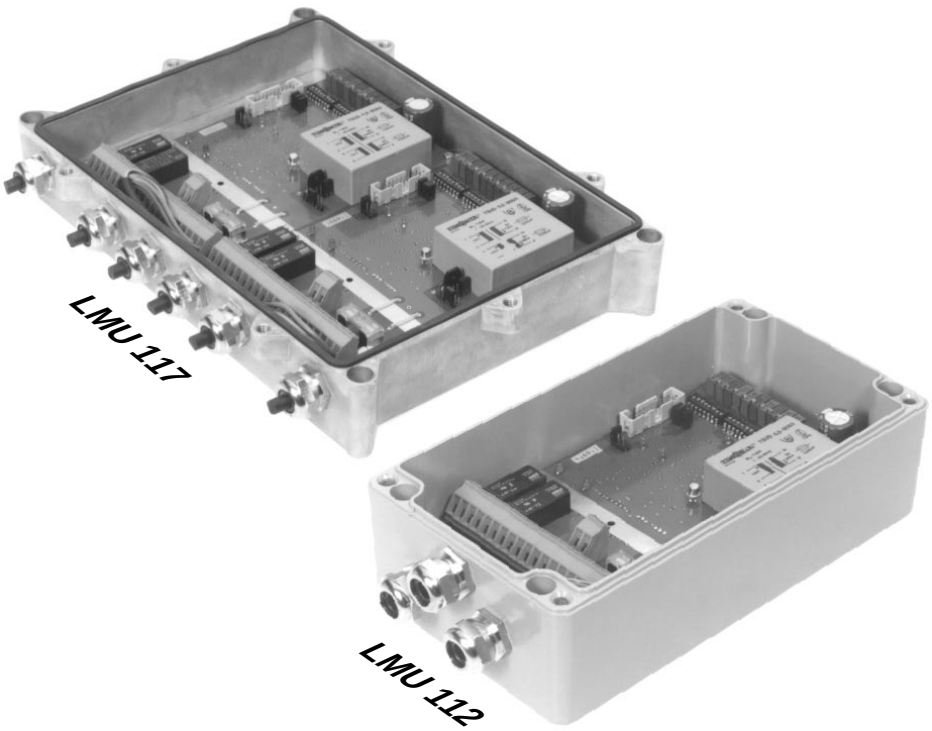
INSTRUCTION MANUAL

LOAD MONITORING UNIT
LMU 112 VERSIONS 02X AND 02XC
LMU 117 VERSIONS 01X AND 01XC

P/N 633.014 E

(MALMU112-02/E)



REVISION RECORD SHEET

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PREFACE

Purpose and Scope of This Manual

This manual has all the necessary information regarding the installation, configuration, calibration and connection of the LMU 112 or LMU 117 load monitoring unit for strain gauge transducers.

Who Should Use This Manual ?

This manual is for users who want to install the load monitoring unit on lifting, weighing or other equipment, to program it, calibrate it, connect it to the strain gauge and to a display and alarm system and to use it to measure loads.

The user should have suitable technical training in mechanics and electronics (certificate of professional ability or equivalent) so as to allow him to install and use this load monitoring unit.

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.

The chapters of this manual are presented in a logical order. You should read those that are most relevant to you and then keep the manual at hand for future reference.

The structure of the manual is as follows :

Chapter 1 : **Safety** - Contains important information for your personal safety and the correct installation of the load monitoring unit.

THIS CHAPTER SHOULD BE READ BEFORE STARTING INSTALLATION, CONFIGURATION, CALIBRATION AND CONNECTION OF THE LOAD MONITORING UNIT.

Chapter 2 : **Introduction** - Contains the technical data sheet for the load monitoring unit. This data sheet describes the monitor and gives its technical characteristics.

Chapter 3 : **Configuration and Calibration** - Description of the programming and calibration procedures for optimum functioning of the load monitoring unit.

Chapter 4 : **Assembly and Connection** - Specifications for the assembly and connection of the load monitoring unit to a strain gauge and a display and alarm system.

Chapter 5 : **Applications** - Examples of applications for the load monitoring unit.

Appendix A : **Mechanical Layout** - Drawing of the LMU 112 and LMU 117 load monitoring units.

Appendix B : **Configuration and Calibration Form** - Contains a blank form which can be copied and filled in during the configuration and calibration of the load monitoring unit.

Appendix C : **CE Conformity declaration** - Document certifying that the LMU 112 and LMU 117 load monitoring units conform to the EN-50081-2 and EN-50082-2 standards.

Product Defect Report - Allows the user to indicate problems observed on a module/system, thus enabling our After-Sales Service department to repair the unit as quickly as possible.

Documentation Evaluation Form - Allows the user to provide us with valuable feedback on our documentation.

Related Publications

For additional information relating to the use of the LMU 112 or LMU 117 load monitoring unit, the operator is referred to the following document :

- LB 210 & LB 230 Instruction manual P/N 632.005

1 SAFETY

1.1 Symbols Used in This Manual

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

*The **NOTE** symbol.* ☞

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 functioning of the product to be obtained.

The CAUTION safety symbol. ⚠

This is used to draw the operator's attention to information, directives, procedures, etc. which, if ignored, may result in damage being caused to the material being used.
The associated text describes the necessary precautions to take and the consequences that may arise if the precautions are ignored.

THE WARNING SAFETY SYMBOL. STOP

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

1.2 Important Remarks on Safety

WARNING

THIS EQUIPMENT MUST ALWAYS BE EARTHED.

ALWAYS DISCONNECT THE MAINS SUPPLY BEFORE UNDERTAKING ANY WORK ON THE SYSTEM.

THE OPERATOR OR THIRD PARTIES MAY BE SERIOUSLY OR FATALLY INJURED BY ELECTROCUTION IF THESE DIRECTIVES ARE INGNORED.

CAUTION

This instruction manual should be read carefully and the safety instructions observed before installing, calibration or using the material described herein.

1.2.1 Location of Safety Symbols in This Manual

The operator should also take note of the safety-related information found elsewhere in this manual :

This symbol is found on the following pages :
1-2 ; 3-1; 4-5

This symbol is found on the following page :
1-2

1.3 Additional Remarks on Safety

For the correct and safe use of this instrument, it is essential that both operating and servicing personnel follow generally accepted safety procedures in addition to safety precautions specified in this manual. Specific warning and caution statements, where they apply, will be found throughout the manual. These are highlighted by the corresponding warning and caution symbols (described above).

The safety procedures should be communicated to all personnel who are liable to operate the equipment described in this manual.

No modifications, transformations or repairs should be made to the equipment without having first obtained the written permission of Vibro-Meter. Failure to observe this will invalidate the warranty.

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2 INTRODUCTION

This chapter contains the technical data sheet of the LMU 112 and LMU 117 load monitoring units. This gives a description of the LMU and their technical characteristics.

Data sheet	**P/N**
- LMU 112 / LMU 117 load monitoring unit for strain gauge transducer	238-013

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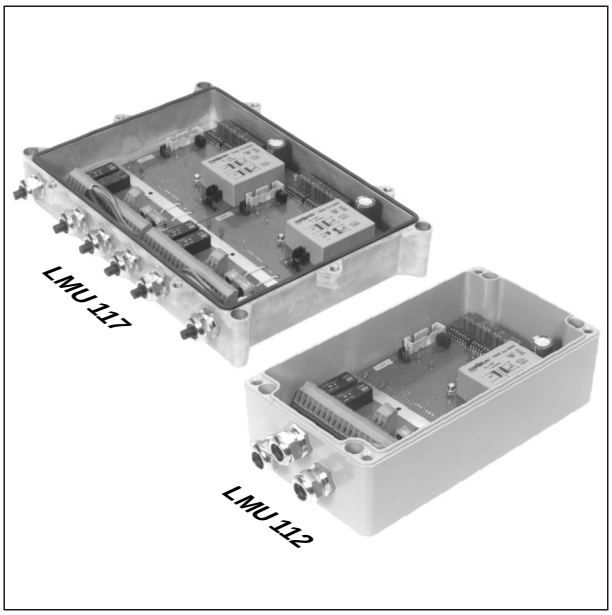
LMU 112
LMU 117

vibro-meter certified by

Load Monitoring Unit for Strain Gauge Transducer



LMU 112 FEATURES

- **For use with full-bridge strain gauge transducers (sensitivity 0.5 to 2 mV/V)**
- **Voltage input for different charge summation**
- **2 level detectors with relay output contacts**
- **0 to 20 mA DC current output**
- **±10 V voltage output**
- **"OK" to monitor correct operation (detect signal line failure or short circuits)**
- **Compatible to CE standards**
- **IP 65 aluminium housing**

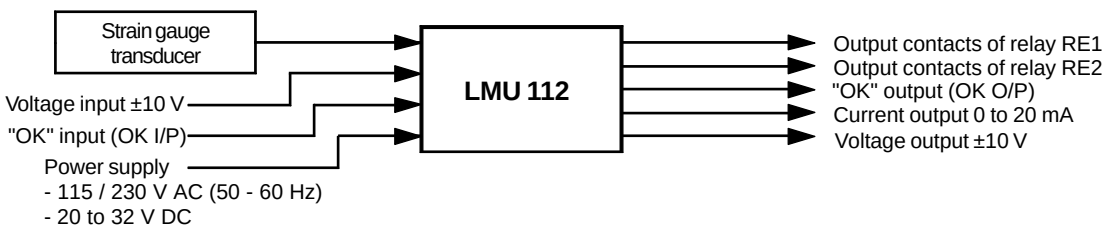
LMU 117 FEATURES

- **Composed of two LMU 112 units**
- **Same features as the LMU 112 unit**

DESCRIPTION

The LMU load monitoring unit is specially designed for strain gauge transducer applications. It is flexible and fully configurable thanks to DIP-switches and jumpers, which allow the unit to be easily installed (no solder connections required).
The LMU contains 1 full-bridge strain gauge transducer input, 1 voltage input, 2 level detectors (output contacts), 1 current output, 1 voltage output and 2 "OK" self-test signals for monitoring the correct operation while running several LMU units simultaneously. 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). A built-in self-test 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 (resp. current) changes to >10 V DC (>20 mA).
The LMU is fully compatible with European Community reglementation (CE).
Its IP 65 aluminium housing allows the system to be used in harsh environments.
Using SMD (surface mounted device) technology, the LMU allows the maximal performance/price ratio for strain gauge transducer monitoring.

System configuration :



INPUT CHARACTERISTICS

Power supply
- Voltage : 115 VAC/230 VAC (50 ÷ 60 Hz) or 20 to 32 V DC, jumper selectable
- Maximum current : 70 mA for 230 V AC, fuse rating = 80 mAT
  150 mA for 115 V AC, fuse rating = 160 mAT
  250 mA for 20 V DC, fuse rating = 400 mAT

Bridge signal
- Supply voltage : 10 V DC
- Max. possible current : 150 mA DC
- Sensitivity : 0.5 to 2 mV/V
- Max. dynamic component of bridge signal : ±30 mV DC
- Max. common mode voltage on input : ±10 V

Voltage input for summation of another load
- Input impedance : 200 kΩ
- Max. input signal (dynamic) : ±10 V

Input for self-test feature (OK I/P)
- Type : active if short circuited

OUTPUT CHARACTERISTICS

Relay outputs
- Number : 2 (RE 1; RE 2)
- Normal state : Normally energized
- Max. current per contact : 5 A continuous / break 20 A make
- Max. voltage per contact : AC : 250 V_{rms} DC : 350 V DC
- Max. break power : 100 W or 1000 VA
- Insulation voltage : Contact-contact : 750 V_{rms} contact-coil : 1,5 kV_{rms}
- Lifetime : > 2 x 10^8 switchings
- 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. value : ±10 V ≡ FSD
- Max. load : ≥10 kΩ (ε ≤1%) [≥2 kΩ (ε ≤5%)] [1)]
- Output impedance : 100 Ω (in series)

Output for self-test feature (OK O/P)
- Type : open collector (short circuit-proof)

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 : Using DIP-switches
- Zero adjustment for measuring chain : - Coarse adjustment using multi-turn potentiometer : equivalent to ± 10 V/output for Range 3
  - Fine adjustment using multi-turn potentiometer : 5% of the coarse adjustment
- Temperature drift of transfer function : ≤ 200 ppm/°C
- Temperature drift of 0 : ≤ 200 ppm of FSD/°C for range 0.5 mV/V ≡ ≤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 : ± 5mA DC for $I_{O/P}$ ≥ 5 mA DC

Selectable low-pass filter
- Filter type : Butterworth
- Filter order : 2nd
- -3dB cut-off frequency : Selectable using DIP-switches to 0.3 Hz; 1 Hz; 3 Hz; 10 Hz
- Transfer function between summer input / voltage output : 1

Level detectors
- Number of detectors : 2 (REL1; REL2)
- Level adjustment range : -10 to +10 V DC using multi-turn potentiometer (measured on voltage output)
- Hysteresis : 0 or ~ 5% (selectable using DIP-switches)
- Detection indication : < or > (selectable using DIP-switches)

Switching delay
- Number of circuits : 2
- Delay adjustment range : 0 to 5 sec. using multi-turn potentiometer

Application selection

Selection	Det. REL1	Det. REL2	$U_{O/P}$, $I_{O/P}$
1	A	A	A
2	A + B	A	A + B
3	A	A + B	A
4	A + B	A + B	A + B
5	B	B	B
6	A + B	B	A + B

A : Bridge signal
B : Voltage input

ENVIRONMENTAL SPECIFICATIONS

Operating temperature : -40 to +80 °C

Storage temperature : -45 to +85 °C

Humidity : IP 65

Vibration and shock : According to IEC 68.2

EMC : According to EN-50081-2 (Generic Emission Standard) and EN-50082-2 (Generic Immunity Standard)

MECHANICAL SPECIFICATIONS

Housing
- Type : A 123
- Material : Aluminium
- Finish : RAL 7001 grey paint
- Dimensions : 220 x 120 x 90 mm
- Weight : 2 kg

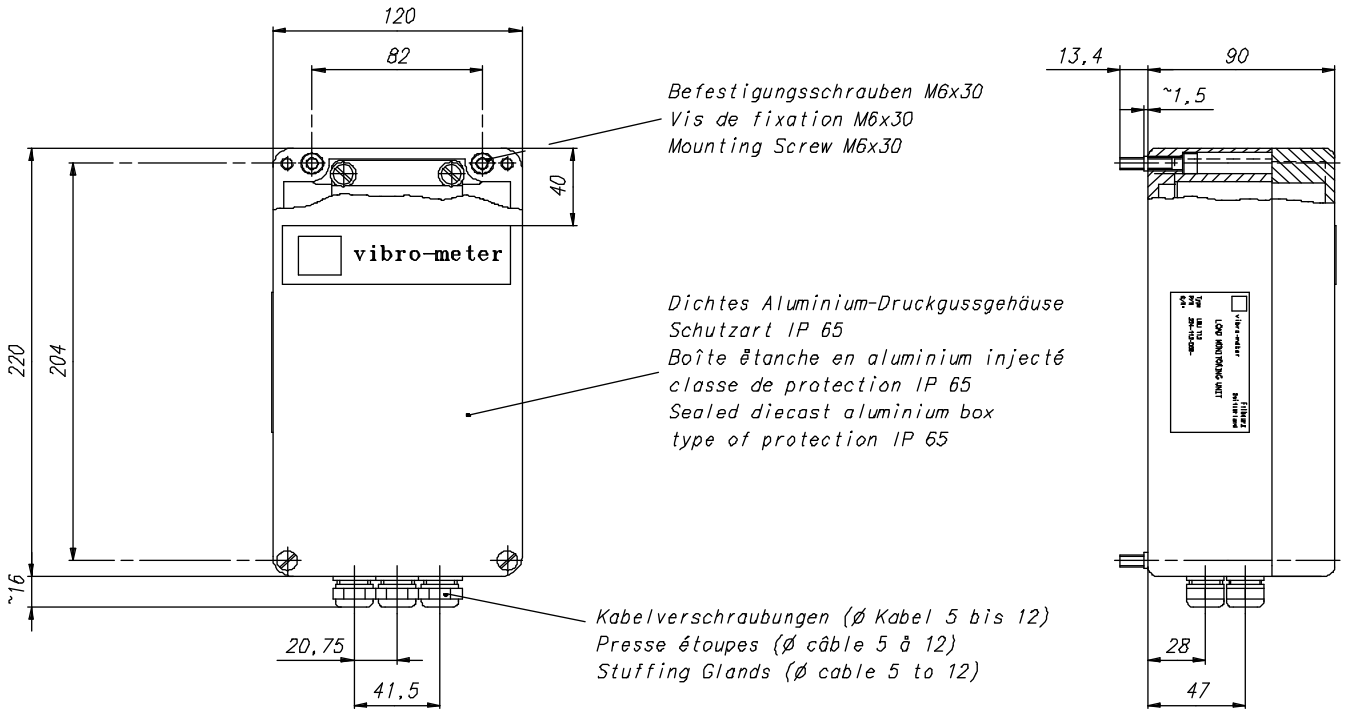
Stuffing glands
- Type and number : 3 x PG 11
- Material : Nickel-plated brass

Terminal strip
- Type : MK8 (screw at 45° and connection at 45°)
- Max. ∅ of connecting wire : AWG 26 ... 16
  Cross-section : 0,5 ... 1,5 mm²

Note :

[1] **In order to guarantee a precise calibration, the customer is asked to indicate the impedances of the connected unit together with the order.** If this value is unknown, an impedance of 1 MΩ will be used for calibration. The resulting deviation will be in the order of ≤ 5% with an impedance of ≥ 2 kΩ or ≤ 1% with ≥ 10kΩ.

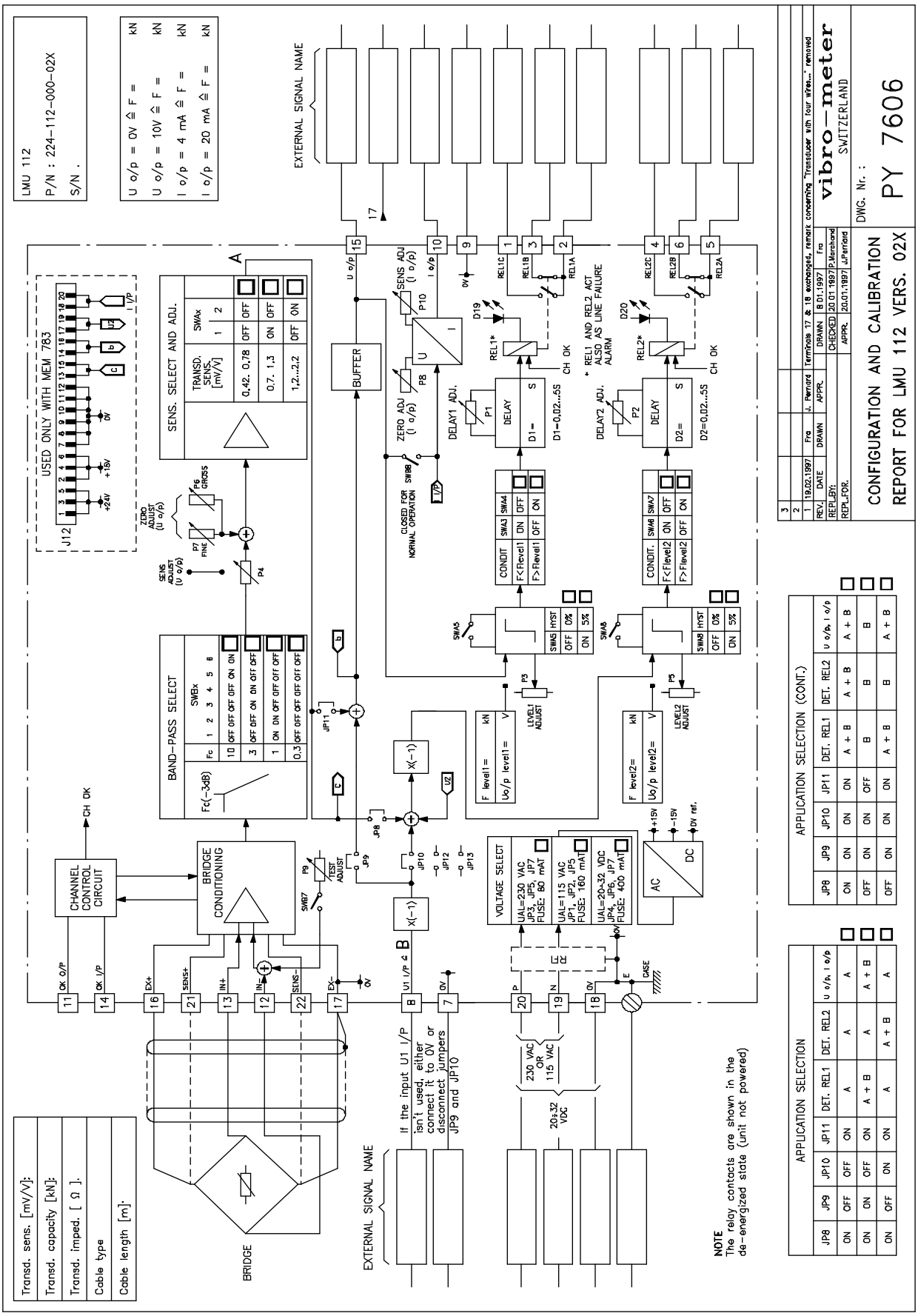
Dimension :



Ordering information :

- Designation : **LMU 112 load monitoring unit**
- Ordering number : **224-112-000-021**, standard module with no set-up and no calibration

  224-112-000-021C, set-up and calibrated according to the configuration and calibration report PY 7598 (to be filled in according to the application).


LMU 112
P/N : 224-112-000-02X
S/N .
U o/p = 0V ≙ F = kN
U o/p = 10V ≙ F = kN
I o/p = 4 mA ≙ F = kN
I o/p = 20 mA ≙ F = kN
EXTERNAL SIGNAL NAME
USED ONLY WITH MEM 783
SENS. SELECT AND ADJ.
BAND-PASS SELECT
BUFFER
CHANNEL CONTROL CIRCUIT
BRIDGE CONDITIONING
VOLTAGE SELECT
AC
DC
CH OK
BRIDGE
If the input U1 I/P isn't used, either connect it to 0V or disconnect jumpers JP9 and JP10
230 VAC OR 115 VAC
20÷32 VDC
NOTE
The relay contacts are shown in the de-energized state (unit not powered)
* REL1 AND REL2 ACT ALSO AS LINE FAILURE ALARM
CLOSED FOR NORMAL OPERATION
APPLICATION SELECTION
APPLICATION SELECTION (CONT.)
Trans. sens. [mV/V]:
Trans. capacity [kN]:
Trans. imped. [Ω].
Cable type
Cable length [m]:
vibro-meter
SWITZERLAND
CONFIGURATION AND CALIBRATION
REPORT FOR LMU 112 VERS. 02X
DWG. Nr. :
PY 7606

The LMU 117 load monitoring unit is a dual-channel electronic device composed of **two** LMU 112s assembled in an aluminium housing (the connection between power supplies is factory-made).

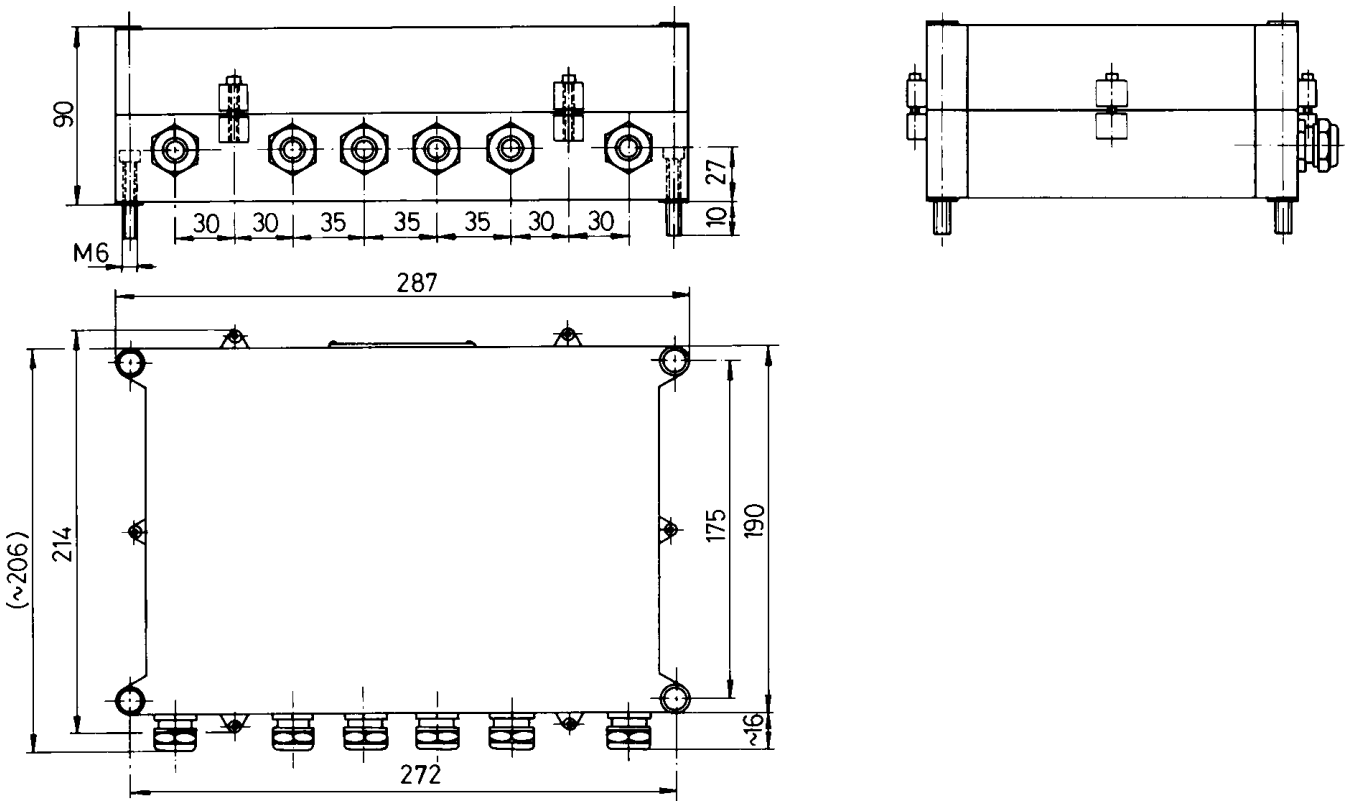
The specifications are identical to those of the LMU 112.

When using several load monitoring units, the "OK" feature allows the operation of all units to be monirored using a single "OK" input or output.

Note :

[1] **In order to guarantee a precise calibration, the customer is asked to indicate the impedances of the connected unit together with the order.** If this value is unknown, an impedance of 1 MΩ will be used for calibration. The resulting deviation will be in the order of ≤ 5% with an impedance of ≥ 2 kΩ or ≤ 1% with ≥ 10kΩ.

Dimensions :



Ordering information :

- Designation : **LMU 117 load monitoring unit**
- Ordering number : **224-117-000-011**, standard module with no set-up and no calibration.

  224-117-000-011C, set-up and callibrated according to the configuration and calibration report PY 7606 (to be filled in according to the application).

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

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3 CONFIGURATION AND CALIBRATION

3.1 Configuration of the Load Monitoring Unit

3.1.1 Adaptation of the Monitor to the Supply Voltage

Before connecting the LMU 112 or LMU 117 load monitoring unit, select its operating voltage, choose the supply fuse rating and position the jumpers JP1 to JP7 as described in this paragraph.

The monitor can be seriously damaged, if not destroyed, if this advice is not followed.

The information given in Figures 3-1 and 3-2 allows the user to select the operating voltage of the load monitoring unit, to choose the supply fuse and to assign the supply terminals (as a reminder : the LMU 117 load monitoring unit consists of two LMU 112 units).

Record the designation of the external signals connected to the supply terminals on the configuration and calibration form (see Appendix B).

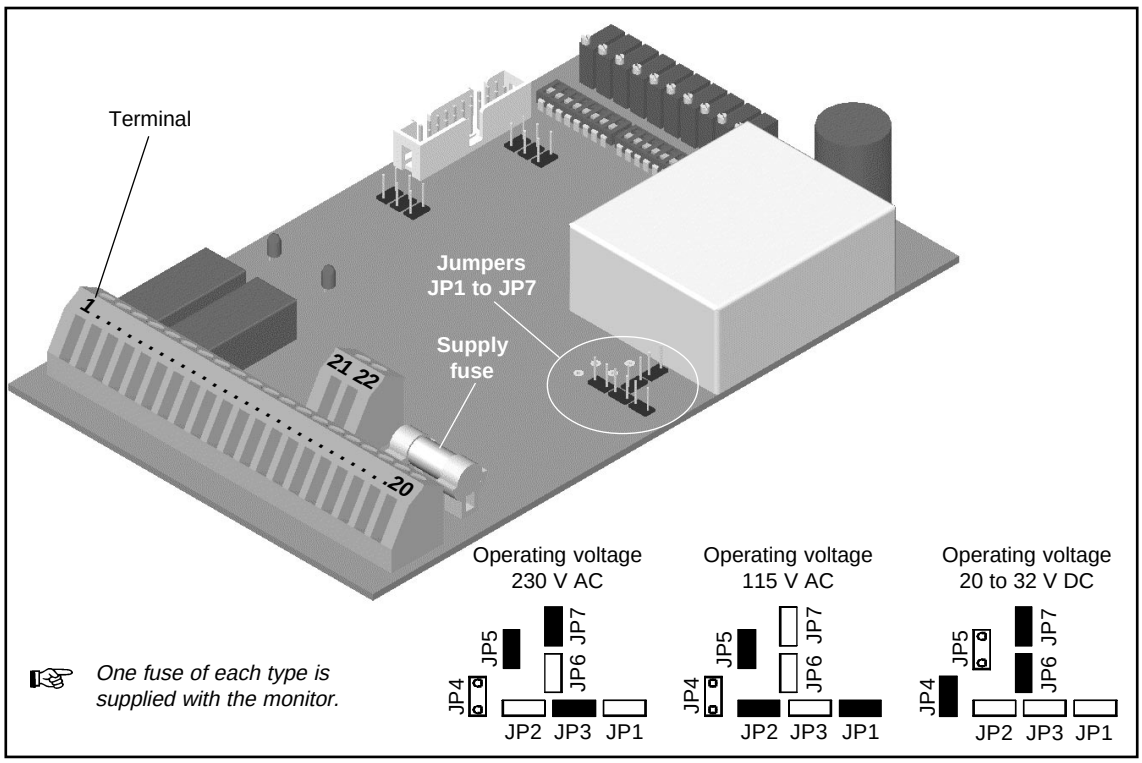

Fig. 3-1 : Monitor board with location of the selection elements.

	Operating voltage	Supply terminals			Fuse	Jumpers
		0 V (18)	P (20)	N (19)		
◊	230 V AC	- - -	Phase	Neutral	80 mAT	JP3, JP5, JP7
	115 V AC	- - -	Phase	Neutral	160 mAT	JP1, JP2, JP5
	20 to 32 V DC	0 V	20 to 32 V	- - -	400 mAT	JP4, JP6, JP7

Fig. 3-2 : Table for adaptation of the monitor to the operating voltage.

☞ *The asterisks (◊) correspond to LMU 112 version 02X, i.e. the standard configuration (basic module, uncalibrated) or to LMU 117 version 01X (basic module, uncalibrated).*

3.1.2 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 112/LMU 117 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 transformer is ≥200 Ω and the length of the cable is ≤100 m, the wiring of type 1 can be selected (see Figure 3-3).

It is possible to modify the cable or its length after calibration, but wiring of type 2 must be selected (see Figure 3-3). In this way the LMU 112/LMU 117 does not require any new calibration.

If the length of cable is >200m, type 2 is recommended (see Figure 3-3).

☞ *Record the length of cable (transducer - LMU 112) and its type on the configuration and calibration form (see Appendix B).*

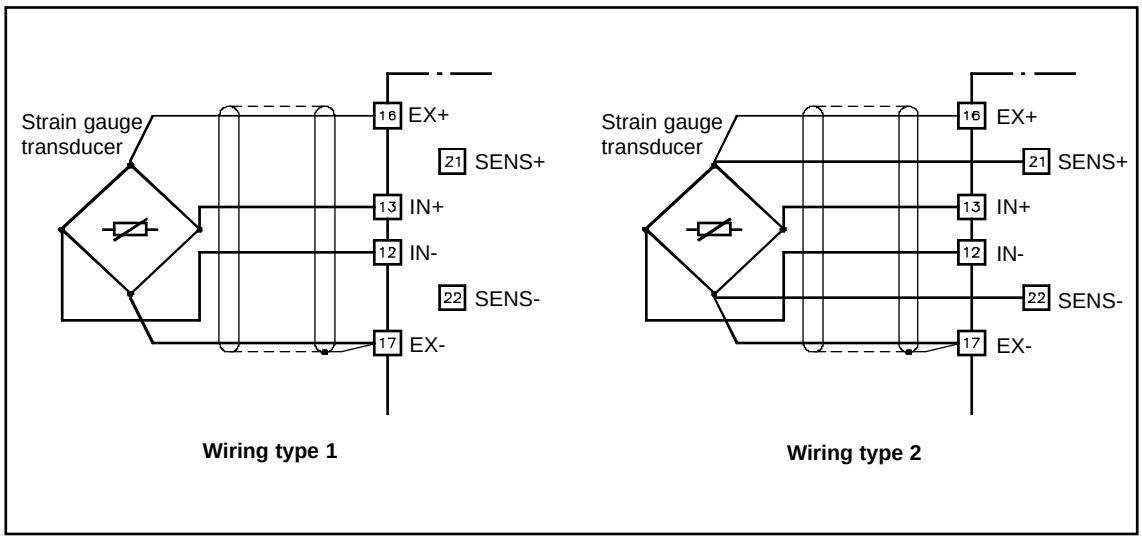

Fig. 3-3 : Wiring types.

3.1.3 Designation of the Voltage and Current Inputs/Outputs

Record the designation of the external signals connected to $U_{I/P}$, $U_{O/P}$ and $I_{O/P}$.

3.1.4 Configuration of the Detection Chains

a) Detection chain for relay 1 (REL1)

The table in Figure 3-4 allows the user to select the direction of detection and the hysteresis value. Figure 3-5 shows the user where the SWA micro-switches are on the load monitoring unit board.

☞ *Record the value of F_{level1} and the configuration of the micro-switches SWA3, SWA4 and SWA5 on the configuration and calibration form (see Appendix B).*

	Condition	Configuration			Effect
		SW A3	SW A4	SW A5	
◊	REL1 de-energized for F < Flevel	ON	OFF	- - -	Detection for $U_{O/P} < U_{level1}$
	REL1 de-energized for F > Flevel	OFF	ON	- - -	Detection for $U_{O/P} > U_{level1}$
◊	Hysteresis = 0	- - -	- - -	OFF	Hysteresis = 0 mV mesured on $U_{O/P}$
	Hysteresis ≈ 5% (FSD)	- - -	- - -	ON	Hysteresis ≈ 500 mV mesured on $U_{O/P}$

Fig. 3-4 : Configuration of the micro-switches SWA3, SWA4 and SWA5.

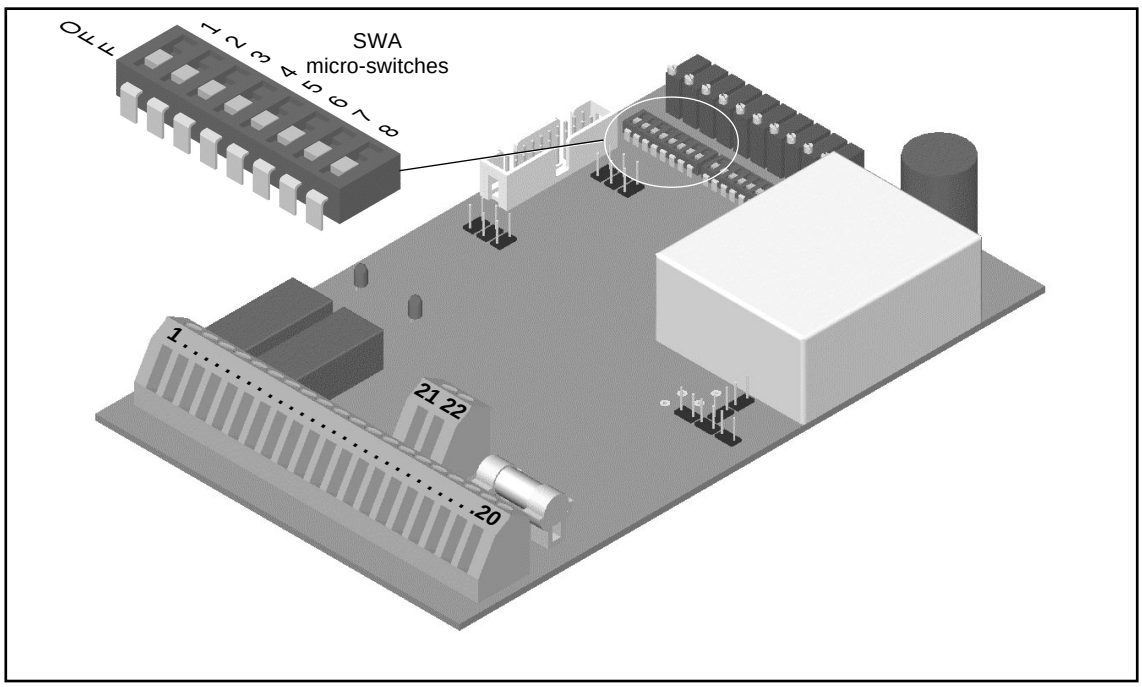

Fig. 3-5 : Location of the SWA micro-switches on the load monitoring board.

The table in Figure 3-6 allows the user to choose the state of the contacts depending on the state of relay REL1.

☞ *Record the designation of the external signals connected to REL1A, REL1B and REL1C on the configuration and calibration form (see Appendix B).*

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

Fig. 3-6 : State of contacts as a function of the state of relay REL1.

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

b) Detection chain for relay 2 (REL2)

The table in Figure 3-7 allows the user to select the direction of detection and the hysteresis value. Figure 3-5 shows the user where the SWA micro-switches are on the load monitoring unit board.

☞ *Record the value of F_{level2} and the configuration of the micro-switches SWA6, SWA7 and SWA8 on the configuration and calibration form (see Appendix B).*

	Condition	Configuration			Effect
		SW A6	SW A7	SW A8	
◊	REL2 de-energized for F < F_{level}	ON	OFF	- - -	Detection for $U_{O/P} < U_{level2}$
	REL2 de-energized for F > F_{level}	OFF	ON	- - -	Detection for $U_{O/P} > U_{level2}$
◊	Hysteresis = 0	- - -	- - -	OFF	Hysteresis = 0 mV mesured on $U_{O/P}$
	Hysteresis ≈ 5% (FSD)	- - -	- - -	ON	Hysteresis ≈ 500 mV mesured on $U_{O/P}$

Fig. 3-7 : Configuration of micro-switches SWA6, SWA7 and SWA8.

The table in Figure 3-8 allows the user to select the state of the contacts depending on the state of relay REL2.

☞ *Record the designation of the external signals connected to REL2A, REL2B and REL2C on the configuration and calibration form (see Appendix B).*

State of relay REL2	Contact REL2A - REL2C	Contact REL2A - REL2B
REL2 energized	Closed	Open
REL2 de-energized	Open	Closed

Fig. 3-8 : State of contacts as a function of the state of relay REL2.

☞ *The REL2 relay also operates as line check relay and is de-energized in case of short-circuit of line failure.*

c) 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 112 ($U_{O/P}$) and the moment when the relay is de-energized (see Figure 3-9). On the other hand, the switching delay on tripping of the relay in relation to the voltage output of the LMU 112 ($U_{O/P}$) is instantaneous.

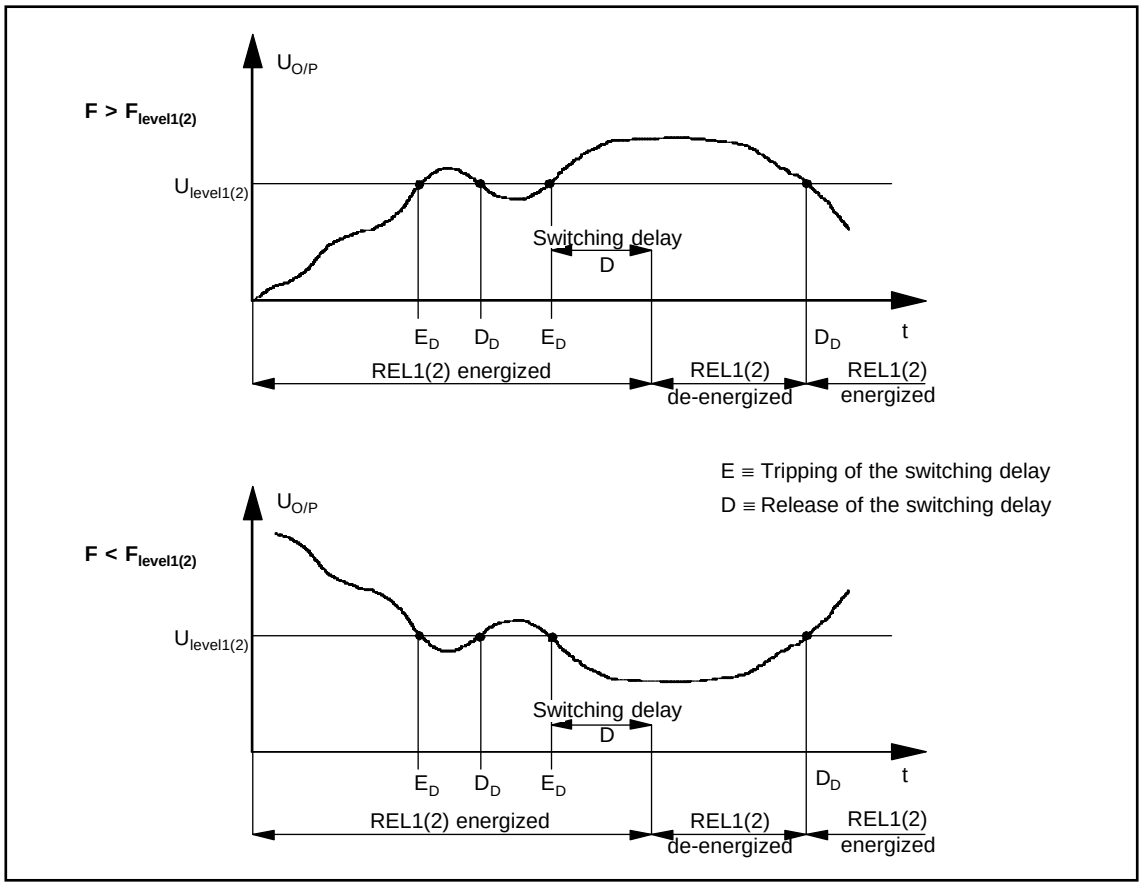

Fig. 3-9 : Examples of switching delays for the load monitoring unit.

To set the switching delay to be applied to the REL1 relay, adjust potentiometer P1. To set the switching delay to be applied to relay REL2, adjust potentiometer P2. Figure 3-10 shows the user where the potentiometers are located on the load monitoring unit board.

The method of adjustment is as follows :

D1 = Switching delay on REL1 D2 = Switching delay on REL2

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

$$N1 = \frac{D1 - 0.02}{0.164}$$ with N1 = number of turns to be applied to potentiometer P1

D1 = switching delay required for relay REL1 in seconds
$D1_{min}$ = 0.02 sec.
$D1_{max}$ = 5 sec.

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.*

☞ *Record the switching delay values of D1 and D2 on the configuration and calibration form (see Appendix B).*

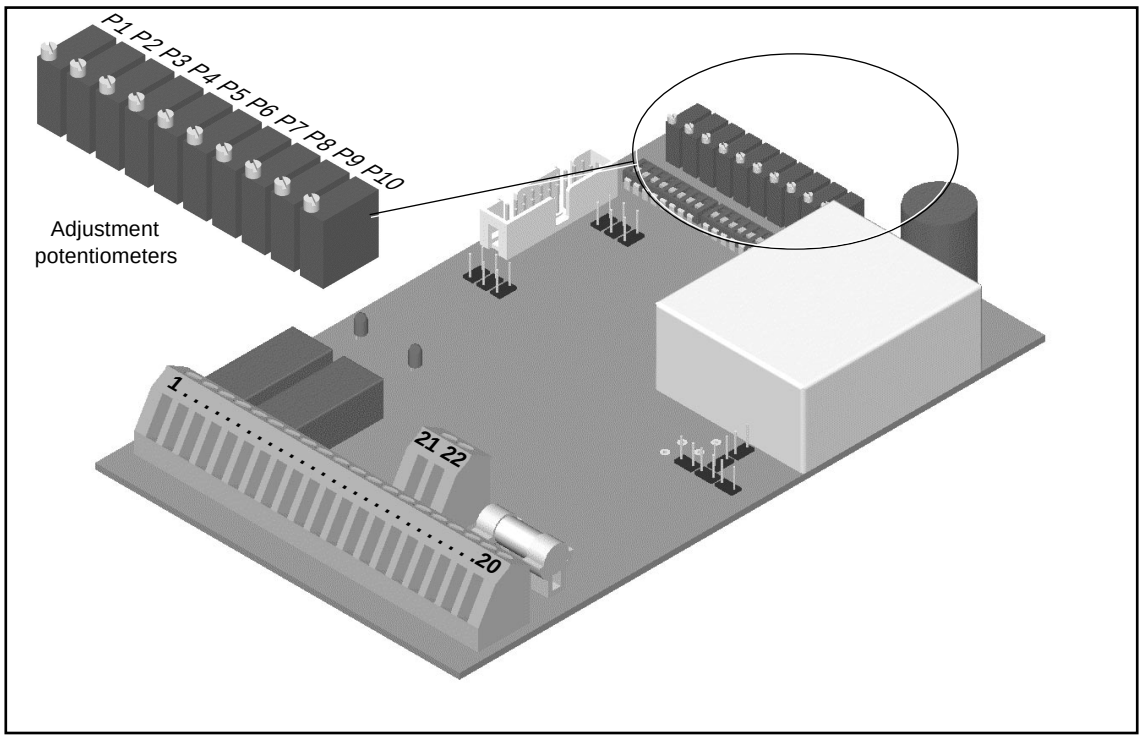

Fig. 3-10 : Location of the potentiometer on the load monitoring board.

3.1.5 Selection of the Pass Band

The table in Figure 3-11 allows the user to select the frequency band of the output signal. Figure 3-12 informs the user of the position of the SWB micro-switches on the load monitoring unit board.

☞ *Record the cut-off frequency fc and the configuration of the micro-switches SWB1, SWB2, SWB3, SWB4, SWB5 and SWB6 on the configuration and calibration form (see Appendix B).*

☞ *The SWB7 micro-switch is only used during the calibration phase of the LMU load monitoring unit (see Section 3.2).*
The SWB8 micro-switch is only used together with the MEM 783 module.

	Frequency band f_c	SWB1	SWB2	SWB3	SWB4	SWB5	SWB6	SWB7	SWB8
◊	DC to 10 Hz	OFF	OFF	OFF	OFF	ON	ON	OFF	ON
	DC to 3 Hz	OFF	OFF	ON	ON	OFF	OFF	OFF	ON
	DC to 1 Hz	ON	ON	OFF	OFF	OFF	OFF	OFF	ON
	DC to 0,3 Hz	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON

Fig. 3-11 : Configuration of micro-switches SWB1 to SWB8 for the selection of the frequency band f_c.

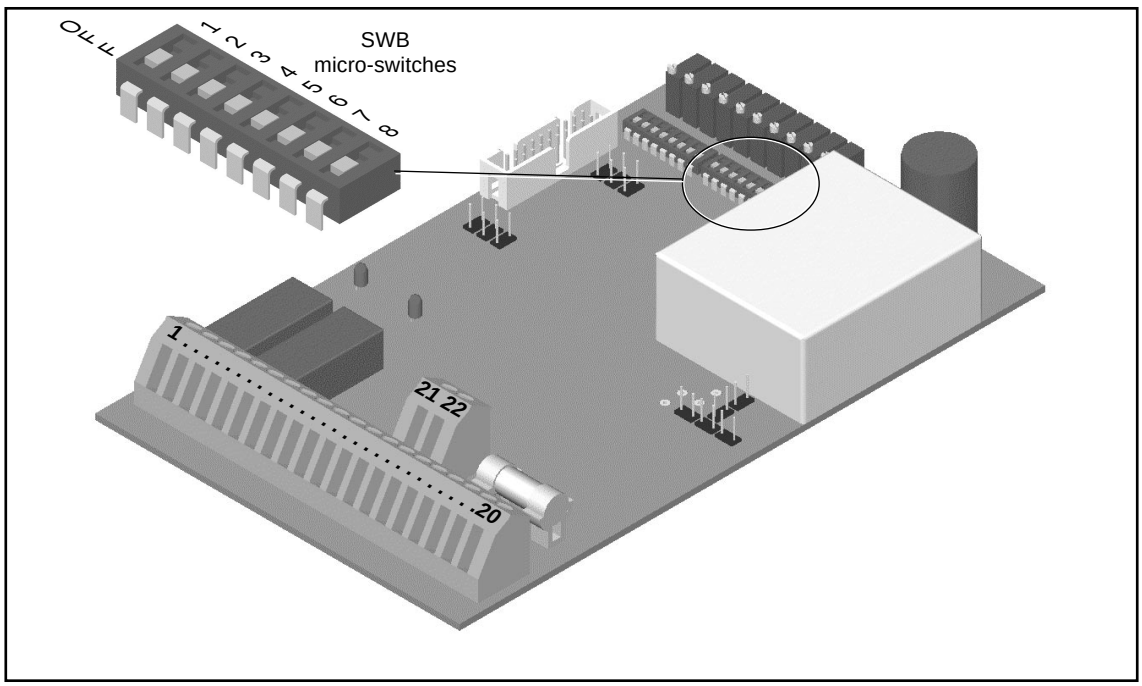

Fig. 3-12 : Location of the SWB micro-switches on the load monitoring board.

3.1.6 Selection of the Sensitivity Range

The table in Figure 3-13 allows the user to select the sensitivity range within which the strain gauge transducer lies. Figure 3-5 informs the user of the position of the SWA micro-switches on the load monitoring unit board.

☞ *Record the selected sensitivity range and the configuration of the micro-switches SWA1 and SWA2 on the configuration and calibration form (see Appendix B).*

	Strain gauge sensitivity [mV/V]	SW A1	SW A2
	0.42 to 0.78	OFF	OFF
	0.7 to 1.3	ON	OFF
◊	1.2 to 2.2	OFF	ON

Fig. 3-13 : Configuration of micro-switches SWA1 and SWA2 for the selection of the strain gauge sensitivity.

3.1.7 Application Selection

The LMU load monitoring unit is able to function by itself or connected with one or several other LMU's depending on the desired application. In this case, the output signal from one load monitoring unit can be added to that of another monitor and so on. The output signals $U_{O/P}$ and $I_{O/P}$ of the last monitor will correspond to the sum of its own signals with those of the other monitors with which it is linked. The detection thresholds can also be totalled using the same principle.

The table in Figure 3-14 allows the user to select the required application by means of jumpers JP8 and JP11. Figure 3-15 informs the user of the position of these jumpers on the load monitoring unit board.

Chapter 5 gives a few examples of load monitoring unit applications.

☞ *Record the position of jumpers JP8 and JP11 on the configuration and calibration form (see Appendix B).*

Jumpers						Detection threshold REL1	Detection threshold REL2	$U_{O/P}$ and $I_{O/P}$
JP8	JP9	JP10	JP11	JP12	JP13			
ON	OFF	OFF	ON	- - -	- - -	A	A	A
ON	ON	OFF	ON	- - -	- - -	A + B	A	A + B
ON	OFF	ON	ON	- - -	- - -	A	A + B	A
◊ ON	ON	ON	ON	- - -	- - -	A + B	A + B	A + B
OFF	ON	ON	OFF	- - -	- - -	B	B	B
OFF	ON	ON	ON	- - -	- - -	A + B	B	A + B

Fig. 3-14 : Table of application selection.

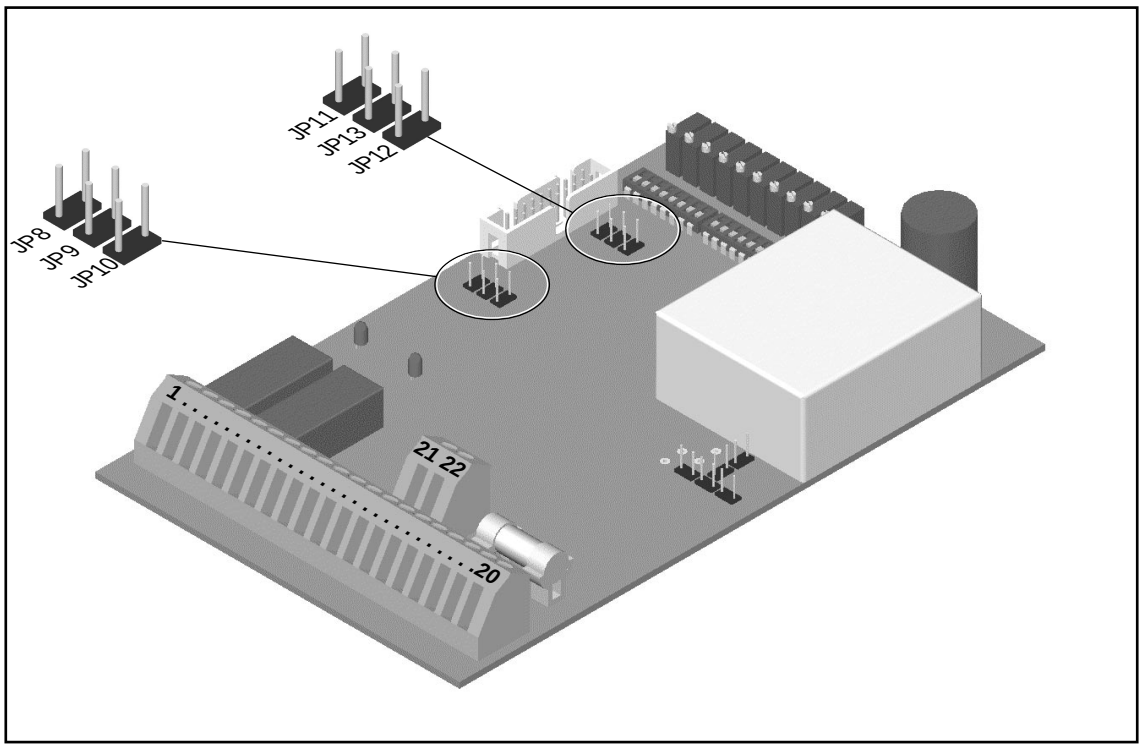

Fig. 3-15 : Location of jumpers JP8 to JP13 on the load monitoring board.

3.2 Calibration of the Load Monitoring Unit

3.2.1 Zero Adjustment on the Voltage Output

The following conditions are required to adjust the zero on the voltage output :

- the load applied to the strain gauge transducer F = 0,
- the micro-switch SWB7 = OFF.

Connect a numerical millivoltmeter between terminals 15 ($U_{O/P}$) and 9 (0 V) of the load monitoring unit.

Adjust P6 then P7 (see Figure 3-10 for their location) to 0 V ±10 mV on the millivoltmeter.

3.2.2 Zero Adjustment on the Current Output

The following conditions are required to adjust the zero on the current output :

- the load applied to the strain gauge transducer F = 0,
- The micro-switch SWB7 = OFF.

Connect a numerical milliammeter between terminals 10 ($I_{O/P}$) and 9 (0 V) of the load monitoring unit.

Adjust P8 (see Figure 3-10 for the location) to the initial value ±50 µA (e.g. 4 mA ±50 µA) on the milliammeter.

3.2.3 Sensitivity Adjustment on the Voltage Output

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

Apply a known load ($F_{known} > 0{,}5F_N$) to the strain gauge transducer.

With : $F_N \equiv$ nominal strain gauge transducer load

$F_N \equiv U_{O/P\ nominal} = 10$ V DC

$U_{O/P\ known} \equiv F_{known}$

To determine the rating of the voltage output, carry out the following calculation :

$$U_{O/P\ known} = \frac{10V \cdot F_{known}}{F_N}$$

Connect a digital millivoltmeter between terminals 15 ($U_{O/P}$) and 9 (0 V) of the load monitoring unit.

Adjust P4 (see Figure 3-10 for the location) to $U_{O/P\ known}$ with an accuracy of ±10 mV.

3.2.4 Sensitivity Adjustment on the Current Output

To adjust the sensitivity on the current output ($I_{O/P}$) , the load applied to the strain gauge transducer F_{known} must be maintained and the sensitivity on the voltage output ($U_{O/P}$) must be adjusted first.

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

$$I_{O/P\ known} = \frac{16mA \cdot F_{known}}{F_N} + \text{initial value (e.g. 4 mA)}$$

Connect a milliammeter between the terminals 10 ($I_{O/P}$) and 9 (0 V) of the load monitoring unit.

Adjust P10 (see Figure 3-10 for the location) to $I_{O/P\ known}$ with an accuracy of ±50 µA.

3.2.5 Adjustment of the U_{level1} and U_{level2} Detection Thresholds

The following conditions are required to adjust the detection thresholds :

- the load applied to the strain gauge transducer F = 0,
- the micro-switch SWB7 = ON (injected test signal).

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

$$U_{O/P\ level1} = \frac{10V \cdot F_{level1}}{F_N}$$

$$U_{O/P\ level2} = \frac{10V \cdot F_{level2}}{F_N}$$

- **Adjustment of detection threshold U_{level1}**

  Connect a millivoltmeter between the terminals 15 ($U_{O/P}$) and 9 (0 V) of the load monitoring unit. Adjust P9 (refer to Figure 3-10 for its location) to obtain $U_{O/P\ level1}$ with an accuracy of ±20 mV. Turn P3 until the illuminated diode of relay REL1 lights up (see Figure 3-16). Then turn P3 slowly until the diode of REL1 goes out (the detection level has been reached).

☞ *Record the rating of $U_{O/P\ level1}$ and that of F_{level1} on the configuration and calibration form (see Appendix B).*

- **Adjustment of detection threshold U_{level2}**

  Connect a millivoltmeter between the terminals 15 ($U_{O/P}$) and 9 (0 V) of the load monitoring unit to $U_{O/P\ level2}$ with an accuracy of ±20 mV. Turn P5 until the illuminated diode of relay REL2 lights up (see Figure 3-16). Then turn P5 slowly until the diode of REL2 goes out (the detection level has been reached).

☞ *Record the rating of $U_{O/P\ level2}$ and that of F_{level2} on the configuration and calibration form (see Appendix B).*

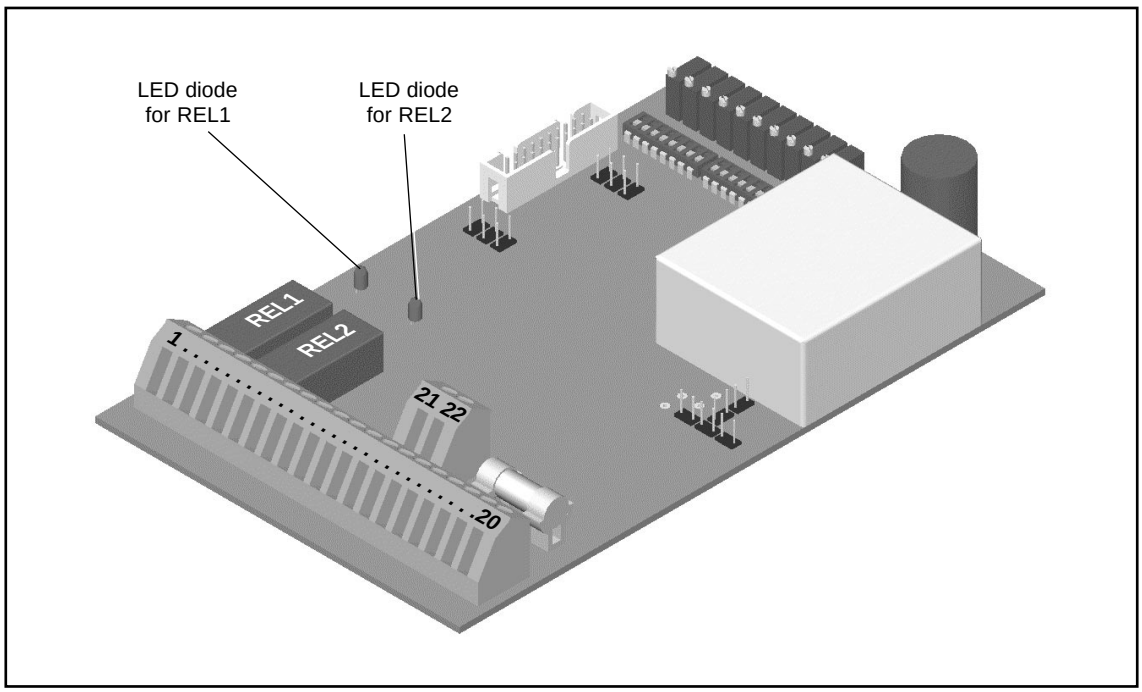

Fig. 3-16 : Location of the diodes of relays REL1 and REL2.

Remember to set micro-switch SWB7 to the OFF position once the U_{level1} and U_{level2} detection thresholds have been adjusted.

4 ASSEMBLY AND CONNECTION

4.1 General

So that the means used to carry out the assembly and connection of the load monitoring unit LMU 112 or LMU 117 are suitable and so that the signals recorded do not suffer any disruption caused by incorrect procedures, follow and apply the procedures indicated in this chapter.

☞ *The procedures contained in this chapter do not cover every assembly and connection option. However, they allow the user to gain inspiration from specific applications. If in doubt, the user should contact Vibro-Meter so that a solution which does not disrupt the measurements can be found.*
Also the user should respect the general instructions of the machine manufacturers and the standards and specifications on the subject of safety and special construction.

4.2 Assembly of the LMU 112 Load Monitoring Unit

☞ *Make sure that the temperature in the area where the load monitoring unit is to be located is between -40°C and +80°C.*

- Choose an assembly location free of vibrations (e.g. instrument support base)
- Mark the position of 4 tapping points on the assembly surface (see Figure 4-1).
- Drill and tap the four M6 holes. The taps should be ~15 mm.
- Remove the cover of the load monitoring unit housing by unscrewing its four screws (see Figure 4-1).
- Position the housing on the assembly surface and tighten up the four M6 x 30 fixing screws. Adopt a torque suitable for the type of screw used.
- If the configuration and calibration of the monitor have not been done, do them using the procedures described in Chapter 3.
- Make the electrical connections in accordance with the specifications given in Section 4.3.
- Put the cover back on the load monitoring unit housing and tighten up its four screws.

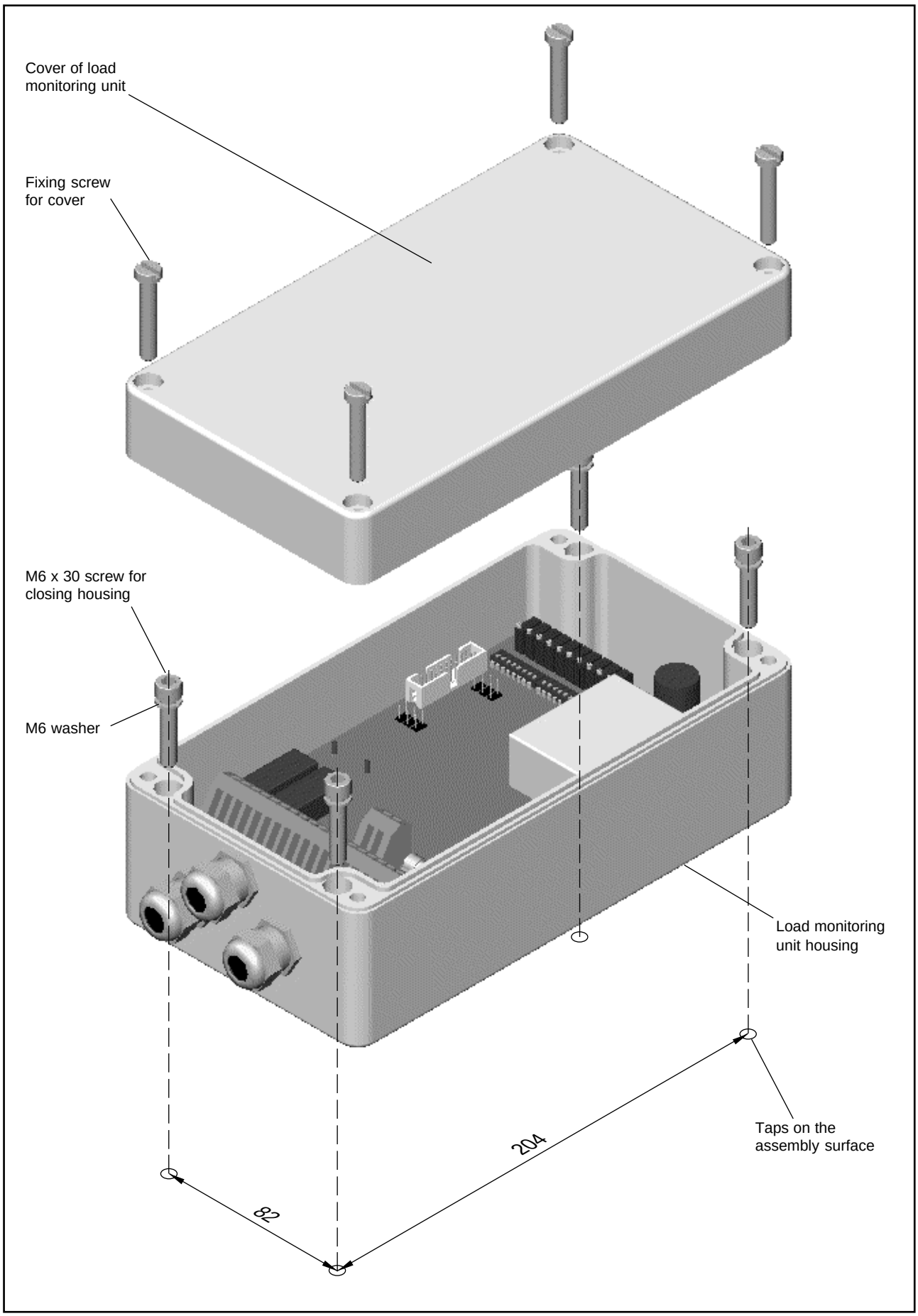

Fig. 4-1 : Installation of the LMU 112 load monitoring unit.

4.3 Connection of the LMU 112 Load Monitoring Unit

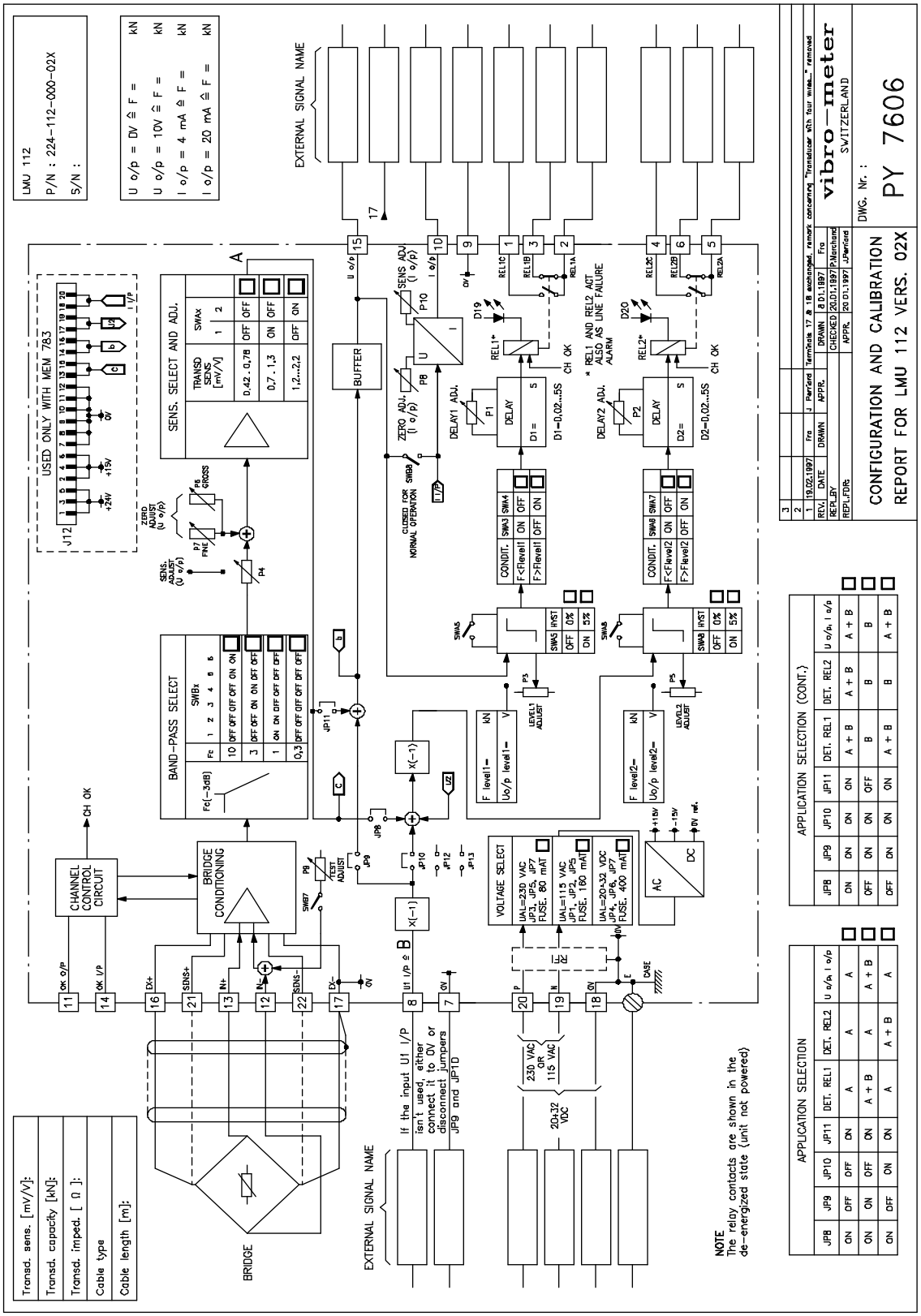

Fig. 4-2 : General wiring diagram.

- Strip the conductors of the integral cable (coming from the strain gauge transducer), the supply cable and the transmission cable (relay, voltage and current outputs), if this has not already been done.

- Remove the cover of the load monitoring unit housing by unscrewing its four screws (see Figure 4-1).

- Pass the cables into the stuffing glands located on the load monitoring unit housing, proceding as follows (see Figure 4-3) :

  - Unscrew element 1 anti-clockwise. Element 5 should not be removed from the housing.
  - Takes out joints 2 and 3 from element 1 (elements 2 and 3 allow the stuffing gland to be adapted to different diameters of cable). Element 2 can be removed from element 3 by simply pushing outwards.
  - Pass the cable across elements 1, 2 (if used), 3, 4 and 5.
  - Reassemble the elements of the stuffing gland and, before placing element 1, coat joint 3 with silicone as shown in Figure 4-3. Tighten element 1 in such a way that joint 2 and/or 3 protrudes, so as to provide the degree of watertightness required.
  - Ensure also that the cable is well gripped by the stuffing gland.

Do not damage the joints 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 joint.

The seal of the stuffing gland cannot be guaranteed if these instructions are not followed.

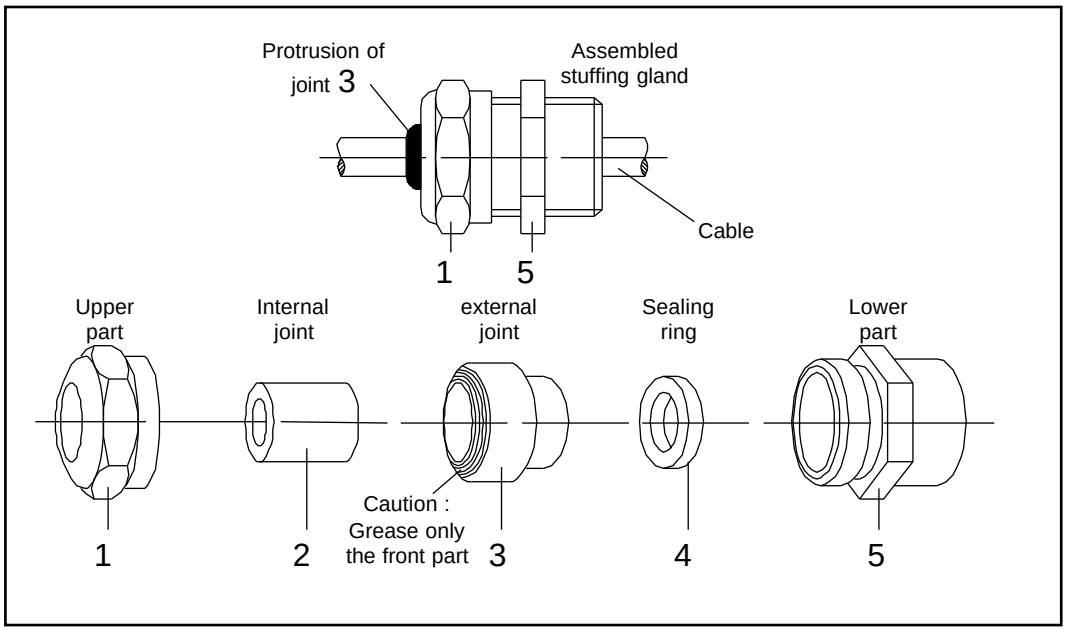

Fig. 4-3 : Stuffing gland (overall view and exploded view).

- Connect the conductors of the various cables to the load monitoring unit terminals (see Figure 4-2).

- Put the cover back on the load monitoring unit and tighten up its four screws.

4.2 Assembly of the LMU 117 Load Monitoring Unit

☞ *Make sure that the temperature in the area where the load monitoring unit is to be located is between -40°C and +80°C.*

- Choose an assembly location free of vibrations (e.g. instrument support base)
- Mark the position of 4 tapping points on the assembly surface (see Figure 4-4).
- Drill and tap the four M6 holes. The taps should be ~15 mm.
- Remove the cover of the load monitoring unit housing by unscrewing its six screws (see Figure 4-4).
- Position the housing on the assembly surface and tighten up the four M6 x 30 fixing screws. Adopt a torque suitable for the type of screw used.
- If the configuration and calibration of the monitor have not been done, do them using the procedures described in Chapter 3.
- Make the electrical connections in accordance with the specifications given in Section 4.3.
- Put the cover back on the load monitoring unit housing and tighten up its six screws.

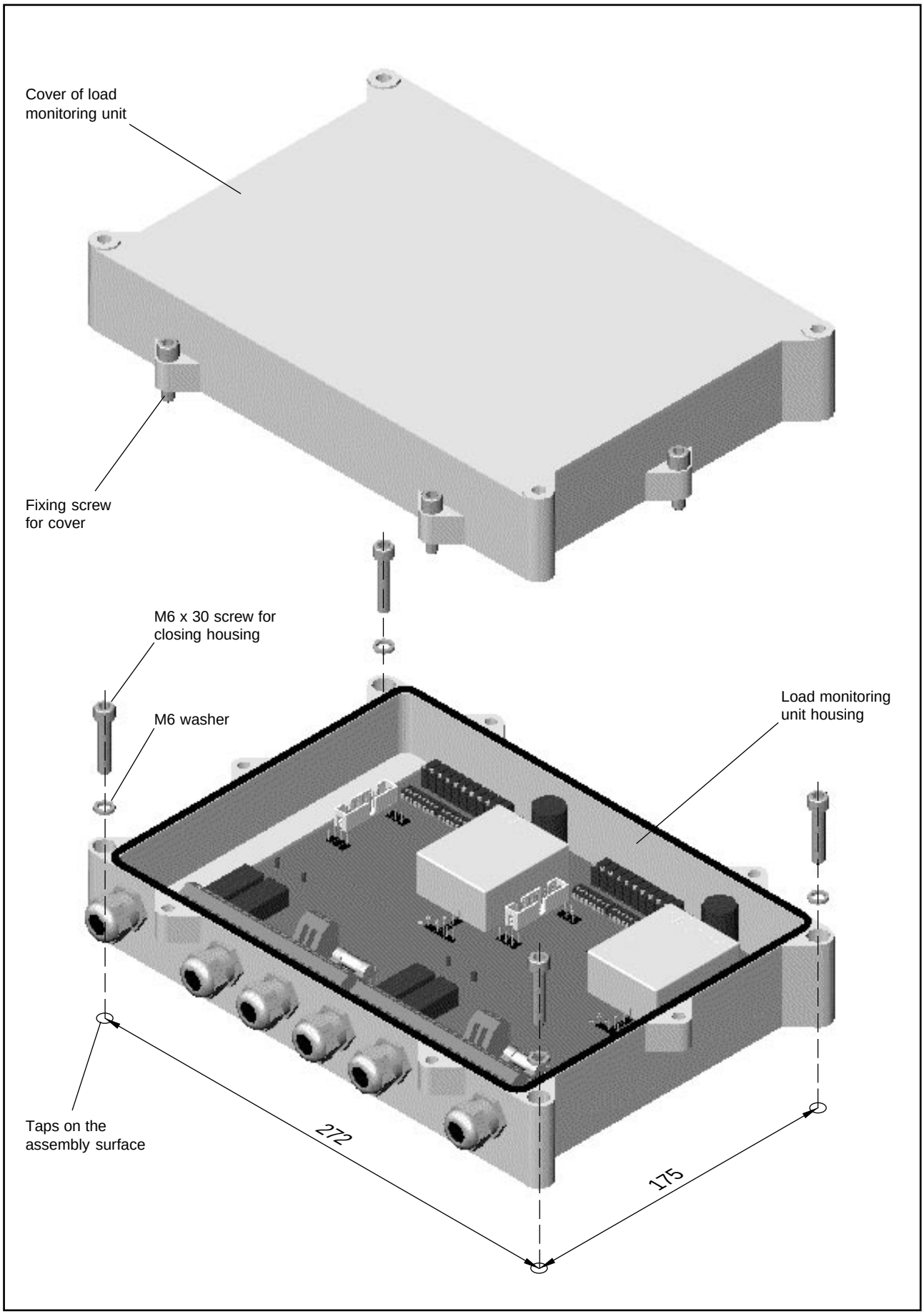

Fig. 4-4 : Installation of the LMU 117 load monitoring unit.

4.5 Connection of the LMU 117 Load Monitoring Unit

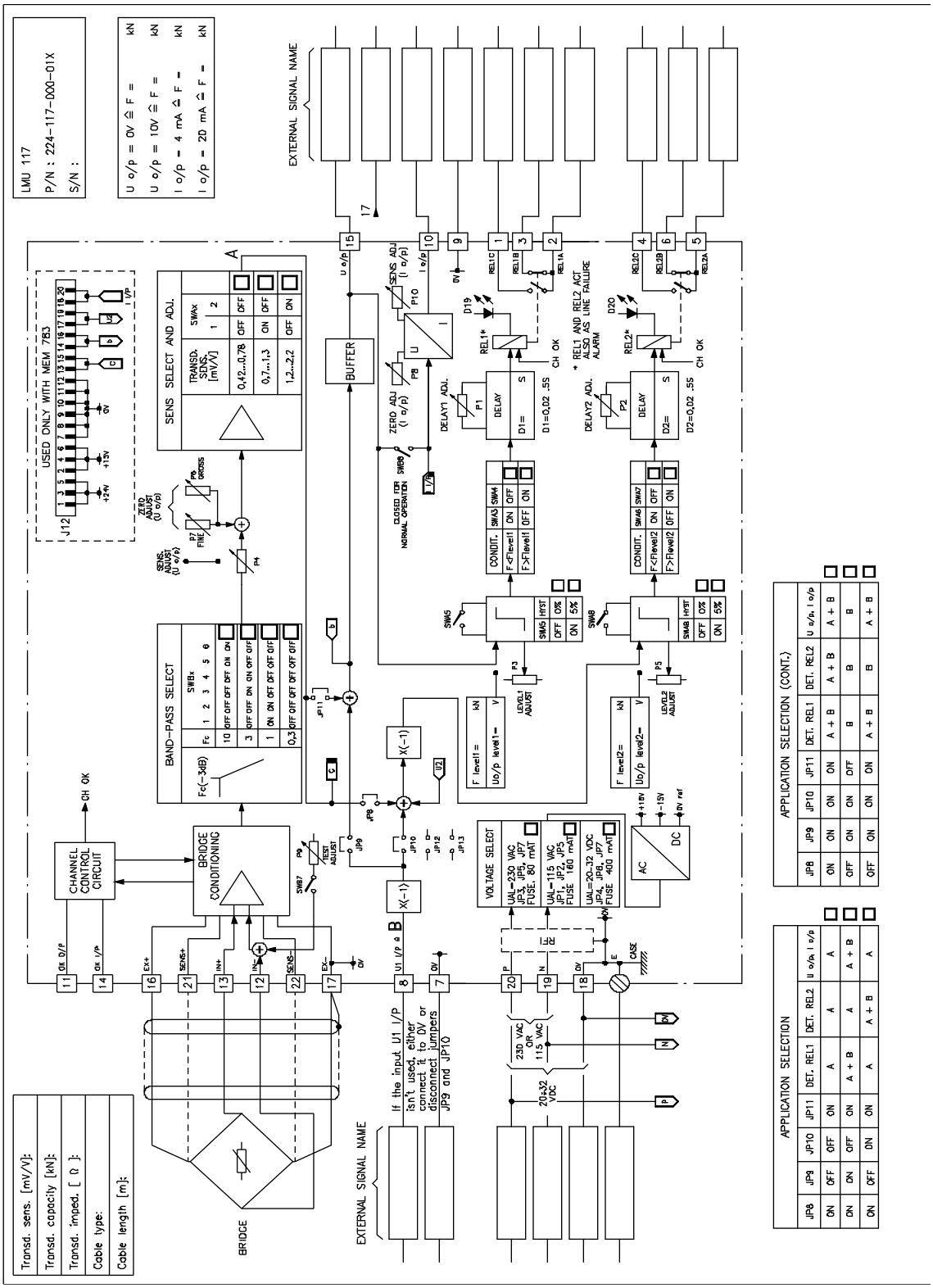

Fig. 4-5 : General wiring diagram (part 1 of 2).

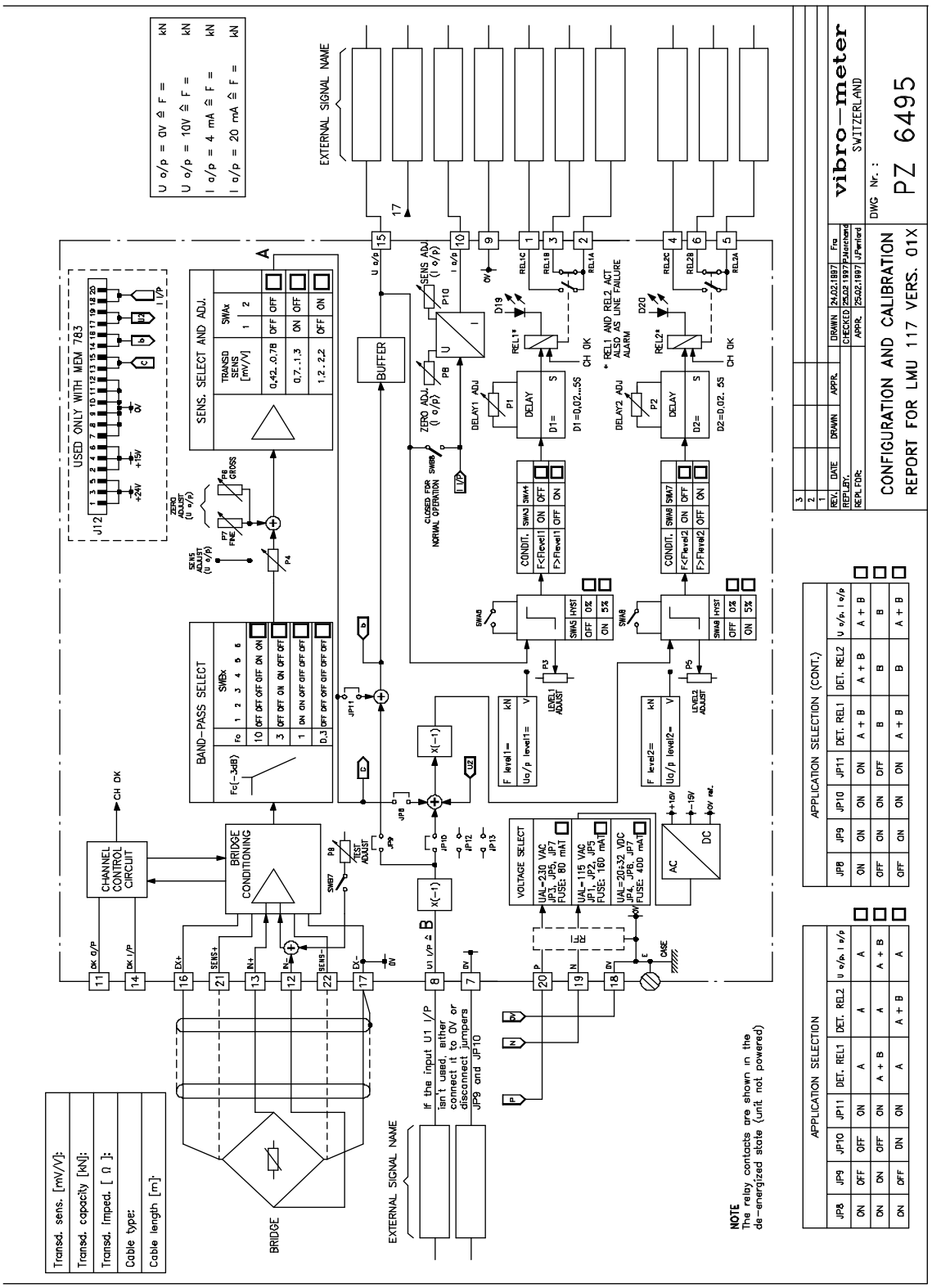

Fig. 4-6 : General wiring diagram (part 2 of 2).

- Strip the conductors of the integral cable (coming from the strain gauge transducer), the supply cable and the transmission cable (relay, voltage and current outputs), if this has not already been done.

- Remove the cover of the load monitoring unit housing by unscrewing its six screws (see Figure 4-4).

- Pass the cables into the stuffing glands located on the load monitoring unit housing, proceding as indications given at page 4-5

- Connect the conductors of the various cables to the load monitoring unit terminals (see Figures 4-5 and 4-6).

- Put the cover back on the load monitoring unit and tighten up its six screws.

5 APPLICATIONS

☞ *The information contained in this chapter concerns both load monitoring units (LMU 112 and 117).*

5.1 Use of One LMU 112 Load Monitoring Unit

In this case only one monitor is used and functions by itself. The selected application then corresponds to that shown in Figure 5-1.

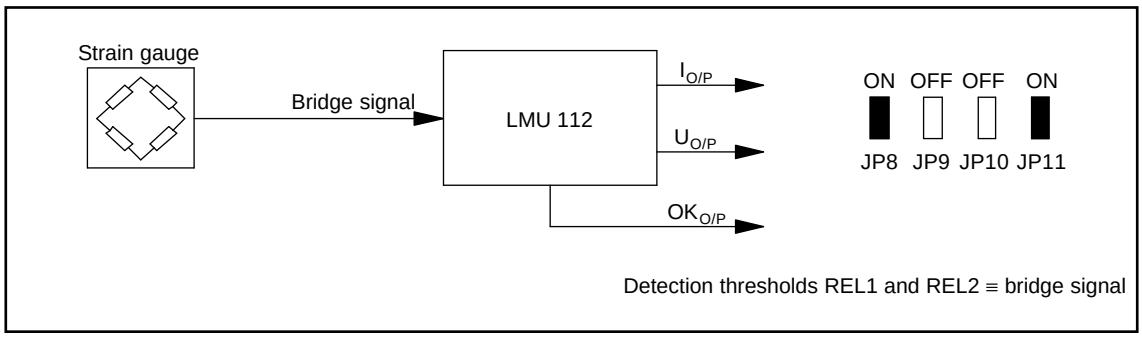

Fig. 5-1 : Selection of the application for one LMU 112 load monitoring unit.

5.2 Use of one LMU 117 Load Monitoring Unit

In this case two load monitoring units are used and are connected together. The voltage output of the first is connected to the voltage input of the second and the bridge signal of the second is added to its own voltage input. The selected applications then correspond to those shown in Figure 5-2.

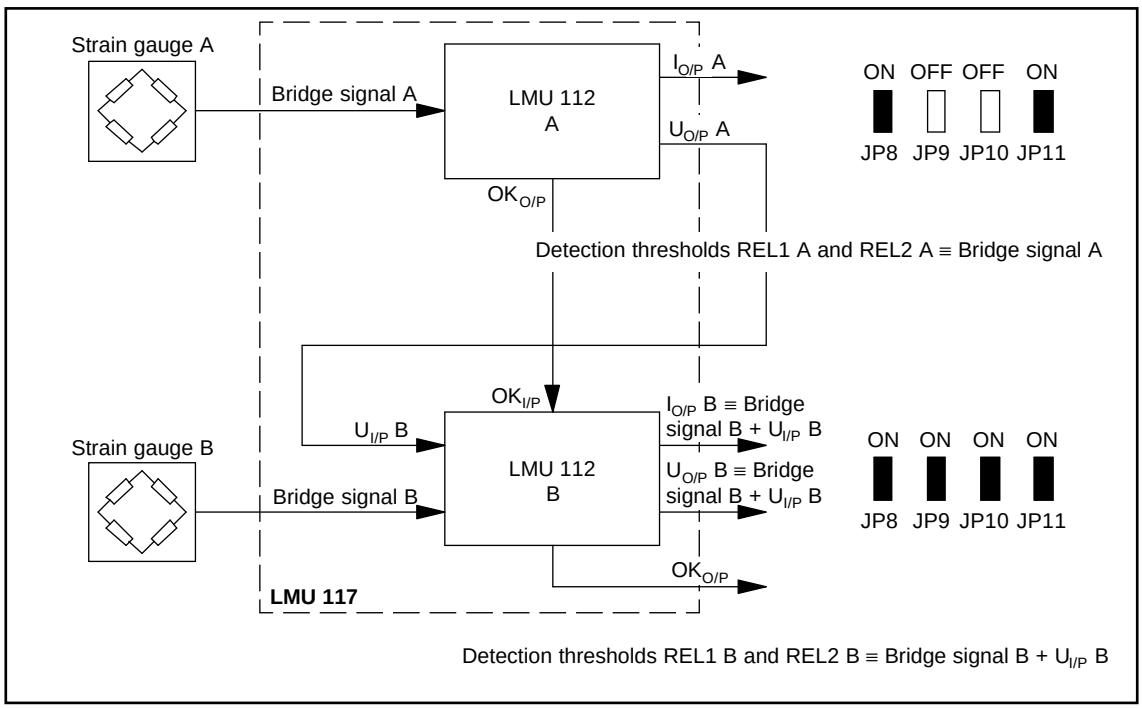

Fig. 5-2 : Selection of the application for one LMU 117 load monitoring unit.

5.3 Use of Three LMU 112 Load Monitoring Units

In this case three load monitoring units are used and connected together. The voltage output of the first is connected to the voltage input of the second and the bridge signal of the second is added to its own voltage input. The voltage output of the second is connected to the voltage input of the third and the bridge signal of the third is added to its own voltage input. The selected applications then correspond to those shown in Figure 5-3.

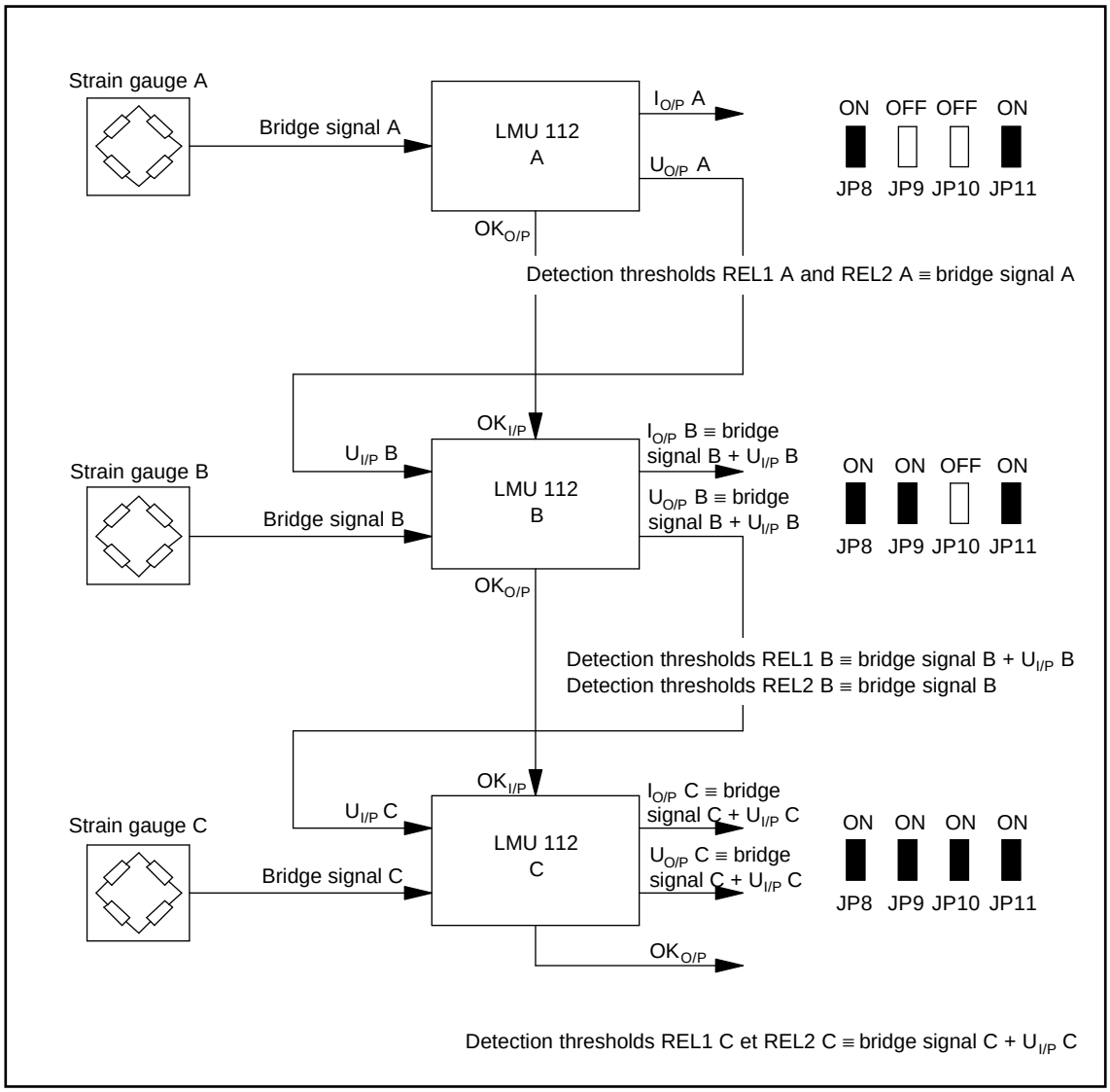

Fig. 5-3 : Selection of the application for three LMU 112 load monitoring units.

5.4 Using Strain Gauges in Parallel

To obtain the average of signals coming from several strain gauges (up to 4 per load monitor), these can be connected in parallel to a JB 113 junction box (for 2 strain gauges) or JB 114 (up to 4 strain gauges). The junction box will then be connected to the voltage input of the load monitor (refer to Figure 5-4).

☞ *The number of strain gauges that can be connected to a load monitor is limited to 4 and the input impedance must be ≥ 70 Ω.*

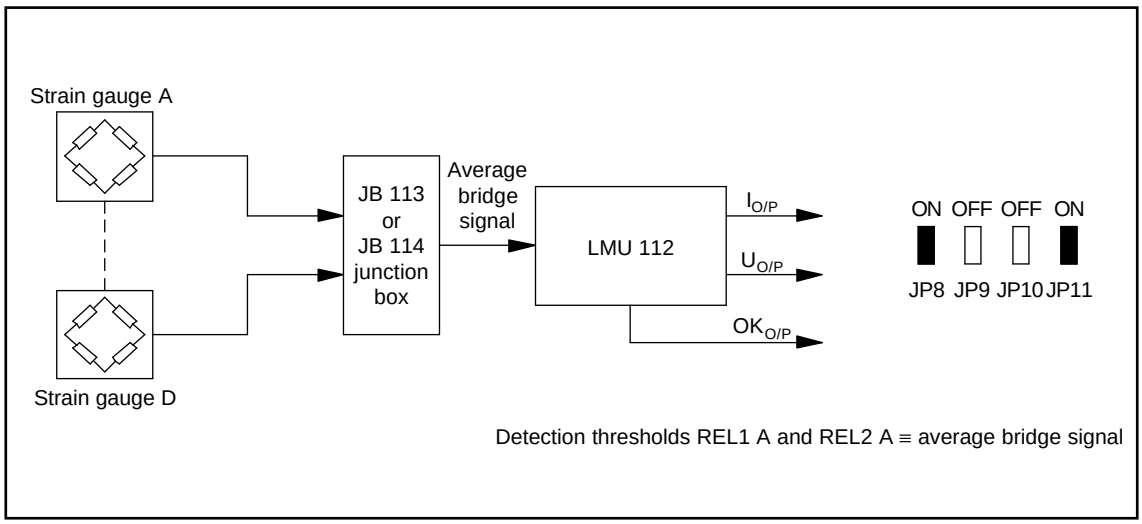

Fig. 5-4 : Using strain gauges in parallel.

5.5 Control of Correct Operation of the Measuring Chain ("OK" Feature)

5.5.1 Transmission between Transducer and Load Monitoring Unit

A short-circuit or a line failure in the transmission cable will produce the following effects :

- relays REL1 and REL2 are de-energized,
- the output current $I_{O/P}$ > 20 mA,
- the output voltage $U_{O/P}$ > 10 V DC,
- the output signal $OK_{O/P}$ falls to zero.

A short-circuit or a line failure in the transmission cable connected to the voltage input $U_{I/P}$ on the load monitoring unit will produce effects which are identical to those mentioned above.

5.5.2 "OK" Philosophy

Each load monitoring unit has an "OK" input ($OK_{I/P}$) and an "OK" output ($OK_{O/P}$). When simultaneously using several load monitoring units, it is possible to cascade these inputs and outputs in order to centralise the resulting information (see Figures 5-1 to 5-4).

If the "OK" output signal ($OK_{O/P}$) falls to zero (~100 Ω to 0 V) this indicates that a transmission fault has occurred between the transducer and the load monitoring unit. This will also happen if the load monitoring unit is defective.

If an "OK" input signal ($OK_{I/P}$) is forced to zero by a switch or by an "OK" signal coming from the preceding load monitoring unit, the reasons will be the same as described above. If several load monitoring units are connected together in a cascade manner, it is therefore necessary to interrupt the $OK_{I/P} \rightarrow OK_{O/P}$ links between these units in order to simplify the finding of the fault. An ohmmeter can be connected to the "OK" output ($OK_{O/P}$) for measuring the impedance (faulty system shows ~100 Ω to 0 V).

☞ *Applications in conformity with TÜV regulations must guaranty the detection of a short-circuit or a line failure. Thus, no signal can be sent to the contacts 21 (SENS+) and 22 (SENS-).*

A MECHANICAL DRAWINGS

Designation	Drawing No.
- LMU 112 Load Monitoring Unit	224-112-000 V 011
- LMU 116/117 Load Monitoring Unit	224-116-000 V 011

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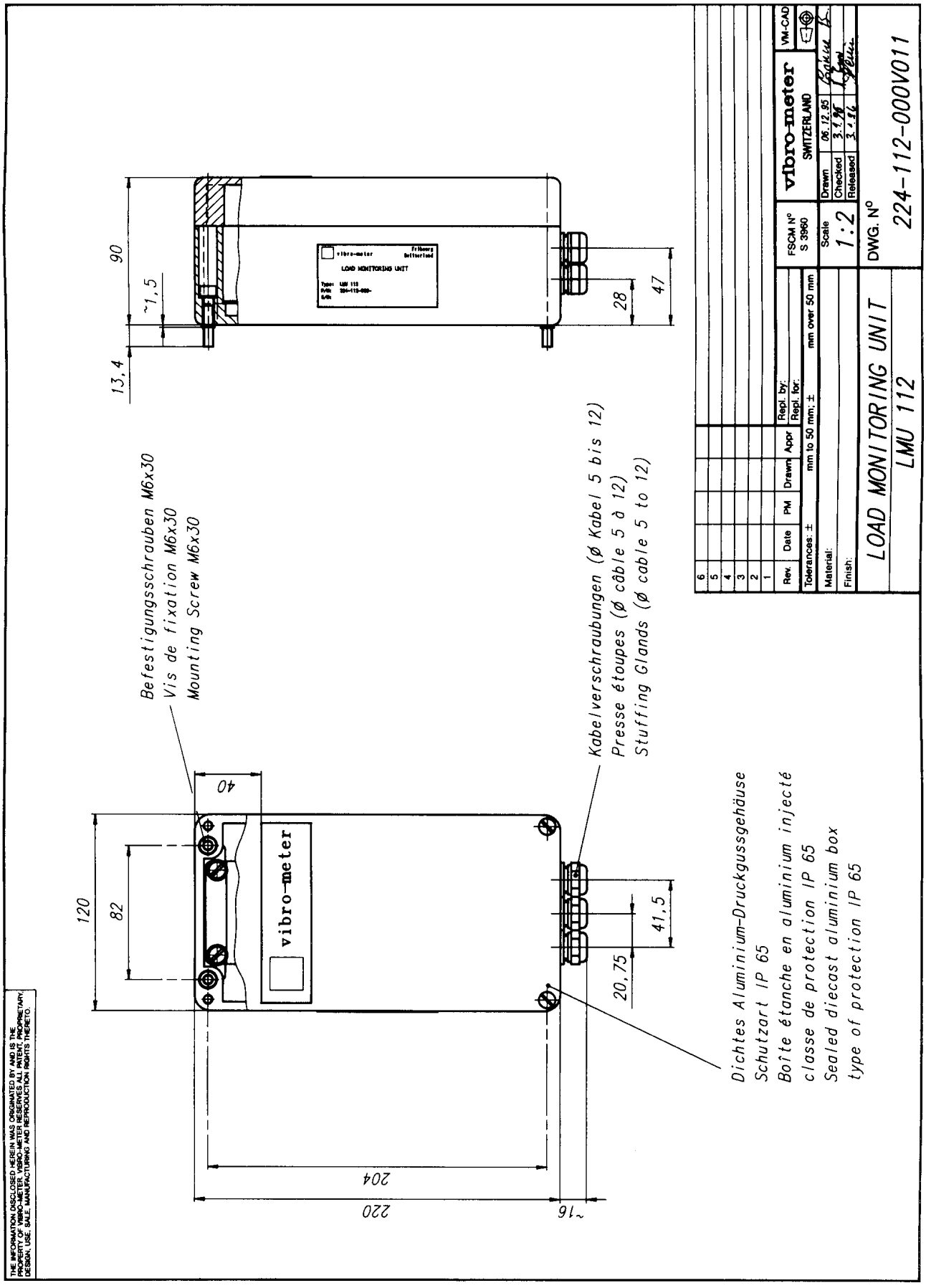
90
~1,5
13,4
28
47
LOAD MONITORING UNIT
LMU 112
Befestigungsschrauben M6x30
Vis de fixation M6x30
Mounting Screw M6x30
Kabelverschraubungen (ø Kabel 5 bis 12)
Presse étoupes (ø câble 5 à 12)
Stuffing Glands (ø cable 5 to 12)
40
120
82
vibro-meter
41,5
20,75
204
220
~16
Dichtes Aluminium-Druckgussgehäuse
Schutzart IP 65
Boîte étanche en aluminium injecté
classe de protection IP 65
Sealed diecast aluminium box
type of protection IP 65
Rev.
Date
PM
Drawn
Appr
Repl. by:
Repl. for:
Tolerances: ±
mm to 50 mm; ±
mm over 50 mm
Material:
Finish:
FSCM N° S 3960
vibro-meter SWITZERLAND
VM-CAD
Scale
1:2
Drawn
Checked
Released
06.12.95
DWG. N°
224-112-000V011
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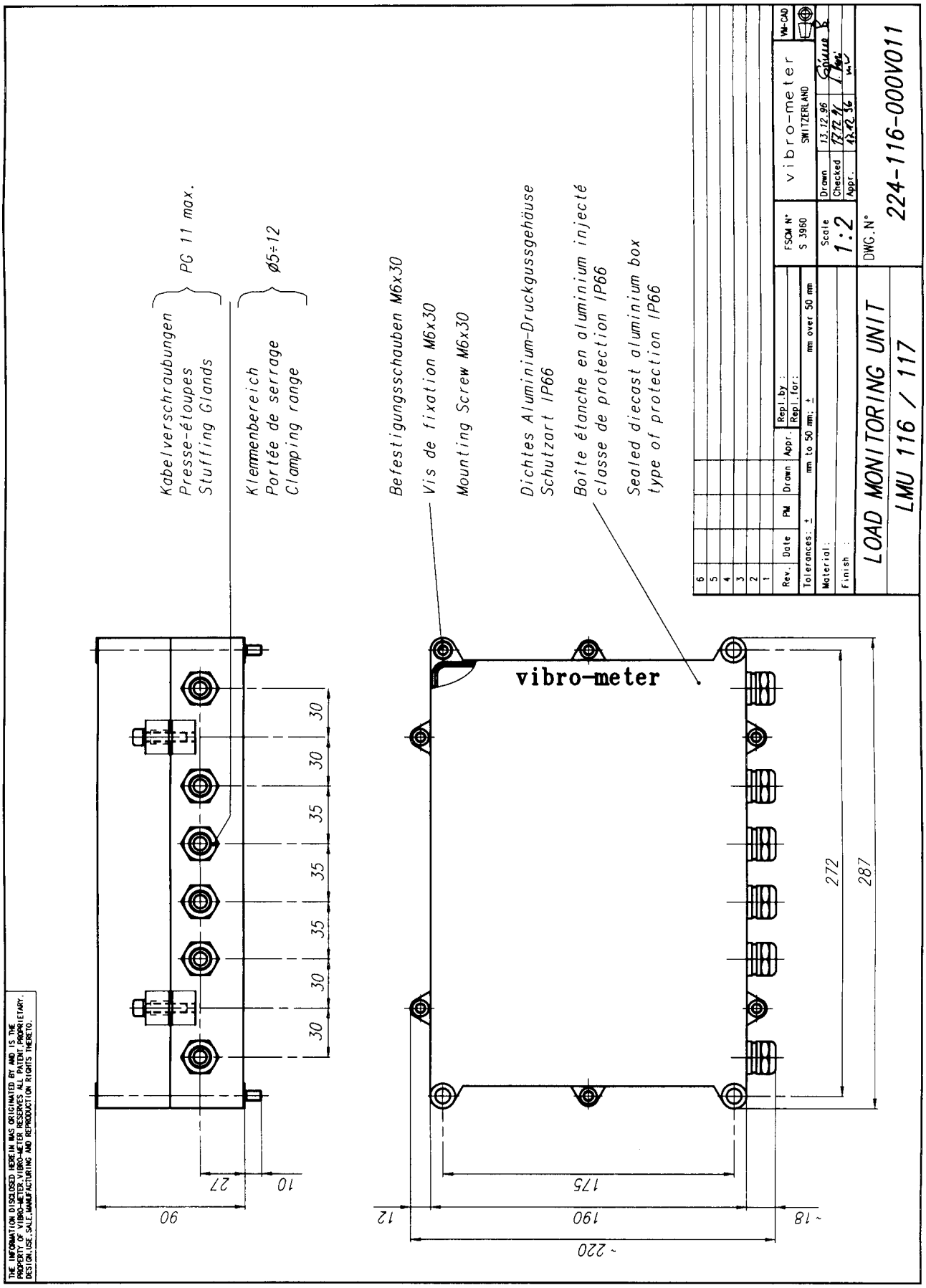
Kabelverschraubungen
Presse-étoupes
Stuffing Glands
PG 11 max.
Klemmenbereich
Portée de serrage
Clamping range
Ø5÷12
Befestigungsschrauben M6x30
Vis de fixation M6x30
Mounting Screw M6x30
Dichtes Aluminium-Druckgussgehäuse
Schutzart IP66
Boîte étanche en aluminium injecté
classe de protection IP66
Sealed diecast aluminium box
type of protection IP66
vibro-meter
30
30
35
35
35
30
30
27
10
90
175
190
220
12
18
272
287
LOAD MONITORING UNIT
LMU 116 / 117
224-116-000V011
DWG. N°
Scale 1:2
FSCM N° S 3960
vibro-meter
SWITZERLAND
Drawn 13.12.96
Checked
Appr.
Rev. Date PM Drawn Appr.
Repl. by :
Repl. for :
Tolerances: ± mm to 50 mm; ± mm over 50 mm
Material :
Finish :
VM-CAD
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B CONFIGURATION AND CALIBRATION FORMS

Configuration and calibration forms PY 7606 and PZ 6495 contained in this appendix must be duly completed by the user in accordance with the information given in Chapter 3 of this manual and placed inside the load monitor under the cover.

One copy of this must be returned to the address indicated below so that the after-sales service for the unit is assured on the best conditions :

Vibro-Meter SA
Instrumentation After-Sales Service
Department IB
Route de Moncor 4
CH-1701 Fribourg

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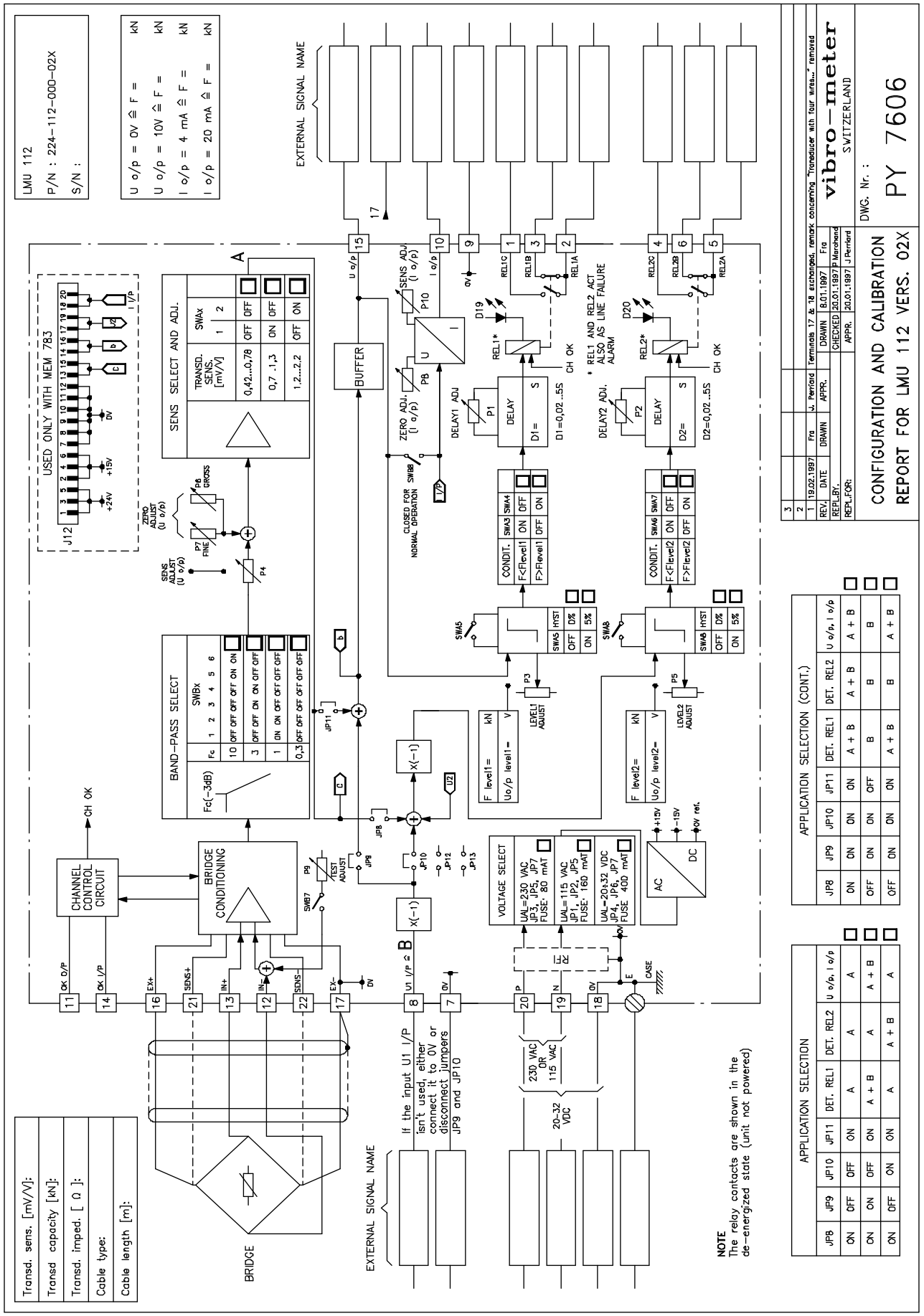
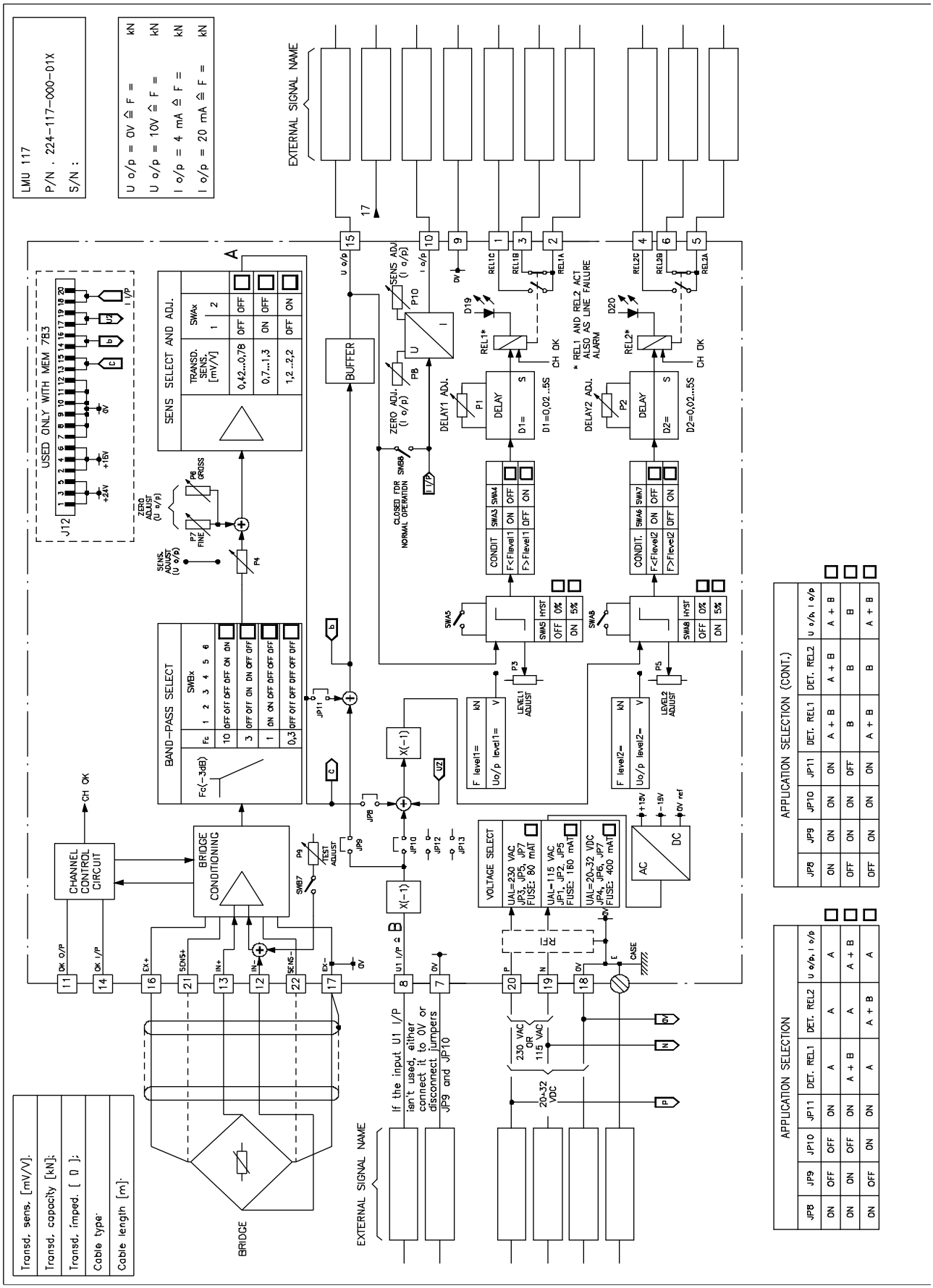
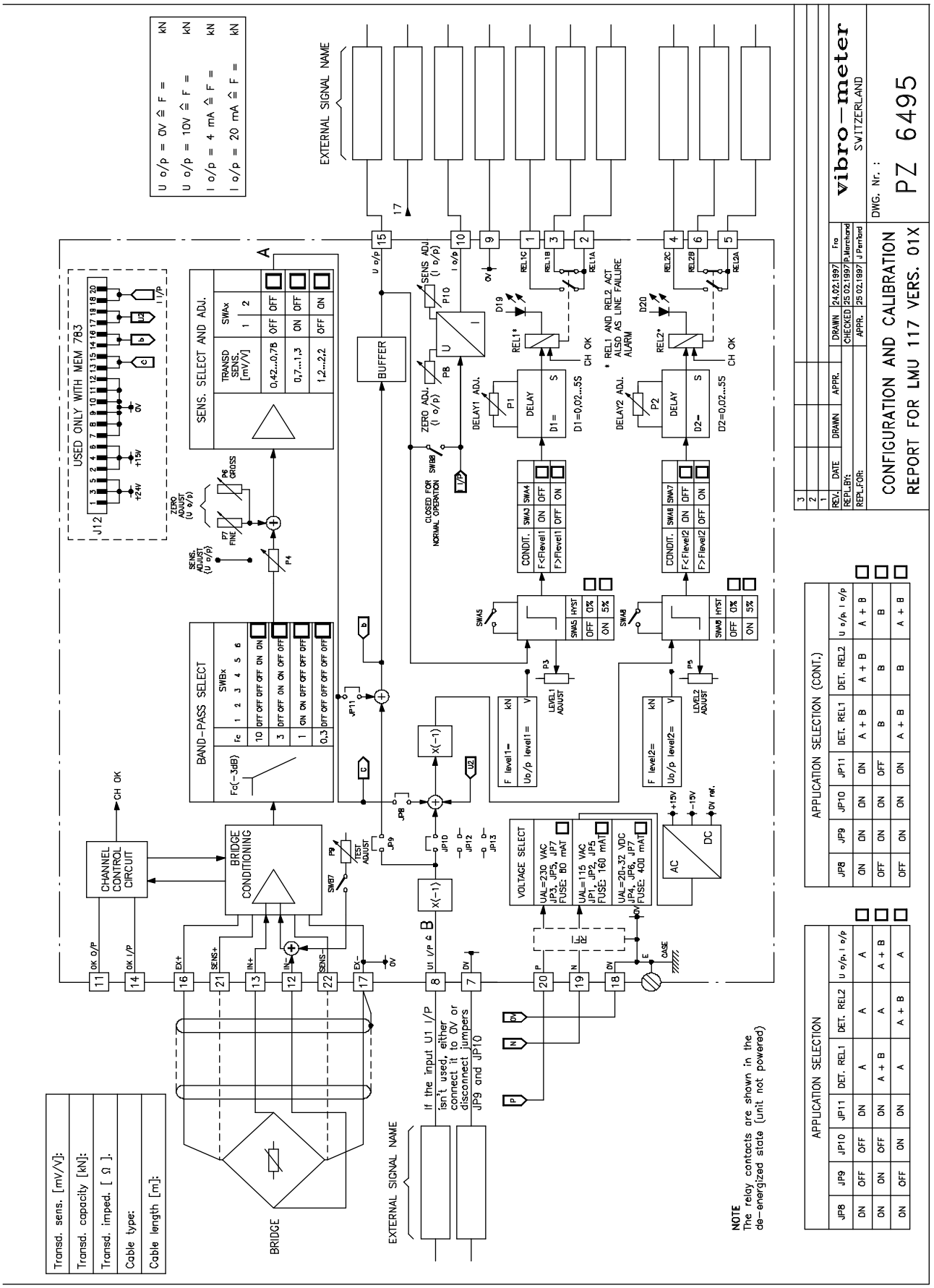

LMU 112
P/N : 224-112-000-02X
S/N :
U o/p = 0V ≙ F = kN
U o/p = 10V ≙ F = kN
I o/p = 4 mA ≙ F = kN
I o/p = 20 mA ≙ F = kN
EXTERNAL SIGNAL NAME
USED ONLY WITH MEM 783
J12
SENS SELECT AND ADJ.
TRANSD. SENS. [mV/V]
0,42...0,78
0,7 ..1,3
1,2...2,2
BAND-PASS SELECT
Fc(-3dB)
SENS ADJUST (U o/p)
ZERO ADJUST (U o/p)
BUFFER
ZERO ADJ. (I o/p)
SENS. ADJ. (I o/p)
DELAY1 ADJ
DELAY2 ADJ.
DELAY
D1=0,02..5S
D2=0,02..5S
CLOSED FOR NORMAL OPERATION
REL1 AND REL2 ACT ALSO AS LINE FAILURE ALARM
CH OK
CHANNEL CONTROL CIRCUIT
BRIDGE CONDITIONING
VOLTAGE SELECT
UAL=230 VAC JP3, JP5, JP7 FUSE: 80 mAT
UAL=115 VAC JP1, JP2, JP5 FUSE: 160 mAT
UAL=20...32 VDC JP4, JP6, JP7 FUSE: 400 mAT
AC
DC
LEVEL1 ADJUST
LEVEL2 ADJUST
APPLICATION SELECTION
APPLICATION SELECTION (CONT.)
JP8 JP9 JP10 JP11 DET. REL1 DET. REL2 U o/p, I o/p
ON OFF OFF ON A A A
ON ON OFF ON A + B A + B A + B
OFF ON OFF ON B B B
OFF ON ON ON A + B B A + B
If the input U1 I/P isn't used, either connect it to 0V or disconnect jumpers JP9 and JP10
230 VAC OR 115 VAC
20-32 VDC
BRIDGE
NOTE
The relay contacts are shown in the de-energized state (unit not powered)
Transd. sens. [mV/V]:
Transd capacity [kN]:
Transd. imped. [Ω]:
Cable type:
Cable length [m]:
CONFIGURATION AND CALIBRATION REPORT FOR LMU 112 VERS. 02X
PY 7606
DWG. Nr. :
vibro-meter
SWITZERLAND
Terminals 17 & 18 exchanged, remark concerning Transducer with four wires... removed
REV. DATE
19.02.1997 Fra J. Perriard
DRAWN 8.01.1997 Fra
CHECKED 20.01.1997 P. Marchand
APPR. 20.01.1997 J.Perriard



APPLICATION SELECTION						
JP8	JP9	JP10	JP11	DET. REL1	DET. REL2	U o/p, I o/p
ON	OFF	OFF	ON	A	A	A
ON	ON	OFF	ON	A + B	A	A + B
ON	OFF	ON	ON	A	A + B	A
ON	ON	ON	ON	A + B	A + B	A + B

APPLICATION SELECTION (CONT.)						
JP8	JP9	JP10	JP11	DET. REL1	DET. REL2	U o/p, I o/p
ON	ON	ON	ON	A + B	A + B	A + B
OFF	ON	ON	OFF	B	B	B
OFF	ON	ON	ON	A + B	B	A + B


CONFIGURATION AND CALIBRATION
REPORT FOR LMU 117 VERS. 01X
PZ 6495
vibro-meter
SWITZERLAND
DRAWN 24.02.1997 Fra
CHECKED 25.02.1997 P.Marchand
APPR. 25.02.1997 J.P.Pantland
REV. DATE DRAWN APPR.
REPL.BY:
REPL.FOR:
DWG. Nr. :
U o/p = 0V ≙ F = kN
U o/p = 10V ≙ F = kN
I o/p = 4 mA ≙ F = kN
I o/p = 20 mA ≙ F = kN
EXTERNAL SIGNAL NAME
USED ONLY WITH MEM 783
J12
SENS. SELECT AND ADJ.
TRANSD SENS. [mV/V]
0,42...0,78
0,7...1,3
1,2...2,2
SWAx
BAND-PASS SELECT
SWBx
BUFFER
SENS ADJ. (I o/p)
ZERO ADJ. (I o/p)
DELAY1 ADJ.
DELAY2 ADJ.
DELAY
D1=0,02...5S
D2=0,02...5S
CONDIT.
F<Flevel1
F>Flevel1
F<Flevel2
F>Flevel2
CLOSED FOR NORMAL OPERATION
REL1 AND REL2 ACT ALSO AS LINE FAILURE ALARM
CH OK
CHANNEL CONTROL CIRCUIT
BRIDGE CONDITIONING
VOLTAGE SELECT
UAL=230 VAC JP3, JP5, JP7 FUSE: 80 mAT
UAL=115 VAC JP1, JP2, JP5 FUSE: 160 mAT
UAL=20...32 VDC JP4, JP6, JP7 FUSE: 400 mAT
AC
DC
F level1=
Uo/p level1=
F level2=
Uo/p level2=
LEVEL1 ADJUST
LEVEL2 ADJUST
TEST ADJUST
ZERO ADJUST (U o/p)
SENS. ADJUST (U o/p)
BRIDGE
EXTERNAL SIGNAL NAME
If the input U1 I/P isn't used, either connect it to 0V or disconnect jumpers JP9 and JP10
NOTE
The relay contacts are shown in the de-energized state (unit not powered)
APPLICATION SELECTION
APPLICATION SELECTION (CONT.)
Transd. sens. [mV/V]:
Transd. capacity [kN]:
Transd. imped. [Ω]:
Cable type:
Cable length [m]:

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C DECLARATION OF EC CONFORMITY

Designation	No.	Reference
Declaration of conformity	DEC No 202	QHB-001/K12

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Vibro-Meter Fribourg Switzerland	Q-Form **CE Conformity declaration**	*Form No :*	QFO-067E/a
		Document Ref :	QHB-001/K12
		Emission date/Visa	95/11/28/W.K.

	Conformity declaration	DEC No 202	CE

We,

VIBRO-METER SA
Rte de Moncor 4
CH-1752 Villars-sur-Glâne (Switzerland)

herewith declare that the following products :

Family Types

Load Monitoring Unit LMU

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

89/336/EC Electromagnetic compatibility (EMC) / applicable for Vibro-Meter's products.
93/68/EC Instruction of marking of 89/336/EC (and the following).

Those products have been developed and manufactured according to the internal directives QHB001 conformity with the EN29001 / ISO 9001 norm.

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

EN 50081-2 generic EMISSION Standard part 2 : industrial environment
EN 50082-2 generic IMMUNITY Standard part 2 : industrial environment.

	Place and date of emission	Name and signature
Duly allowed Vibro-Meter's Representative	Fribourg 22. 11. 95	P. Jeger W. Kurth

LMUE.doc/mj

Page 1 de 1

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PRODUCT DEFECT REPORT

Please cut out or copy and send to Vibro-Meter Sales agent

If you should observe any problems with this Vibro-Meter product would you please contact your **Vibro-Meter agent**.
Please fill in this form (in English), giving as much specific information as possible on the problems observed. This will enable us to decide the quickest way to solve the problem.
NB : If more than one unit is defective, photocopy this sheet and fill in one copy for each unit.

☞ **THIS REPORT OR A COPY OF IT SHOULD ACCOMPANY THE DEFECTIVE UNIT AT ALL TIMES !**

NB : For plug-in modules this information can usually be found on the label stuck on its side.

Module type : _____

Part number (P/N) : _____

Serial number (S/N) : _____

Vibro-Meter order no. : _____

Date of purchase : _____

Site where used : _____

Problems observed : _____

_____

_____

_____

_____

_____

_____

(Please continue on back of sheet if necessary)

Is the problem :

☐ Always evident ?

☐ Temperature dependent ?

☐ Intermittent ?

(☒ Mark as appropriate)

In case we need any further information, please provide us with the name of an employee with whom we can make contact :

Name : _____

Department : _____

Company : _____

Address : _____

_____

_____

Country : _____ **Postal code :** _____

Tel. : _____ **Telex :** _____

Fax : _____

Signature : _____ **Date :** _____

PRODUCT DEFECT REPORT
(cont.)

Please use this space for any additional information :

DOCUMENTATION EVALUATION FORM

Instruction Manual : LOAD MONITORING UNIT LMU 112 / LMU 117 **P/N :** 633.014 E

Vibro-Meter welcomes your evaluation of this intruction manual. Your comments and suggestions will help us to improve our documentation.

Please circle the following Yes or No :

• Is the document well organized ?	Yes	No
• Is the information technically accurate ?	Yes	No
• Would you like more technical detail ?	Yes	No
• Are the instructions clear and complete ?	Yes	No
• Are the descriptions easy to understand ?	Yes	No
• Are the examples and diagrams/photos helpful ?	Yes	No
• Are there enough examples and diagrams/photos ?	Yes	No
• Is the style/wording easy to read ?	Yes	No
• Are there any omissions ? (If so, please list below)	Yes	No

Comments : _____

_____

_____

_____

_____

_____

_____

Name : _____

Title : _____

Company : _____

Address : _____

_____

_____

Country : _____ **Postal code :** _____

Signature : _____ **Date :** _____

Please cut out and mail to Vibro-Meter Thank you for your cooperation

Tape here

Please do not staple

Tape here

Tape here

Tape here

Fold here

Attn : Technical Documentation Dept. (I / M)

Switzerland
CH-1701 Fribourg
Route de Moncor 4
Vibro-Meter SA

Place
stamp
here