION SELECTION : REL1
APPLICATION SELECTION : REL2
* Default values
2 24.06.09 09018 M. BAPST J. MONOT 0% hysteresis changed to <0.5%
1 02.02.09 09018 M. BAPST J. MONOT Galvanic separation option removed (JP3, JP4)
REV DATE PM DRAWN APPR. COMMENTS
LMU212
CONFIGURATION AND CALIBRATION
DRAWN M. BAPST 18.06.2008
CHECK M. BAPST 18.06.2008
APPR. J. MONOT 18.06.2008
Created due to PM: 08104
DWG. NO 224-212-000T011
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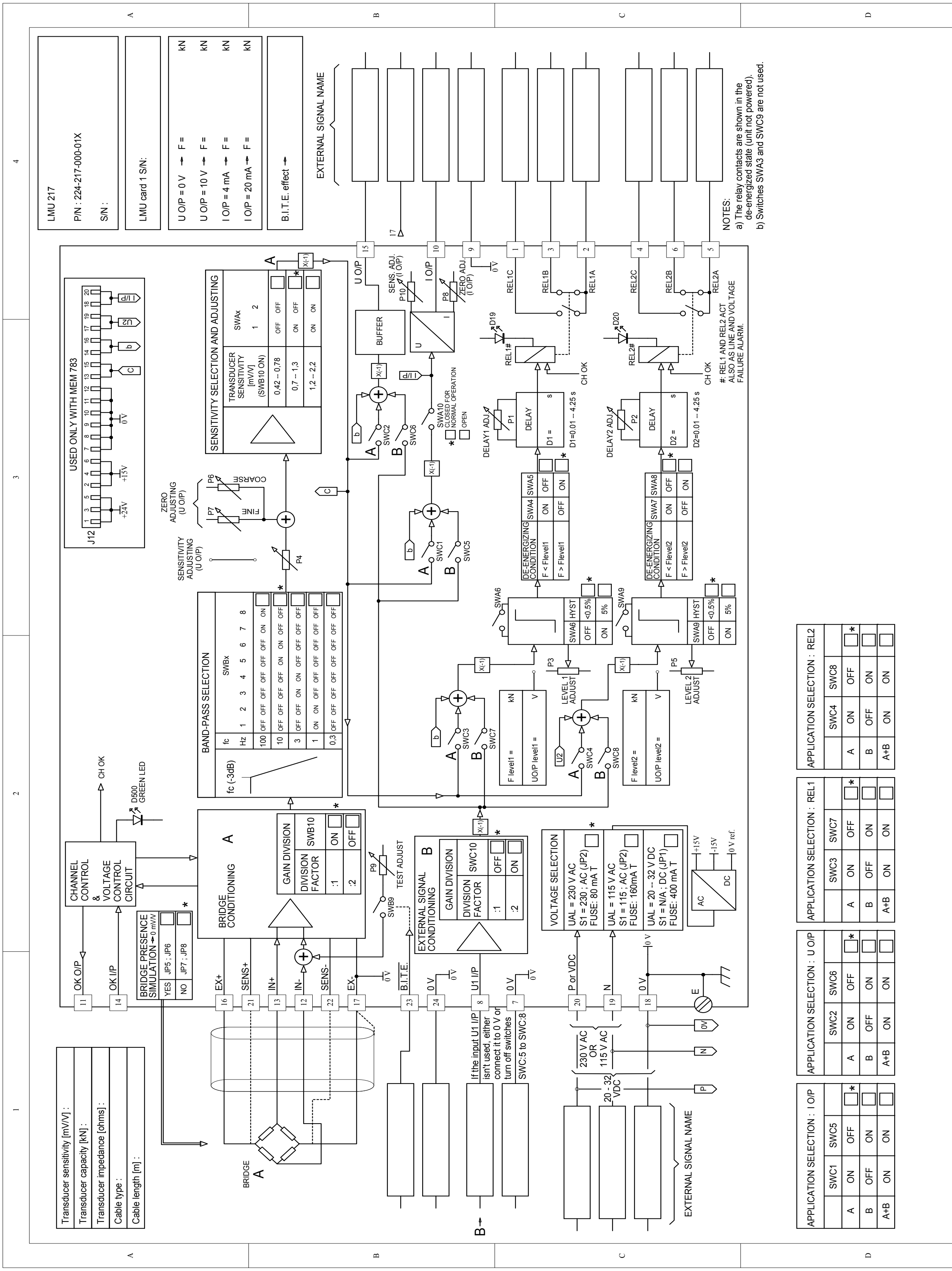
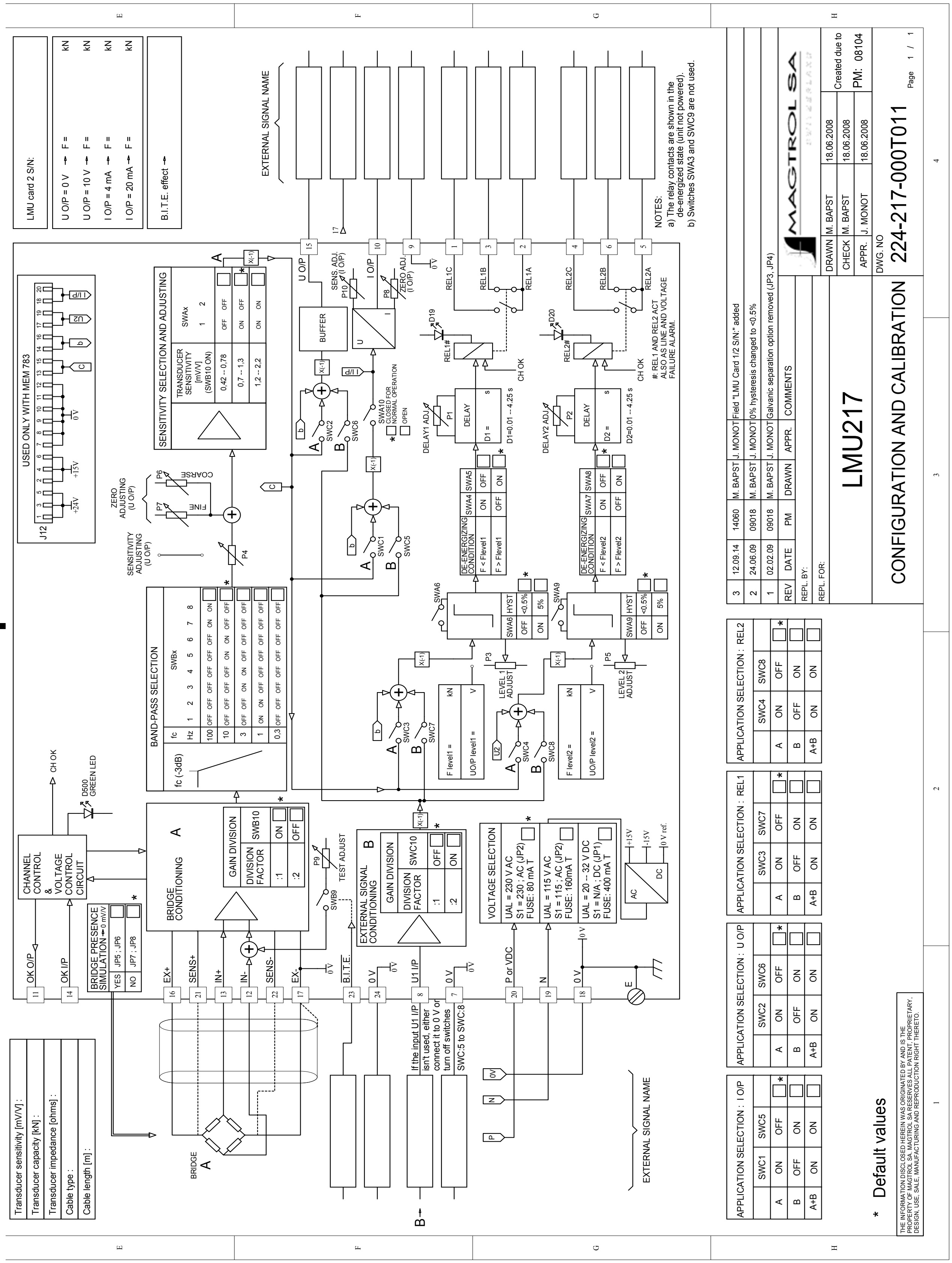
# A.2 LMU 217


LMU 217
P/N : 224-217-000-01X
S/N :
LMU card 1 S/N:
U O/P = 0 V → F = kN
U O/P = 10 V → F = kN
I O/P = 4 mA → F = kN
I O/P = 20 mA → F = kN
B.I.T.E. effect →
EXTERNAL SIGNAL NAME
NOTES:
a) The relay contacts are shown in the de-energized state (unit not powered).
b) Switches SWA3 and SWC9 are not used.
USED ONLY WITH MEM 783
SENSITIVITY SELECTION AND ADJUSTING
BAND-PASS SELECTION
ZERO ADJUSTING (U O/P)
SENSITIVITY ADJUSTING (U O/P)
CHANNEL CONTROL & VOLTAGE CONTROL CIRCUIT
BRIDGE PRESENCE SIMULATION
BRIDGE CONDITIONING
GAIN DIVISION
EXTERNAL SIGNAL CONDITIONING
TEST ADJUST
VOLTAGE SELECTION
UAL = 230 V AC S1 = 230 : AC (JP2) FUSE: 80 mA T
UAL = 115 V AC S1 = 115 : AC (JP2) FUSE: 160mA T
UAL = 20 – 32 V DC S1 = N/A : DC (JP1) FUSE: 400 mA T
DE-ENERGIZING CONDITION
DELAY1 ADJ.
DELAY2 ADJ.
D1=0.01 – 4.25 s
D2=0.01 – 4.25 s
LEVEL 1 ADJUST
LEVEL 2 ADJUST
#: REL1 AND REL2 ACT ALSO AS LINE AND VOLTAGE FAILURE ALARM.
Transducer sensitivity [mV/V] :
Transducer capacity [kN] :
Transducer impedance [ohms] :
Cable type :
Cable length [m] :
If the input U1 I/P isn't used, either connect it to 0 V or turn off switches SWC:5 to SWC:8
230 V AC OR 115 V AC
20 - 32 VDC
APPLICATION SELECTION : I O/P
APPLICATION SELECTION : U O/P
APPLICATION SELECTION : REL1
APPLICATION SELECTION : REL2


LMU217
CONFIGURATION AND CALIBRATION
224-217-000T011
MAGTROL SA
Created due to
PM: 08104
DRAWN M. BAPST 18.06.2008
CHECK M. BAPST 18.06.2008
APPR. J. MONOT 18.06.2008
3 12.09.14 14060 M. BAPST J. MONOT Field "LMU Card 1/2 S/N:" added
2 24.06.09 09018 M. BAPST J. MONOT 0% hysteresis changed to <0.5%
1 02.02.09 09018 M. BAPST J. MONOT Galvanic separation option removed (JP3, JP4)
REV DATE PM DRAWN APPR. COMMENTS
* Default values
NOTES:
a) The relay contacts are shown in the de-energized state (unit not powered).
b) Switches SWA3 and SWC9 are not used.
EXTERNAL SIGNAL NAME
BAND-PASS SELECTION
SENSITIVITY SELECTION AND ADJUSTING
BRIDGE CONDITIONING A
EXTERNAL SIGNAL CONDITIONING B
VOLTAGE SELECTION
USED ONLY WITH MEM 783
Transducer sensitivity [mV/V] :
Transducer capacity [kN] :
Transducer impedance [ohms] :
Cable type :
Cable length [m] :
LMU card 2 S/N:
B.I.T.E. effect

| MAGTROL SA SWITZERLAND | Formulaire - Q<br>**Declaration of conformity CE** | *Document No :* **Do033E**<br>*Date :* 16.03.2009<br>*Visa :* nbur |
|---|---|---|

DEC No : **026**

We,

**MAGTROL SA**
Centre technologique Montena
CH – 1728 ROSSENS / Fribourg (SWITZERLAND)

Herewith declare that the following products :

**Load monitoring unit**

family types

**LMU 212, 216 and 217**

which are mentioned in this declaration, meet all requirements defined in :

2004/108/CE Electromagnetic compatibility (EMC)

Those products have been developed and manufactured according to the processes described in Magtrol's Manual conformity with the ISO 9001 norm.

For the evaluation of these products, following norms have been taken into account :

IEC ou EN 61326-1
Electrical equipment for measurement, control and laboratory use
– EMC requirements – Part 1: General requirements

IEC ou EN 61326-2-3
Electrical equipment for measurement, control and laboratory use
– EMC requirements – Part 2-3: Particular requirements

Rossens, may 5th 2009

J. Cattin
General Manager

N.Buri
QES System Manager

Page : 1 de 1

# Magtrol Limited Warranty

Magtrol, Inc. warrants its products to be free from defects in material and workmanship under normal use and service for a period of twenty-four (24) months from the date of shipment. Software is warranted to operate in accordance with its programmed instructions on appropriate Magtrol instruments. This warranty extends only to the original purchaser and shall not apply to fuses, computer media, or any other product which, in Magtrol's sole opinion, has been subject to misuse, alteration, abuse or abnormal conditions of operation or shipping.

Magtrol's obligation under this warranty is limited to repair or replacement of a product which is returned to the factory within the warranty period and is determined, upon examination by Magtrol, to be defective. If Magtrol determines that the defect or malfunction has been caused by misuse, alteration, abuse or abnormal conditions of operation or shipping, Magtrol will repair the product and bill the purchaser for the reasonable cost of repair. If the product is not covered by this warranty, Magtrol will, if requested by purchaser, submit an estimate of the repair costs before work is started.

To obtain repair service under this warranty, purchaser must forward the product (transportation prepaid) and a description of the malfunction to the factory. The instrument shall be repaired at the factory and returned to purchaser, transportation prepaid. **MAGTROL ASSUMES NO RISK FOR IN-TRANSIT DAMAGE.**

THE FOREGOING WARRANTY IS PURCHASER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, OR FITNESS FOR ANY PARTICULAR PURPOSE OR USE. MAGTROL SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OR LOSS WHETHER IN CONTRACT, TORT, OR OTHERWISE.

## CLAIMS

Immediately upon arrival, purchaser shall check the packing container against the enclosed packing list and shall, within thirty (30) days of arrival, give Magtrol notice of shortages or any nonconformity with the terms of the order. If purchaser fails to give notice, the delivery shall be deemed to conform with the terms of the order.

The purchaser assumes all risk of loss or damage to products upon delivery by Magtrol to the carrier. If a product is damaged in transit, PURCHASER MUST FILE ALL CLAIMS FOR DAMAGE WITH THE CARRIER to obtain compensation. Upon request by purchaser, Magtrol will submit an estimate of the cost to repair shipment damage.

**MAGTROL SA**
Route de Montena 77
1728 Rossens / Fribourg, Suisse
Tél: +41 (0)26 407 3000
Fax: +41 (0)26 407 3001
E-mail: magtrol@magtrol.ch

**MAGTROL INC**
70 Gardenville Parkway
Buffalo, New York 14224 USA
Tél: +1 716 668 5555
Fax: +1 716 668 8705
E-mail: magtrol@magtrol.com

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