vibro-meter

User Manual

VIBRATION MONITOR

VibroSmart VMU100

MAVMU100/E

REVISION RECORD SHEET

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PREFACE

About This Manual

This manual provides information on vibration monitoring using Vibro-Meter's VibroSmart VMU100. It describes the installation and general use of this system.

Who Should Use This Manual?

This manual is written for operators of process monitoring/control systems using Vibro-Meter's accelerometers for absolute vibration measurement. These proximity systems form the "front end" of the overall monitoring/control system, which usually also includes a modular monitoring system (based on, for example, Vibro-Meter's VMU100).

The operator is assumed to have the necessary technical training in electronics and mechanical engineering (professional certificate/diploma, or equivalent) to enable him to install the proximity system and operate the monitoring system and the controlled system.

Related Documentation

Table 1 lists the data sheet that concerns the VibroSmart VMU100 described in this manual. Data sheets for associated equipment are listed in Table 2.

Document	Doc. Ref. Number
VibroSmart VMU100	266-650

Table 1 : Related documentation (VibroSmart VMU100)

Document	Doc. Ref. Number
Piezoelectric accelerometer with Integrated Electronics CE 680 M411	262-055
Cable Assembly EC 318	262-645

Table 2 : Related documentation (associated equipment)

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SAFETY

Symbols and Styles Used in This Manual

The following symbols are used in this manual where appropriate :

The WARNING safety symbol

THIS INTRODUCES DIRECTIVES, PROCEDURES OR PRECAUTIONARY MEASURES WHICH MUST BE EXECUTED OR FOLLOWED. FAILURE TO OBEY A WARNING CAN RESULT IN INJURY TO THE OPERATOR OR THIRD PARTIES.

The CAUTION safety symbol

This draws the operator's attention to information, directives or procedures which must be executed or followed. Failure to obey a caution can result in damage to equipment.

The ELECTROSTATIC SENSITIVE DEVICE symbol

This indicates that the device or system being handled can be damaged by electrostatic discharges.
Refer to Handling Precautions for Electrostatic Sensitive Devices on page xiv for further information.

NOTE : This is an example of the NOTE paragraph style. This draws the operator's attention to complementary information or advice relating to the subject being treated.

Important Remarks on Safety

Read this manual carefully and observe the safety instructions before using the equipment described.

Location of Safety Symbols

The following safety symbols are found on the pages specified below :

This symbol is found on the following page:
3-1

This symbol is found on the following pages:
xii, **xiii**, **2-1**, **3-21**, **4-1**

This symbol is found on the following page:
xiv

Additional Remarks

Every effort has been made to include specific safety-related procedures in this manual using the symbols described above. However, operating personnel are expected to follow all generally accepted safety procedures.

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

Vibro-Meter does not accept any liability for injury or material damage caused by failure to obey any safety-related instructions or due to any modification, transformation or repair carried out on the equipment without written permission from Vibro-Meter. Any modification, transformation or repair carried out on the equipment without written permission from Vibro-Meter will invalidate any warranty.

General Handling Precautions

Certain precautions should be taken when using the VibroSmart VMU100.

Read the following recommendations carefully before using the VibroSmart VMU100.

- Do not excessively bend the cables connecting transducers to the VMU100, or any associated cables. Respect the minimum bending radius quoted in the appropriate data sheet.
- When storing and using the equipment, respect the environmental specifications (temperature, humidity) quoted in the appropriate data sheet.
- Refer also to Handling Precautions for Electrostatic Sensitive Devices on page xiv.

Handling Precautions for Electrostatic Sensitive Devices

Certain devices used in electronic equipment can be damaged by electrostatic discharges resulting from built-up static electricity. Because of this, special precautions must be taken to minimize or eliminate the possibility of these electrostatic discharges occurring.

Read the following recommendations carefully before handling electronic circuits, printed circuit boards or modules containing electronic components.

- Before handling electronic circuits, discharge the static electricity from your body by touching and momentarily holding a grounded metal object (e.g. a pipe or cabinet).
- Avoid the build-up of static electricity on your body by not wearing synthetic clothing material, as these tend to generate and store static electric charges. Cotton or cotton blend materials are preferred because they do not store static electric charges.
- Do not handle electronic circuits unless it is absolutely necessary. Only hold modules by their front panel handles.
- Do not touch printed circuit boards, their connectors or their components with conductive devices or with your hands.
- Put the electronic circuit, printed circuit board or module containing electronic components into an antistatic protective bag immediately after removing it from the system rack.

1 INTRODUCTION

1.1 Version

This user manual contains the general information relating to the vibration monitor VibroSmart VMU100 designated by the following version numbers:

- Equipment : Version M1
- Software : Version VT1.98

1.2 Concept and Application Areas

The design of the VibroSmart VMU100 vibration monitor answers the following requirements:

- Resistance to industrial environments
- Simple programming
- Easy wiring
- Legibility of parameters
- Outputs available for connection to other systems
- Alarm and self-checking relays
- Analog output
- Serial digital output (various RS protocols)

The unit can be used in various application areas, for example:

- Compressors
- Pumps
- Groups of hydraulic instruments
- Electric and thermal motors
- All rotary machines

and also:

- Grinders
- Conveyor belts and vibrating hoppers
- Compacting process
- Any machine generating vibrations

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2 SYSTEM DESCRIPTION

2.1 Basic Version

The basic version comprises :

- **The IP65 metal housing** front panel in Lexan and accessories (stuffing glands, BNC socket, screws, joints etc.)
- **The indicator board**, integrated into the housing

This card cannot be disconnected.

In the event of deterioration or failure of the Indicator board, the complete unit should be returned to Vibro-Meter for repair / replacement.

- **The mother board or base board** comprising :
  - The power supply block (115/230 V_{AC}, other voltages possible as an option)
  - The microcontroller, the Analog/Digital converter etc.
  - The “Vibration” module for the constant current accelerometer, input in mV/g. This module processes the vibration signals.
- **The three relay module** one of which is a self-test relay (OK) and the other two alarm relays (LD1 and LD2)
- **The removable connectors** for connecting and disconnecting input cables
- This User Manual

2.2 Optional Modules

The base board can take two optional modules :

- **“Analog output” module** (Ordering code Y)
  This module converts the value of the measurement, displayed by the digits, into an analog signal 0-10 V_{DC} or 4-20 mA (programmable selection) on the basis of the measuring range (FSD)
- **RS standard serial digital module** (Ordering code Z)
  Two modules are available for RS serial digital connections :
  - RS232C module
  - RS485 module

2.3 Front Panel

The front panel is made of 400 micron polycarbonate which gives it a mechanical and chemical resistance compatible with the usual industrial environments.

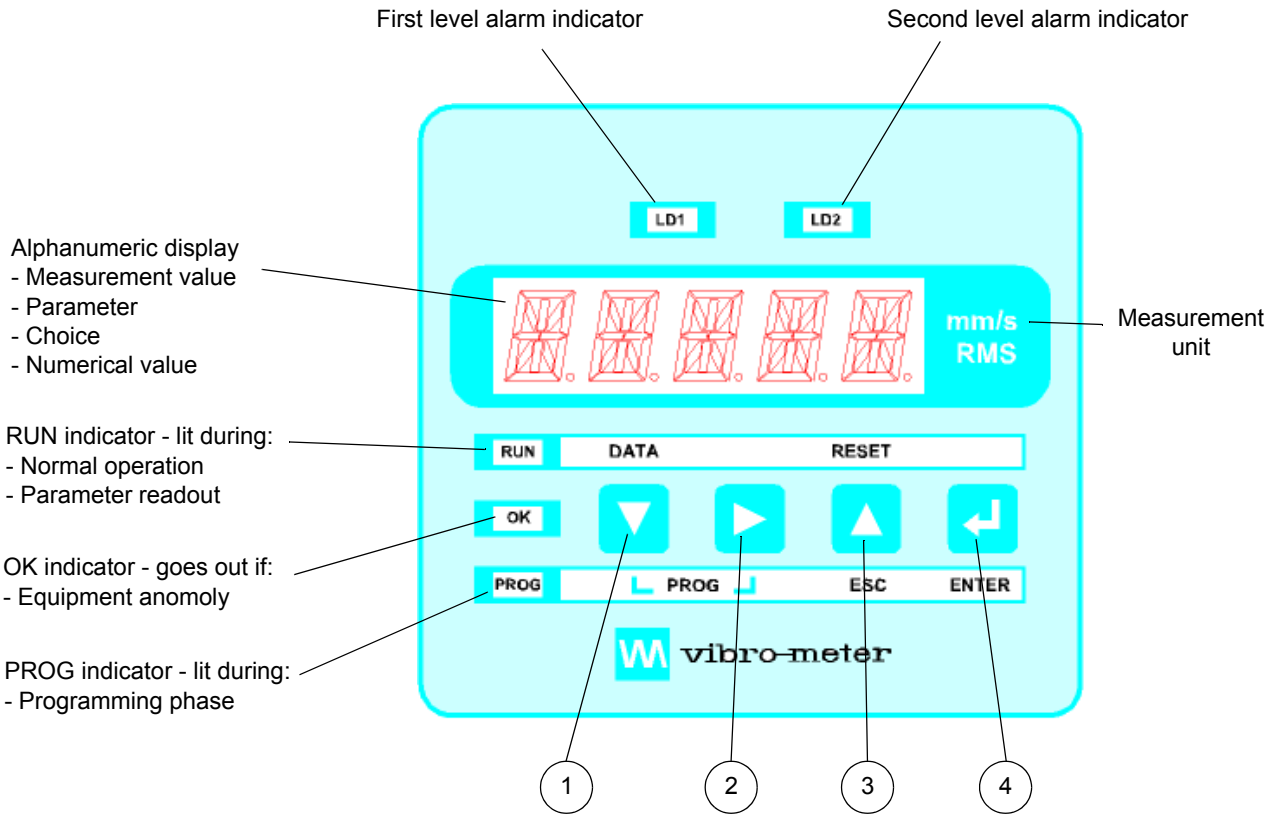
NOTE : NB: The VibroSmart VMU100 must be ordered using the Ordering code V.
- The measurement unit : mm/s or inch/s
- The measurement type : RMS or Peak

so that the front panel suits the customer's requirements.

Available front panels : mm/s RMS, mm/s Peak, inch/s RMS or inch/s Peak

The following section describes the functions of the elements (digits, indicators and push buttons).

2.4 Front Panel Presentation



Description	Operation in RUN mode	Operation in PROG mode
Button 1	Read input or move to lower level	Lower level or lower value
Button 2	Same level	Same level or another digit or another choice
Button 3	Higher level or reset	Higher level or exit without saving
Button 4	---	Exit after saving

3 DETAILED FUNCTIONS

3.1 Power Supply

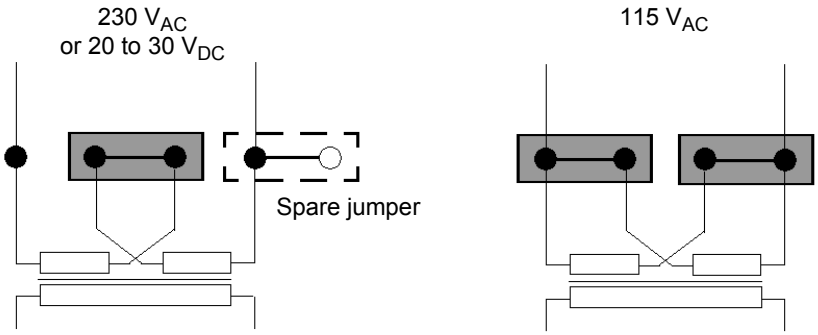
The VibroSmart VMU100 exists in different versions according to the supply voltage used.

- "Standard AC supply": 115/230 V - 50/60 Hz
  Base configuration 230 V_{AC}: Ordering Code X=1
  Configuration option 115 V_{AC}: Ordering Code X=2
- "DC supply": 20 to 30 V_{DC}
  One configuration only of 20 to 30 V_{DC}: Ordering code X=5

Change of voltage by the user

The VibroSmart VMU100 is configured for the supply voltage requested on the order form, using Ordering code X.

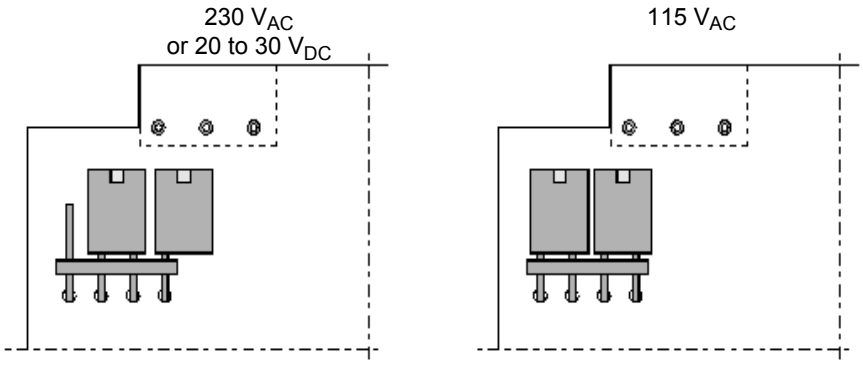
For the "basic" and "low voltage" alternating current versions the user can opt for the other voltage of the supply block by repositioning the jumpers located on the mother board.



Physical arrangement

The jumpers are located under the mother board, on the supply connector side. They are accessible by taking off the lower cover, without removing the electronics from the housing.

IMPORTANT : THE EQUIPMENT MUST BE SWITCHED OFF BEFORE CHANGING THE JUMPER SETTINGS.



View under the motherboard

3.2 Display Functions

The alphanumeric 5 digit display enables readout of:

- The value of the vibration in the chosen measuring unit (mm/s RMS, mm/s Peak, inch/s RMS or inch/s Peak)
- The programming parameters which each include:
  - An alphabetic identification text (Label)
  - A numerical value or a selection option

When the voltage is switched on, all the segments are tested by simulating a clock with turning hands. All of the parameters are described in **Chapter 6 - Programming Mode (PROG)**.

3.3 Self-check / OK Function

The purpose of this function is to identify the following defects which might occur with respect to a vibration sensor or connecting cable :

- At the level of the vibration sensor or the connection cable
  - Break in the cable
  - Short circuit
- At the electronics level
  - Loss of electrical supply
  - Loss of supply voltages generated internally
  - Failure of the Analog/Digital converter

In the event of a fault in the sensor, the line or the electronics:

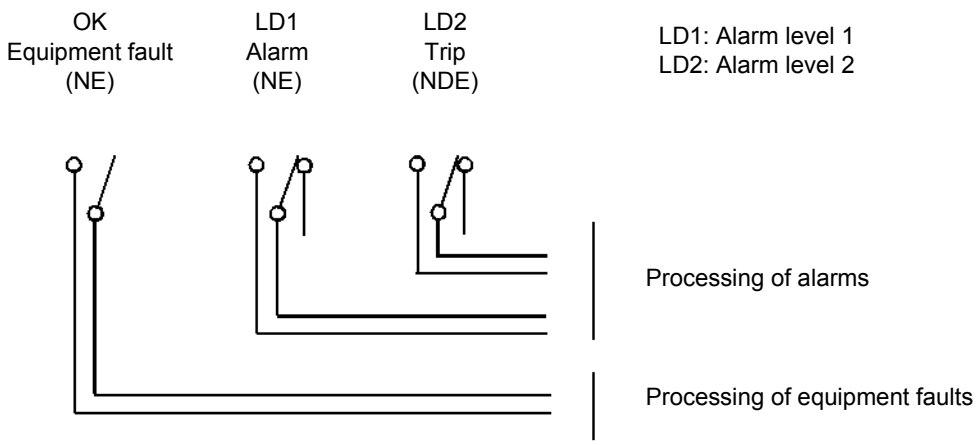
1) The OK indicator (Green) on the front panel, which is normally lit, goes out.
2) The OK relay which is normally excited drops out and its available contacts, which are closed during normal operation, become open.
3) The alarms are inhibited in order to avoid setting off false “machine” alarms by the incorrect interpretation of the measuring signal.

NOTE : If the external alarm processing device allows, this condition enables you to detect the “machine” alarms and the “equipment” alarms for which the functional consequences are different.

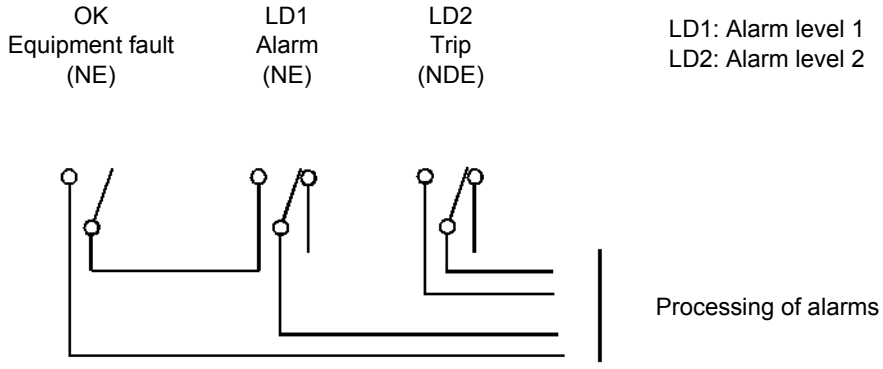
Examples :

Depending on the structure of the supervision system.

A. Supervision system with specific processing of equipment



B. Supervision system without specific processing of equipment



The contact of the OK relay is connected in series with the contact of the LD1 alarm programmed to be closed under normal operation.

(In principle the working contact of the normally energised relay is used.)

3.4 Monitoring

The system allows two alarm levels to be monitored on the vibration signal.

Each of these alarms comprises the following programmable parameters :

NOTE : The text in brackets indicates the messages displayed on the VibroSmart VMU100, followed by the possible responses.

- Activity of the alarm (ACT = Yes/No)
  If the alarm considered is used it should be declared active = **Yes**
  If the alarm considered is not used it should be declared non active = **No**

- Direction of the alarm (Hi-Lo = Hi/Lo)
  The alarm can be:
  - High = **Hi** (General case of supervision of rotating machines)
  - Low = **Lo** (Case of supervision of vibrating machines, grinders etc.)

- State of the relay under normal operation (NORM = ON/OFF)
  In normal operation the relay can be:
  - Normally energised (NE) = **ON**
  - Normally de-energised (NDE) = **OFF**

The first level alarm LD1 is generally with the relay normally energised (failsafe, normally energised relay).

The second level alarm LD2 can be with the relay normally de-energized if it controls the tripping of the machine being monitored and if you want to avoid any accidental stoppage in the case of :

- Loss of power supply on the VibroSmart VMU100
- Breaking of connection between the VibroSmart VMU100 and the supervised unit
- Equipment defect (the OK light goes out)

- Storing the alarm state (LATCH = No/Yes)
  The alarm can be:
  - Not stored (Not latched) = **No**
  - Stored (latched) = **Yes**

See the alarm sequence in graphic form in 3.7 - Alarm Sequence.

- Alarm not stored (Not latched) = No
- Alarm activated : LD indicator blinking, relay oscillating on and off
- Alarm deactivated : Indicator goes out and the relay returns to its normal position
- Alarm stored (latched) = Yes

RESET function

To clear the stored alarm, use the RESET function, by pressing the RESET button on the front panel of the VibroSmart VMU100 or remotely through the logical input “external RESET”.

(See Wiring Diagram on page 4-3.)

Sequence

Alarm activated: LD indicator blinking, relay oscillating on and off

- Reset by the operator before the end of the alarm state:
  - Alarm LD indicator continuously on, relay unchanged
  - After the alarm state is cleared, the indicator goes out and the relay returns to its normal position

- Alarm state cleared before being reset by the operator :
  - LD Indicator blinking and relay unchanged
  - Indicator goes out and the relay returns to its normal position, when the Reset function is selected by the operator
  - Adjustment of the alarm level (LEVEL = Value to be adjusted)

Remarks on hysteresis

In the case of the VibroSmart VMU100, the hysteresis has been fixed at 5% of the measurement value.

The hysteresis acts in such as way as to keep its displayed value at the alarm threshold

- by going down again for a threshold at maximum
- by going up again for a threshold at minimum

The level of the alarm is programmed according to the machine manufacturer’s data or from the operator’s experience.

Taking into account the hysteresis of the alarm fixed at 5% of the measurement value, the lowest values of the alarm thresholds (limited by the software) are :

- 10% FSD for a high threshold = Hi (Re-engagement at 5% FSD)
- 5% FSD for a low threshold = Lo (Re-engagement at 10% FSD)
- Time delay of the alarm (DELAY = Value to be set)

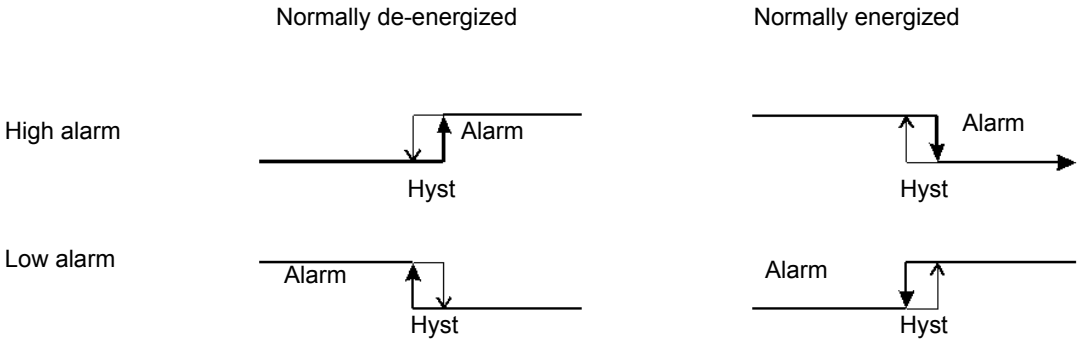
The delay is the minimum time, in seconds, for which the alarm threshold should be exceeded before setting off the alarm.

The delay enables known transitory states during which the vibration levels are higher than in normal operation to pass without setting off the alarm (for example, when passing through a critical speed during machine run-up). Refer to 3.6 - Time Delay for further information.

3.5 Operation of the Alarms

Relay switching behaviour related to:

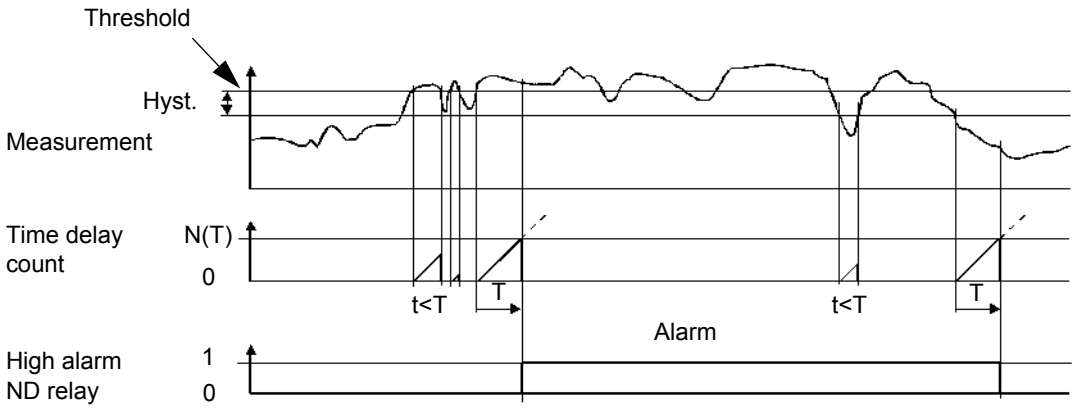
- alarm type (high or low)
- relay mode (normally de-energized or normally energized)



3.6 Time Delay

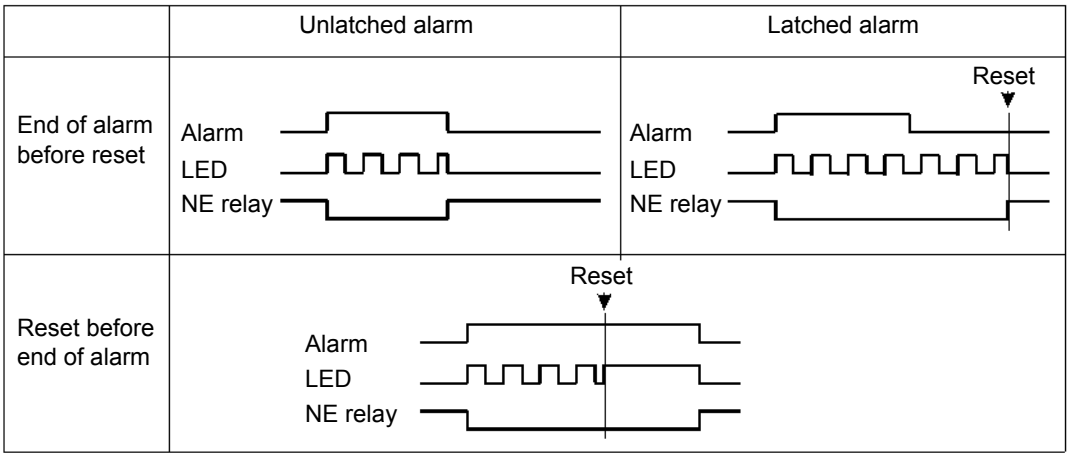
Relay switching behaviour related to:

- Time to cross the alarm threshold
- Hysteresis



3.7 Alarm Sequence

Relay switching behaviour and lighting of the LED as a function of the timing between the end of the alarm and the Reset action.



3.8 Max/min Storage

VibroSmart VMU100 stores the Maximum and Minimum values reached by the vibration from the moment these parameters are initialised.

This function records the extreme levels attained by the vibration being monitored over a given period.

Examples :

- Points exceeding the trip threshold which are ignored by the time delay
- Vibration effectively achieved during the tripping of machines

3.9 Analog Output (Optional)

The analog output is generated by an optional module which can work either under the 0-10 V_{DC} standard, or under the 4-20 mA standard.

The choice is programmable : **(ANOUT = 0-10V / 4-20mA)**

The analog output is refreshed at a rate of 16 times per second.

Ordering Code

This option must be defined with the Ordering code Y :

Y = 0	No analog module
Y = 1	Output 0-10 V (configurable)
Y = 2	Output 4-20 mA (configurable)

3.10 RS232C or RS485 Transmission (Optional)

Ordering code

This option must be defined by the "Z" code :

Z=0	None
Z=1	RS232C submodule
Z=2	RS485 submodule

The RS232C or RS485 output option consists of an additional card that is installed on the VibroSmart VMU100 main board. The card incorporates a contact telephone socket with output at the rear of the meter : RJ9-4 (RS232C) or RJ11-6 (RS485). In the case of the RS485 option, a double adapter is delivered in order to allow in and out links.

The serial output enables a communication line to be configured, allowing a master device to request the transmission of data such as the display value, setpoint values and Max and Min values from the VibroSmart VMU100, and also to perform operations such as displaying or resetting the Max or Min memories and updating setpoint values.

The output option is totally software configurable as regards the transmission rate (4800, 9600 or 19200 baud) and the instrument's address (from 01 to 99). The protocol used is ISO 1745.

The RS232C option allows you to connect one VibroSmart VMU100 to a master device with RS232C output.

The RS485 option allows up to 31 VibroSmart VMU100's to be connected to a master device with an RS485 output.

The operating mode is half-duplex. The serial channel only functions when the monitor is in the run mode and it normally stays in data reception mode until reception of a message.

A valid data transmission may cause the immediate execution of a command (e.g. reset of the Max and Min values in memory, modification of setpoint values) or the transmission of a response from the monitor (e.g. display value, one of the setpoints' values, Max and Min values).

A disk containing the VIBRO_CONF program, for use under Windows 95, lets you control the transmission and reception of data on a PC screen and the complete programming of one or more VibroSmart VMU100 monitors connected to the computer's RS232C/485 serial port by means of the ISO 1745 protocol (PROT 2).

DESCRIPTION OF OPERATION

The communication mode used is the ISO mode = Protocol 2, which conforms to the ISO 1745 standard, and permits a more secure communication in noisy environments since the data transfer is verified both at the transmission and the reception ends.

ISO 1745 PROTOCOL

The transmission format is 1 Start bit, 7 Data bits, 1 Parity (Even) bit and 1 Stop bit.

Receiving messages

The message format, as sent from the master device, must contain the following sequence of ASCII characters :

SOH	D	D	STX	C	C	$X_1...X_n$	ETX	BCC

The bytes have the following meaning :

SOH	Start of header [ASCII 01]
D	Two bytes representing the instrument's address (between 01 to 99). Note : The broadcast address '00' can be used to configure all of the VMU100s with the same parameters and values.
STX	Start of text [ASCII 02]
C	Two command bytes; see 3.11 - List of Commands.
$X_1...X_n$	For commands that are used to change a parameter, the command bytes are followed by a group of n bytes, representing the parameter's new value, including the sign and decimal point.
ETX	End of text [ASCII 03]
BCC	Control byte, calculated as follows :

<BCC> Calculation

1) Perform an Exclusive-OR with all bytes comprised between the <STX> (not included) and the <ETX> (included).
2) If the byte obtained (in ASCII format) is higher than 32, it can be taken as the <BCC>.
3) If the result (in ASCII) is lower than 32, the <BCC> byte is obtained by adding 32.

Example messages

- Request sent to the monitor with the address 35, to send the displayed value :

  <SOH>35<STX>0D<ETX>w

- Request sent to the monitor with the address 4, to change the LD1 set point to 19.3 :

  <SOH>04<STX>M1+019.3<ETX>q

Data transmission

The format of messages as sent from the instrument in response to a command from the master device is the following :

1) Example of commands that request the transmission of a value (data request type) :

SOH	D	D	STX	$X_1...X_n$	ETX	BCC

SOH	Start of header [ASCII 01]
D	Two bytes representing the instrument's address (between 01 to 99). Note : The broadcast address '00' can be used to configure all of the VMU100s with the same parameters and values.
STX	Start of text [ASCII 02]
$X_1...X_n$	A group of n bytes, representing the requested value, including the sign and decimal point.
ETX	End of text [ASCII 03]
BCC	Control byte

Example of message

- The monitor with the address 35 sends the display value = 4.5

  <SOH>35<STX>+004.5<ETX>

2) Example of commands that do not require the return of a value (command type or changing parameters) :

The instrument sends a confirmation to the master device when it receives a message.

D	Dd	ACK	or	D	Dd	NAK

If the message has been correctly received and interpreted, the response will consist of two address bytes and one "ACK" [ASCII 06] (acknowledged) byte.

If the received message has not been well interpreted or it has been detected with errors, the response will be two address bytes and a "NAK" byte [ASCII 21] (Not Acknowledged).

NOTE : When the master device transmits a message to address 00, the command will be received by all the instruments on the bus and there will not be any response.

3.11 List of Commands

ISO 1745 Protocol	Command	Type
0V	Transmit min. value in memory	Data Request
0P	Transmit max. value in memory	
0D	Transmit display value	
L1	Transmit the setpoint value LD1	
L2	Transmit the setpoint value LD2	
TT	Transmit the terminal identification	
NB	Transmit installed options	
SC	Transmit the configuration	
0v	Reset the min. value in memory	Commands / Orders
0p	Reset the max. value in memory	
M1	Change the LD1 setpoint value	Changing Parameters
M2	Change the LD2 setpoint value	
RC	Change the configuration	

3.11.1 Command descriptions

Command 0V/0P: Min value / Max value transmission

The monitor sends the lowest/highest value in memory since power ON or since the last reset of Min and Max values.

Command 0D: Current display value transmission

The monitor sends its current display value.

Command L1/L2: LD1/LD2 setpoint value transmission

The monitor sends the LD1/LD2 setpoint value configured in memory.

Command TT: Type of terminal transmission

The monitor sends the terminal type. The VibroSmart identification code is V5.

Command NB: Type of option transmission

The monitor send its installed options.

3RE: **05** 3RE+ANA: **45**

Command SC: Configuration transmission

The monitor sends its configuration in memory. This configuration is coded in a string of 34 characters.

See Table 3-1 below.

Command 0v/0p: Reset the Min value / Max value

The order is sent to the monitor to reset the Min/Max value in memory.

Command M1/M2: Changing the LD1/LD2 setpoint value

A new LD1/LD2 value is sent to the monitor

Command RC: Changing the configuration

A new configuration is sent to the monitor. This configuration is coded in a string of 34 characters.

See Table 3-1 below.

3.11.2 Configuration Codes Description

The 34 character string comprising the configuration is described below.

Byte	Description	Value
1	Number of decimal places	0, 1, 2
2	Resolution (RND)	0=1, 1=2, 2=5, 3=10
3	Full scale deflection (FSD) (mm/s / inch/s)	0=10.0/0.50, 1=20.0/1.00, 2=50.0/2.00, 3=100/5.00, 4=200/10.0, 5=500/20.0
4	Level detector 1 Activate (ACT)	0=OFF (No), 1=ON (Yes)
5	Level detector 2 Activate (ACT)	0=OFF (No), 1=ON (Yes)
6	Level detector 1 Mode (HI-LO)	0=HIGH (HI), 1=LOW (LO)
7	Level detector 2 Mode (HI-LO)	0=HIGH (HI), 1=LOW (LO)
8	Level detector 1 Normal (NORM)	0=ON, 1=OFF
9	Level detector 2 Normal (NORM)	0=ON, 1=OFF
10	Level detector 1 LATCH	0=OFF (No), 1=ON (Yes)
11	Level detector 2 LATCH	0=OFF (No), 1=ON (Yes)
12	Level detector 1 digit 4 (unit)	From 0 to 9
13	Level detector 1 digit 3 (decade)	From 0 to 9
14	Level detector 1 digit 2 (hundred)	From 0 to 9
15	Level detector 1 digit 1 (thousand)	From 0 to 9
16	Level detector 2 digit 4 (unit)	From 0 to 9
17	Level detector 2 digit 3 (decade)	From 0 to 9
18	Level detector 2 digit 2 (hundred)	From 0 to 9
19	Level detector 2 digit 1 (thousand)	From 0 to 9
20	Delay LD1 digit 2 (unit)	From 0 to 9
21	Delay LD1 digit 1 (decade)	From 0 to 9
22	Delay LD2 digit 2 (unit)	From 0 to 9
23	Delay LD2 digit 1 (decade)	From 0 to 9
24	Specific sensitivity (INPUT;SPEC)	0=Standard, 1=Specific

Table 3-1 : Configuration Coding (Part 1 of 2)

Byte	Description	Value
25	Sensor Sensitivity digit 4 (unit)	From 0 to 9
26	Sensor Sensitivity digit 3 (decade)	From 0 to 9
27	Sensor Sensitivity digit 2 (hundred)	From 0 to 9
28	Sensor Sensitivity digit 1 (thousand)	From 0 to 9
29	Standard Sensitivity (INOUT;STD)	0=Standard, 1=Specific
30	Unit (UNIT)	0=mm/s, 1=Inch/s
31	Calibration (CAL;RMS/Peak)	0=RMS, 1=Peak
32	Filter (FILT) HP (Hz)	0=1, 1=2, 2=5, 3=10, 4=20, 5=40, 6=100, 7=200
33	Filter (FILT) LP (Hz)	0=40, 1=100, 2=200, 3=500, 4=1K, 5=2.5K, 6=5K, 7=10K
34	Analog output (ANOUT)	0=Voltage, 1=Current

Table 3-1 : Configuration Coding (Part 2 of 2)

3.12 Configuration Software Description

(Option with RS232C/RS485 transmission modules.)

Introduction

VIBRO_CONF is an easy-to-use program designed to help you manage the VibroSmart VMU100. For this, you need the VibroSmart VMU100's RS232C/RS485 transmission module (optional) installed inside the VMU100, an RS232C/RS485 converter (only with RS485 configuration) and a computer.

Installation

This section describes how to install VIBRO_CONF on a single machine running Windows 95.

The following is a list of hardware and software required when installing VIBRO_CONF.

- 486 DX 33 MHz having at least 12 MB of RAM with an RS serial port and 1.44” disk drive
- VGA monitor
- Microsoft Windows 95

To install VIBRO_CONF on a Windows 95 computer

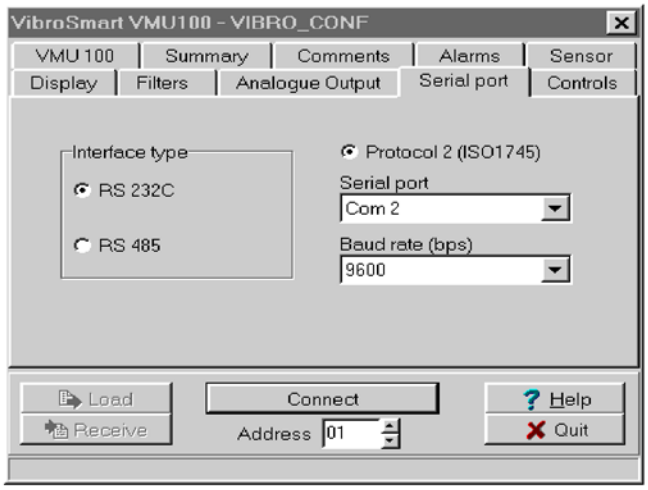
1) Insert the VIBRO_CONF disk in to your disk drive.
2) Click Start>Run... then type a:\setup.exe and press ENTER.
3) Follow the instructions that appear on the screen.

Using the VIBRO_CONF configuration software

The VMU100 welcome window displays the software version. Each VibroSmart VMU100 is delivered from the factory with a default or specific configuration as defined in the configuration sheet (see Appendix B - Data Sheets).

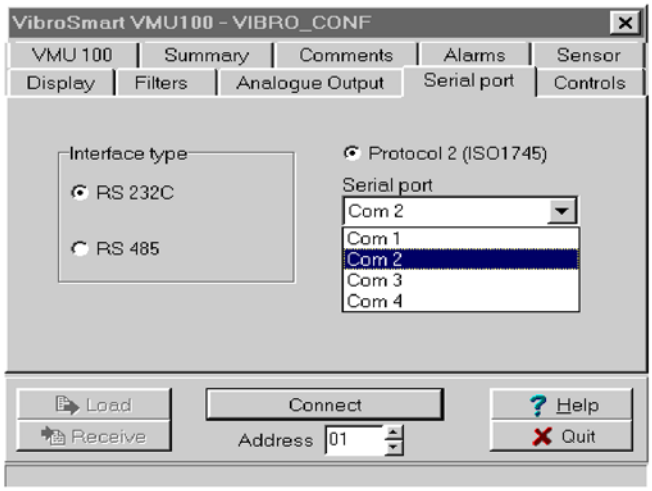
Serial port : (interface type)

- Select the type of interface that is installed in the VMU100.



Serial port :

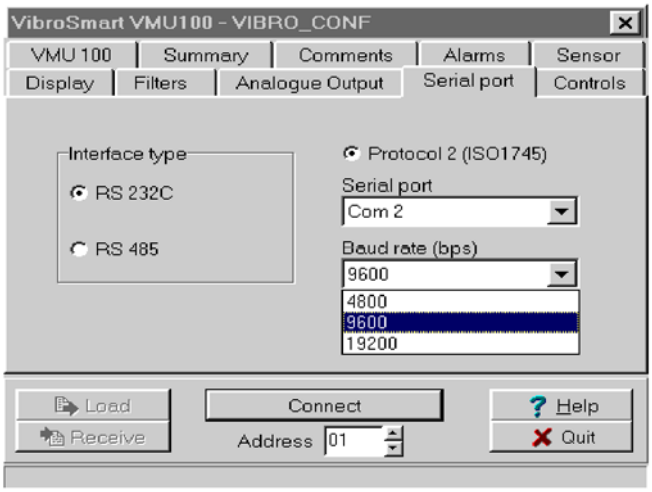
- Select the serial port used on your computer: from Com 1 to Com 4.
- Select the VMU100's address: from 01 to 99.



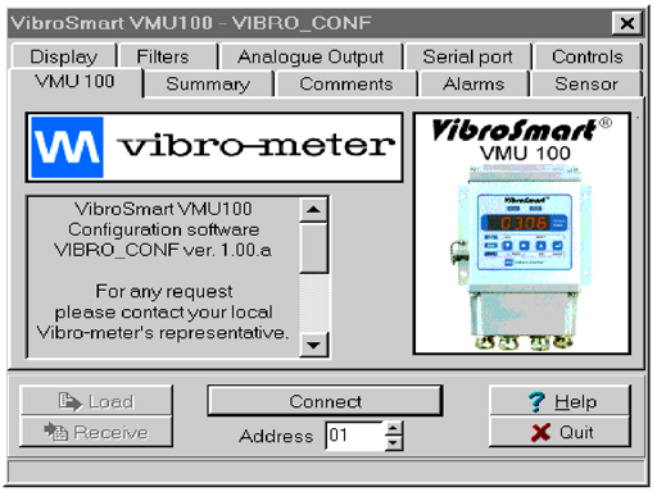
NOTE : Address 00 can only be used when the configuration is the same for all VMU100's on the network. The address must be previously set from the front panel of each VMU100 monitor.

- Select the Baud rate:

9600 bps (recommended)



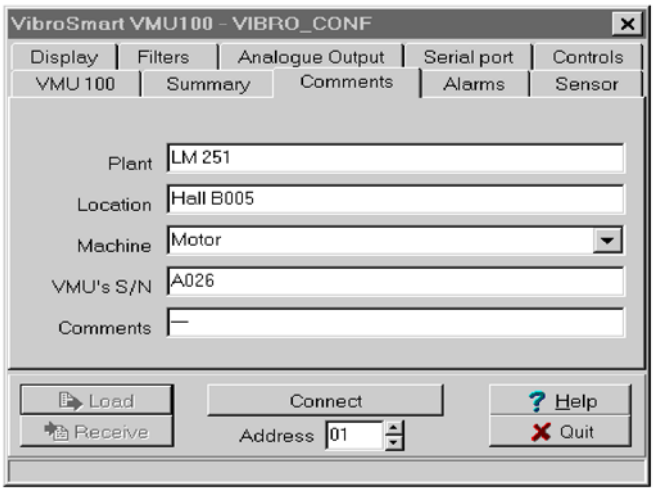
VMU100 welcome window



Comments :

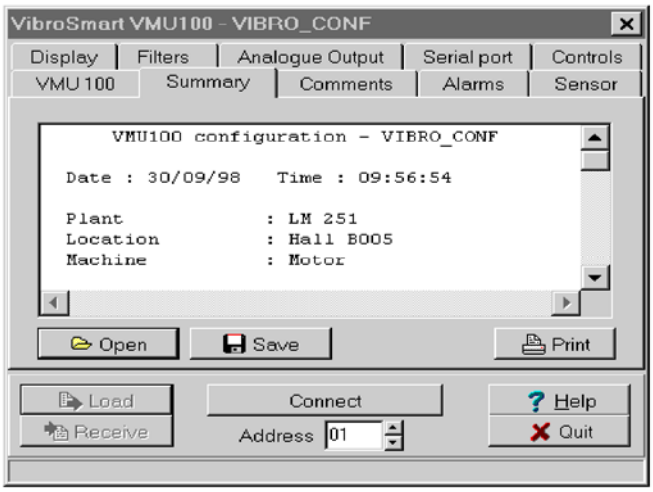
Fill in the empty fields. This information will be reported in the summary.

- Click on the Connect button.
- Click on the Receive button in order to load the current VMU100's configuration at this address.



Summary :

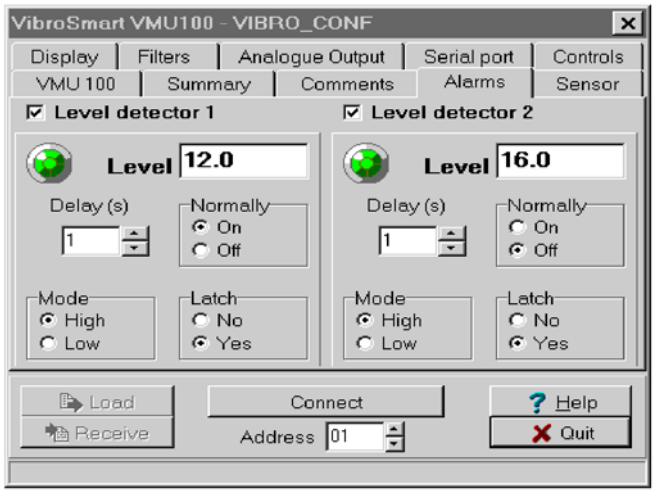
This window shows the current VMU100 configuration. You can save and print this configuration if all parameters are correct. If you want to modify one or more parameters, click on the necessary windows to be modified as defined below.



Example of a configuration summary screen:

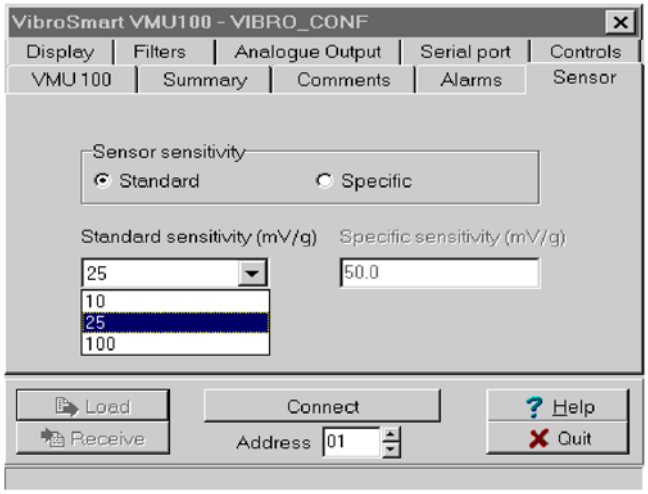
```
VMU100 configuration - VIBRO_CONF

  Date : 28/09/98   Time : 14:39:28

  Plant            : LM 251
  Location         : HALL B05
  Machine          : Motor
  VMU100's S/N     : A026
  VMU100's Address : 1
  Comments         : ---

       <<<<< CONFIGURATION >>>>>
  - Standard sensitivity sensor : 100 mV/g
  - Unit              : mm/s
  - Calibration       : RMS
  - Resolution        : 1
  - F.S.D.            : 20.0
  - High-Pass filter : 10 Hz
  - Low-Pass filter  : 1 kHz

  - Alarm 1 : Active
      Level : 12.0
       Mode : High
   Normally : Yes
      Latch : Yes
      Delay : 1s
  - Alarm 2 : Active
      Level : 16.0
       Mode : High
   Normally : No
      Latch : Yes
      Delay : 1s

  - No analogue output

  - Transmission type : RS232C
  - Baud rate         : 9600 Bits/s
  - Serial port       : Com 2
  - Protocol          : ISO1745
```

Alarms :

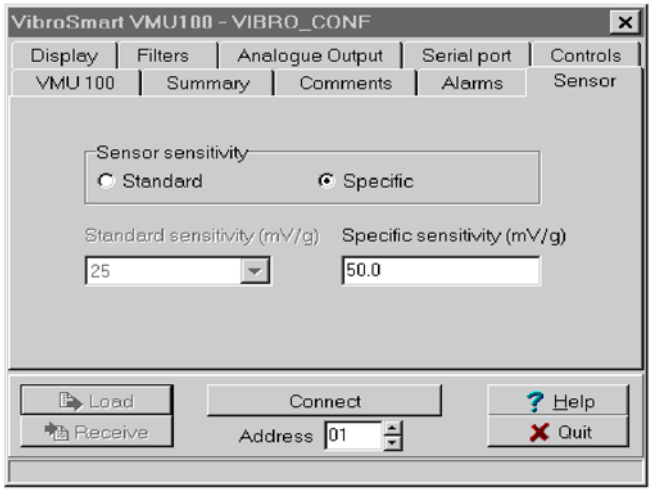


- Click-on the "Level detector 1" or “Level detector 2" check box window to activate it.
- Level :
  Enter the set point LD1 & LD2 values.
- Select the delay, mode, relay action and latch parameters for each level detector.

Sensor :



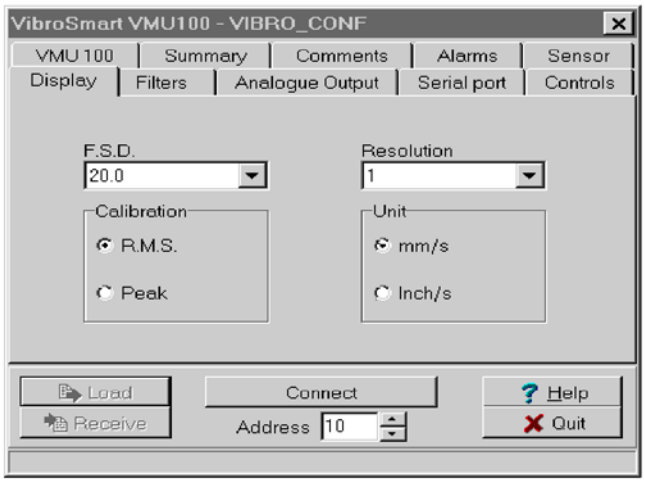
- Click on Standard or Specific sensor sensitivity.
- If standard, select standard sensitivity in the list.



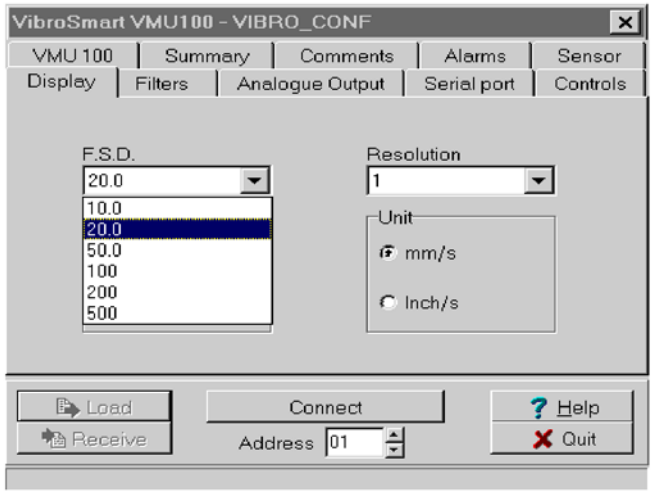
- If specific, enter the sensitivity of the actual sensor associated with the VMU100.

Display :

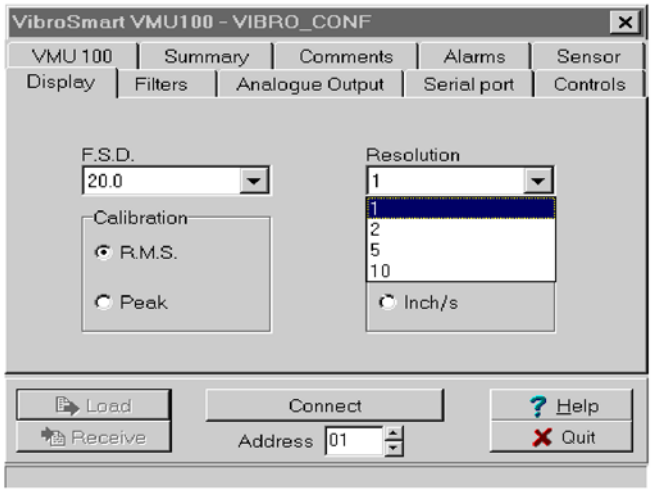
- Select the calibration mode "RMS" or "Peak".
- Select the units "mm/s" or "Inch/s".



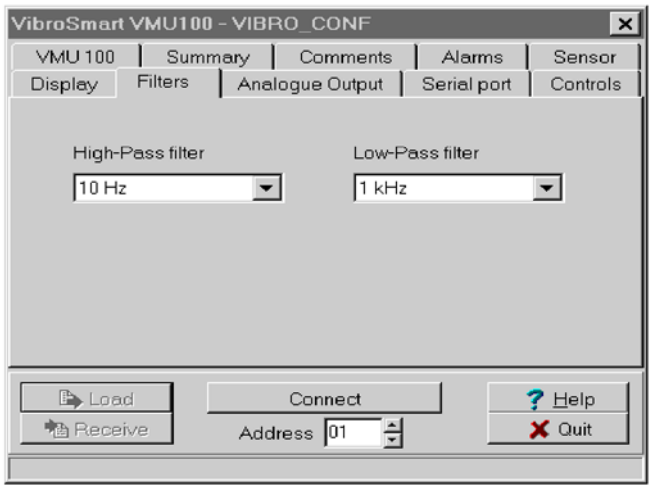
- Select the F.S.D. available in the list.



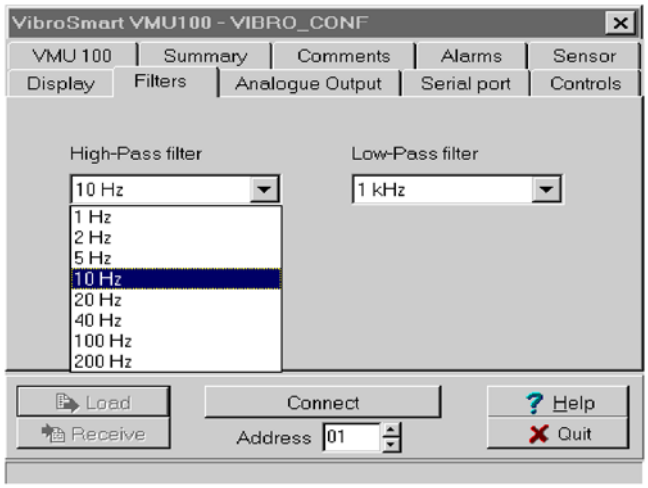
- Select the rounding-up "resolution" available in the list.



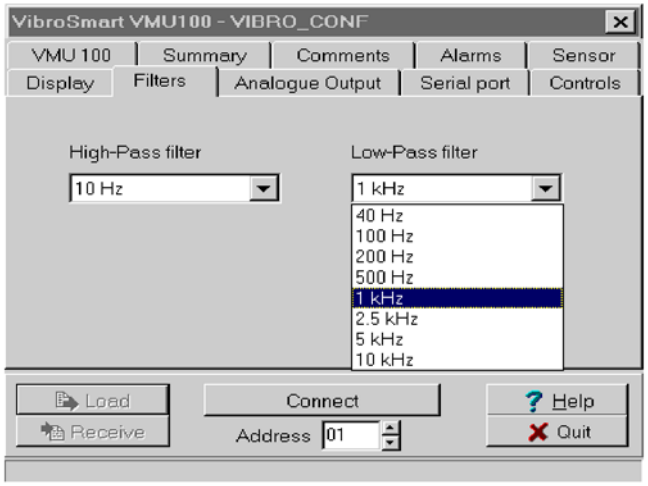
Filters:



- Select the high-pass filter available on the list

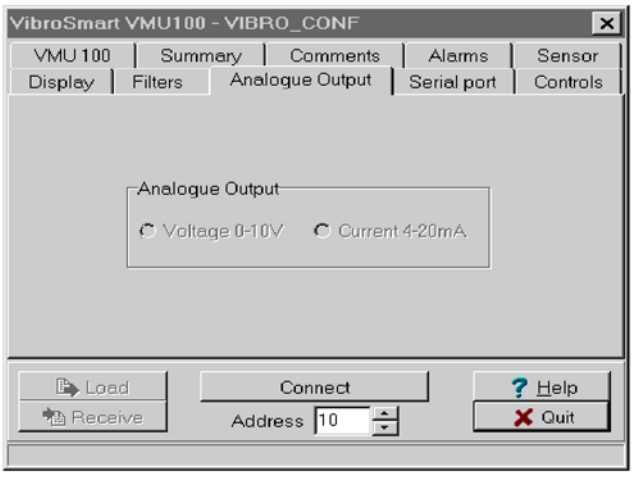


- Select the low-pass filter available on the list



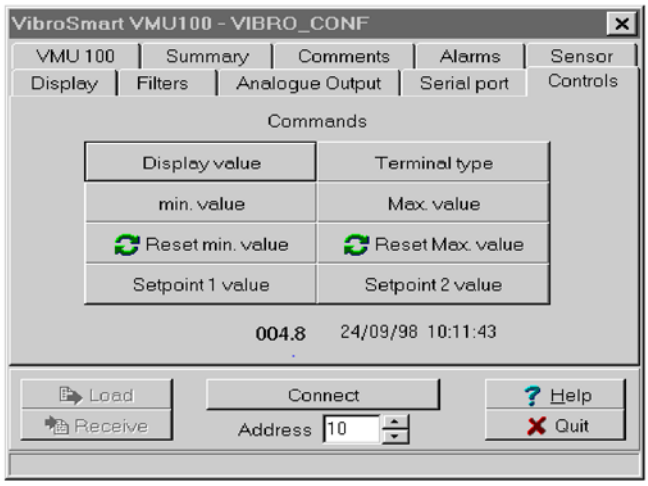
Analog Output :

- Select the analog output (voltage 0-10V or current 4-20 mA).



NOTE : This module must be installed in the VMU100 (Optional).

Controls : (Checking actions)



- Click on "Display value" and the VMU100's actual display value will appear at the bottom.
  This value is not refreshed. You must click again to obtain another value.
- Click on "min. value" to obtain the VMU100's current min. value in memory.
- Click on "Reset min. value" to reset the current min. value in memory.
- Click on "Max. value" to obtain the VMU100's current Max value in memory.
- Click on "Reset Max. value" to reset the current Max value in memory.
- Click on "Set point 1 value" to display the "level detector 1" value in memory.
- Click on "Set point 2 value" to display the "level detector 2" value in memory.

Before you quit the program, make sure that the configuration is loaded, print it from the Summary window and save it to the appropriate disk drive.

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4 ASSEMBLY AND WIRING DETAILS

4.1 Assembly

The housing of the VibroSmart VMU100 is fixed to the wall by 4 screws of 6 mm diameter. We recommend that you position it :

- Between 1.2 and 1.6 metres from the ground (accessibility).
- Under cover, in an area not exposed to strong light (legibility).

The upper and lower covers are held in place by M5 non-removable screws, with an optimum tightening torque of approximately 2 Nm to ensure IP65 housing protection.

The electronics supplied are fitted within the housing, with the options and standard or customised (option) parameters.

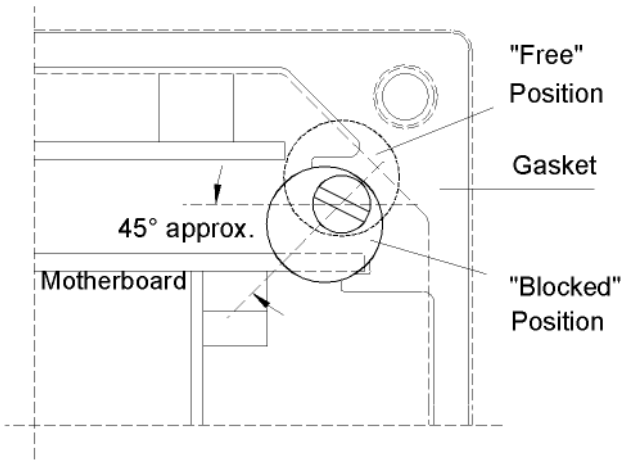
To remove the electronics:

It is preferable that this operation is done by a Vibro-Meter technician.

If this is not done by an approved Vibro-Meter technician, the 12-month warranty cover will be invalidated.

1) Remove the lower cover.
2) Disconnect the connectors and free the earth link wire.
3) Remove the upper cover.
4) Disconnect the indicator board link connector.
5) Unscrew the fixing screws from the eccentric washers locking the mother board in place.
6) Turn these washers to free the mother board.
7) Remove the electronics unit by pulling it from the top.

To put the electronics unit back, reverse the above process, taking care that the eccentric washers do not encroach on the bearing surface of the gasket.



4.2 Wiring

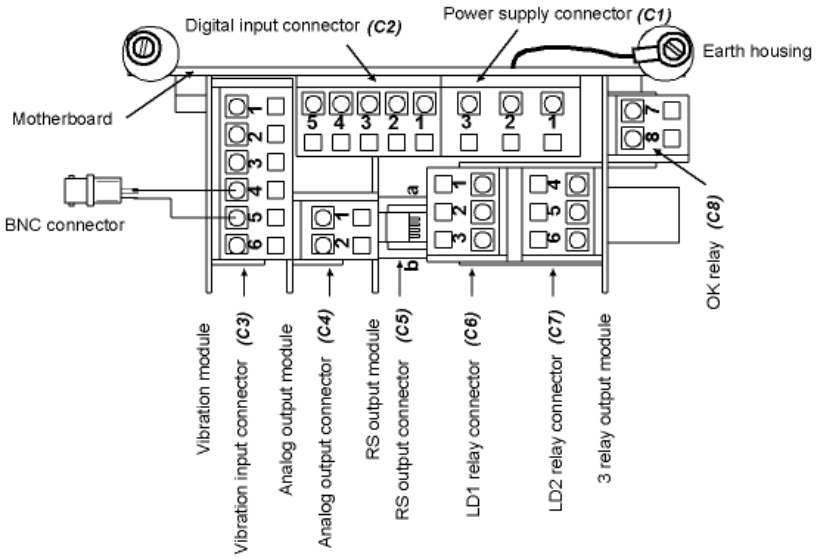
To obtain the optimum results the cables used for the connection of the VibroSmart VMU100 should withstand the environmental conditions of the application and meet the specifications below:

- Supply cable (3 conductors) - (a)
  - Outside diameter: 6 to 11 mm
  - Cross-section of the conductors 1 to 1.5 mm^2
- Accelerometer connection cable (2 conductors)
  - Outside diameter: 6 to 11 mm
  - Screening with copper strands, with a minimum covering of 60%
  - Cross-section of the conductors 1 to 1.5 mm^2
- Analog output cable (2 conductors) - (b)
  - Ditto accelerometer connection cable
- RS digital output cable (2 or 4 conductors) (b)
  - Ditto accelerometer connection cable
- Output cable of the relay contacts (Number of conductors according to the case) - (a)
  - Ditto the supply connection cable
- Input cable of the Reset logic signal (2 conductors) - (b)
  - Ditto accelerometer connection cable

NOTE : The connections marked by the same indices (a) or (b) can be combined in one and the same cable without risk of disruption or cross talk.

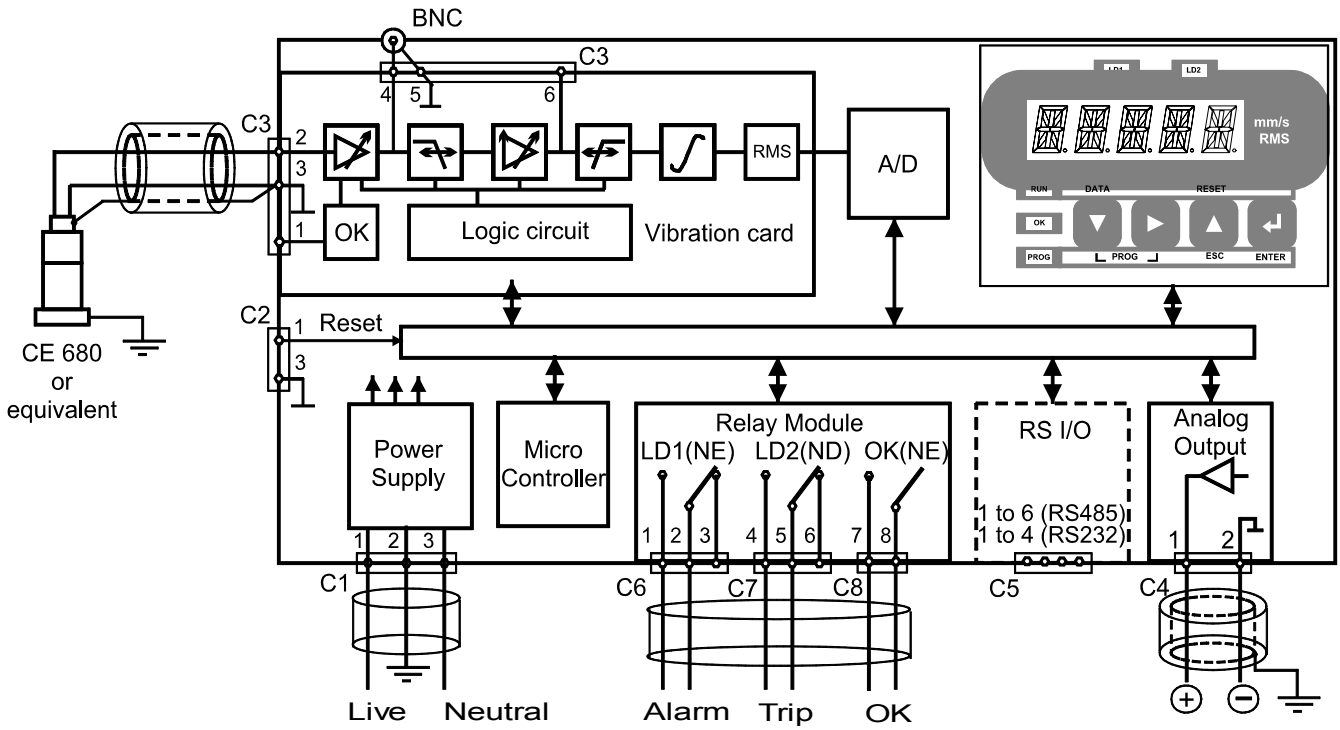
Connections

All of the possible connections are shown below, connectors wired on a circuit except for the RS connection cable.



Typical wiring diagram

The following diagram corresponds to the most commonly used configuration.



Configuration of the relays of the standard diagram above:

LD1: High Alarm - Relay normally energised

Use of “Work” contact = Contact closed during normal operation

LD2: High Alarm - Relay normally not energised

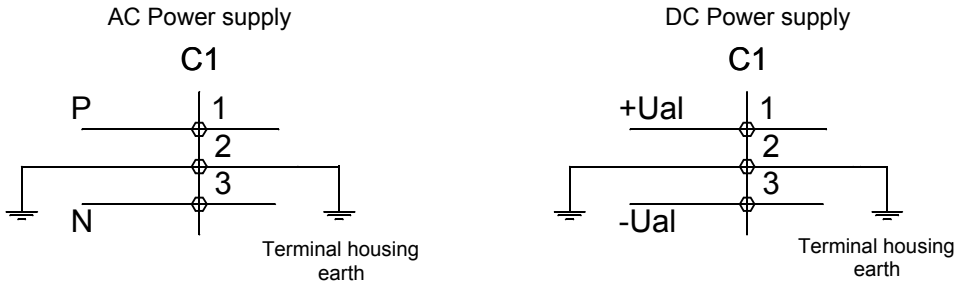
Use of “Work” contact = Contact open during normal operation

Detailed wiring diagrams, connector by connector

A – Mother Board

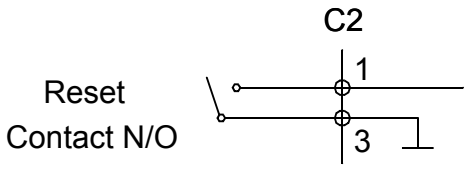
- Power Supply (C1)

NOTE : In order to conform to the safety standard, the earth pin no. 2 of the supply connector projects outward and establishes the earth connection before the other mains connections.

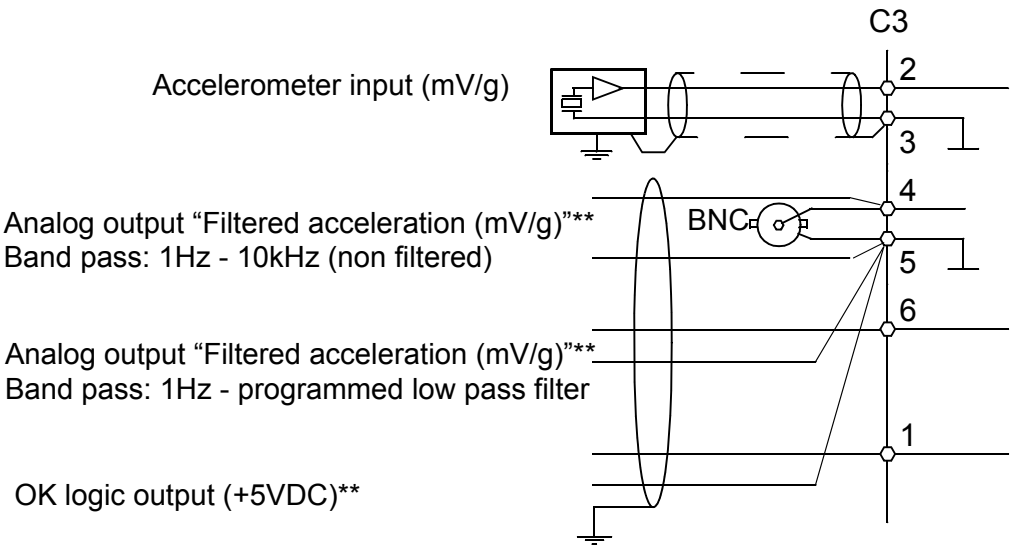


- Logic input (C2)

The VibroSmart VMU100 only has one logic input: External reset of alarms.



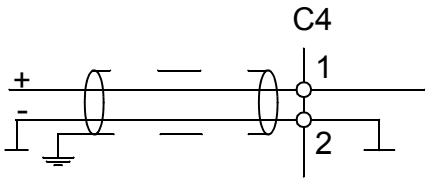
B - Vibration module (C3)



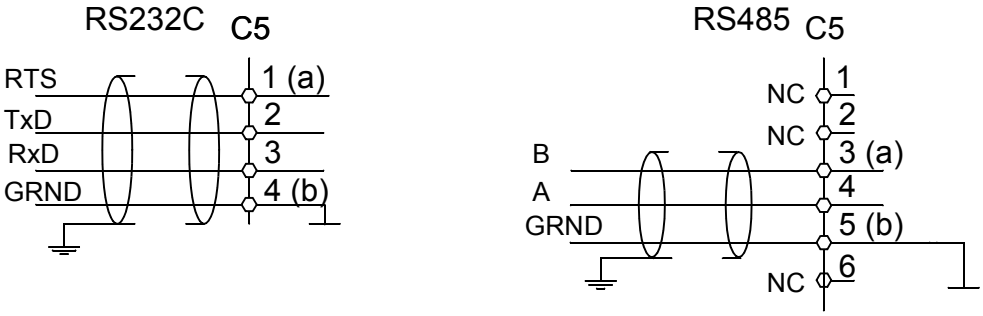
NOTE : **Output available but rarely used.

C - Analog output module

DC signal is proportional to the value displayed (0-10 VDC or 4-20mA)



D - RS output card

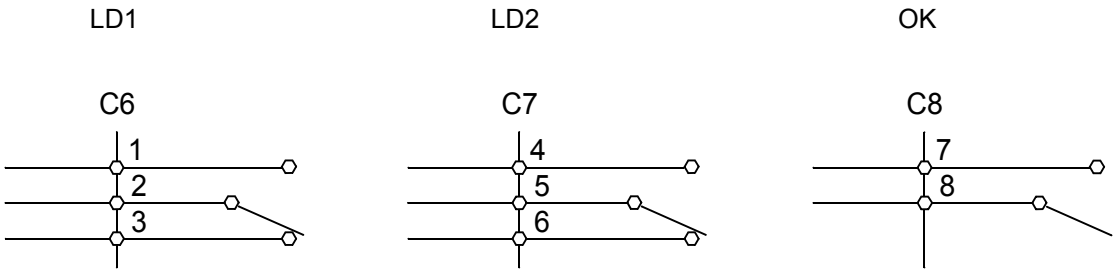


E - 3 relay output module (C6, C7, C8)

This card comprises:

- One first level alarm indicator (LD1)
- One second level alarm indicator (LD2)
- One self-test relay (OK)

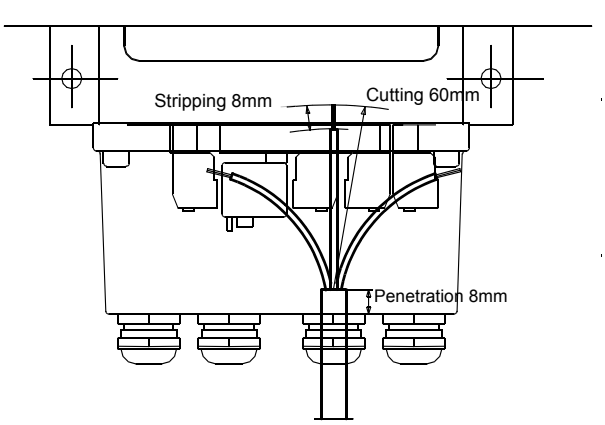
NOTE : The contacts are shown with “Power Off”.
The OK relay is energized during normal operation (NE).
The state of the LD1 and LD2 relays is user-defined (NE or NDE)



Wiring procedure

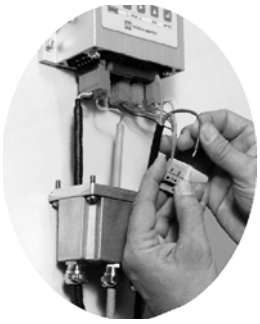
Taking into account the design of the terminal housing, the following procedure is advised :

1) Prepare the cables as indicated opposite.



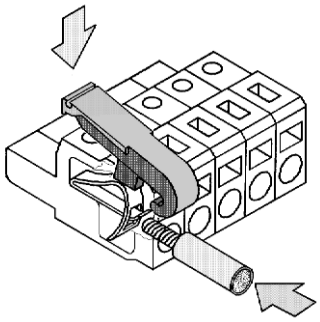
NOTE : It is advisable that the ingoing cables are tagged for ease of maintenance and identification. The stuffing gland inputs could also be marked.

2) Remove the lower cover.
3) Prepare the stuffing housings to receive the cables, if necessary by removing the internal sleeve.
4) Thread the cables into the corresponding stuffing glands and place the cover about thirty centimetres below the unit to disconnect the ends of the cables.
5) Separate the connectors from their bases (Important!).
6) Connect the wires to the connectors in accordance with the wiring diagram. Introduce the bared end of the wire into its housing by opening this using the lever supplied with the equipment (See figure). When the lever is released the wire is firmly clamped.

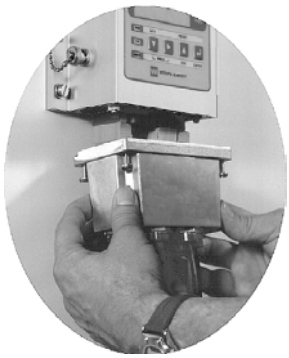


NOTE : If you lose the lever, use a 2 mm screwdriver to push the spring tongue down.

7) Plug the connectors into their respective bases.



8) Refit the lower cover by sliding it along the cables.



9) Tighten the 4 non-removable fixing screws in the cover. Tightening torque = 2 Nm approx.

10) Ensure that the penetration of the cables into the cover is at least 8mm (Markers advised in 1) above) and tighten the stuffing glands.

11) Tighten the stuffing gland screws.

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5 OPERATING MODE (RUN)

5.1 Monitoring

Operation under monitoring is the normal state of the VibroSmart VMU100 during which the monitor oversees the vibration levels of the machine on the basis of the programmed parameters (see 3.4 - Monitoring).

The unit becomes operational after the internal self-test has taken place at power on. This takes several seconds to complete.

Max./min. storage

The extreme values of the vibration levels are stored by the VibroSmart VMU100 starting from the time when these values are initialised.

The values can be viewed by using the readout procedure (see below).

5.2 Readout Procedure

The readout of the programmed parameters as well as the Max and Min values of the measurement is accessible using the following procedure:

- To enter the “Readout” mode from RUN mode press the **DATA** button
- Choose the required readout, corresponding to alarms **(ALARM),** the Max/Min values **(M/m)** or the readout of all parameters **(ALL).**

Then, wherever you are in the menu structure:

1) Go to the lower hierarchical level with ▼.
2) Enter the readout of each parameter from its “label” with ▼.
3) Exit the readout via “**Esc**”, which returns you to the function label.
4) Move to the next function in the same hierarchy by pressing ▶.
5) Return to the higher hierarchical level by pressing “**Esc**” starting from the function label. After a 20 second time-out since your last enquiry, you are returned to the measurement display automatically.

5.3 Initialization of the Max/Min values

The access procedure is the same as for the readout, but once having reached the Max or Min value displayed:

- Press **DATA +** to temporarily enter program mode
- The text "**INIT**" is displayed
  - If you decide not to reinitialise, press **Esc**
  - If you decide to reinitialise, press **ENTER**

NOTE : Reinitialisation sets the Max value to 0000 and the Min value to 9999

- To return to the higher hierarchical levels, press **Esc** as many times as is required.

5.4 Flow-charts for the Readout of Parameters

Parameter	Flow-chart
Max and min values	SL1
Initialization of Max and Min values	
Alarm thresholds	
Software version	
Sensor sensitivity	SL2
Measuring unit (mm/s or inch/s)	
Calibration (RMS or Peak)	
Values of HP and LP filters	
Analog output (0-10V or 4-20mA)**	
Parameters of the serial digital output**	SL3
Address	
Transmission speed	
Protocol	
Complete parameters of the alarms	SL4
Activity	
High/Low	
Latching of the alarm	
Alarm threshold	
Time delay	

NOTE : ** indicates options

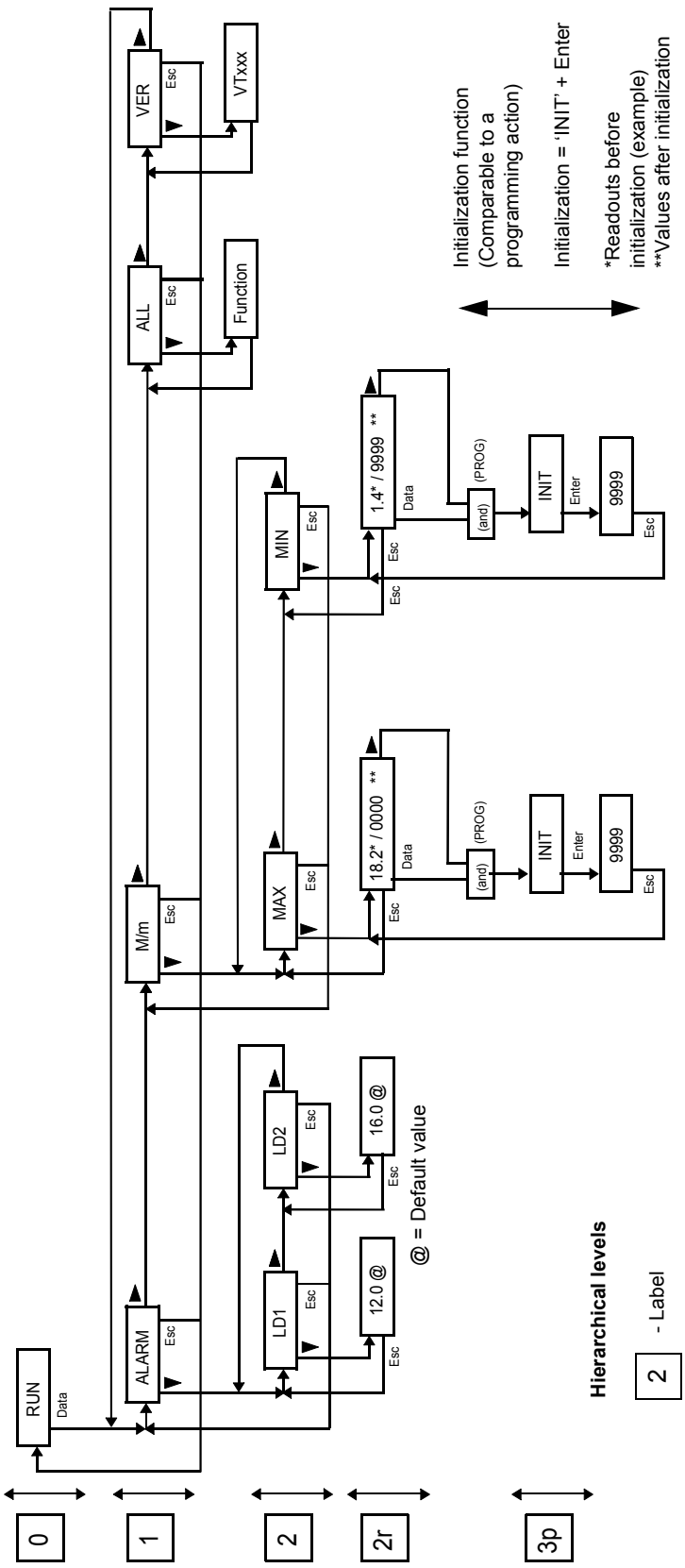


Figure 5-1: SL1 Readout flow-chart

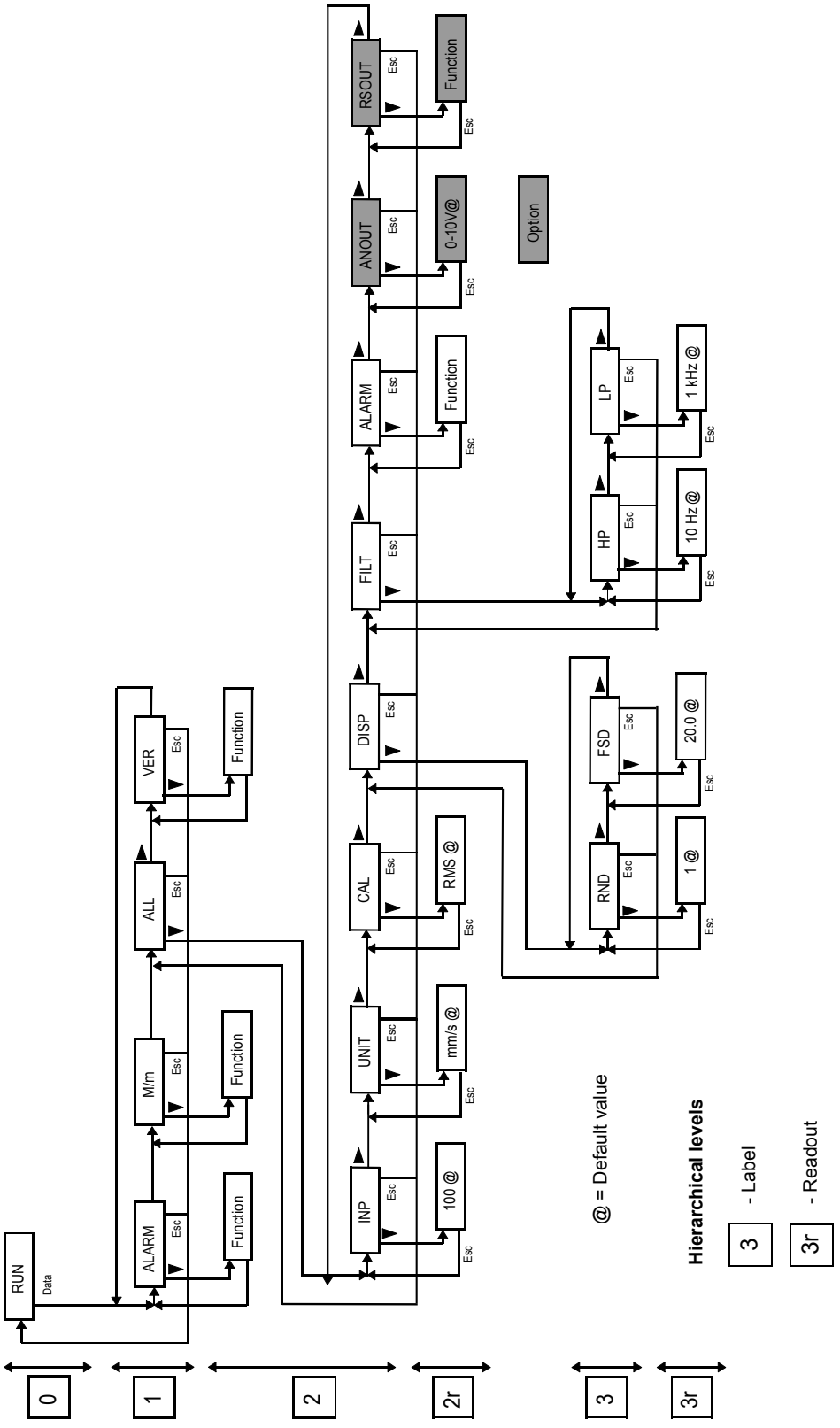


Figure 5-2: SL2 Readout flow-chart

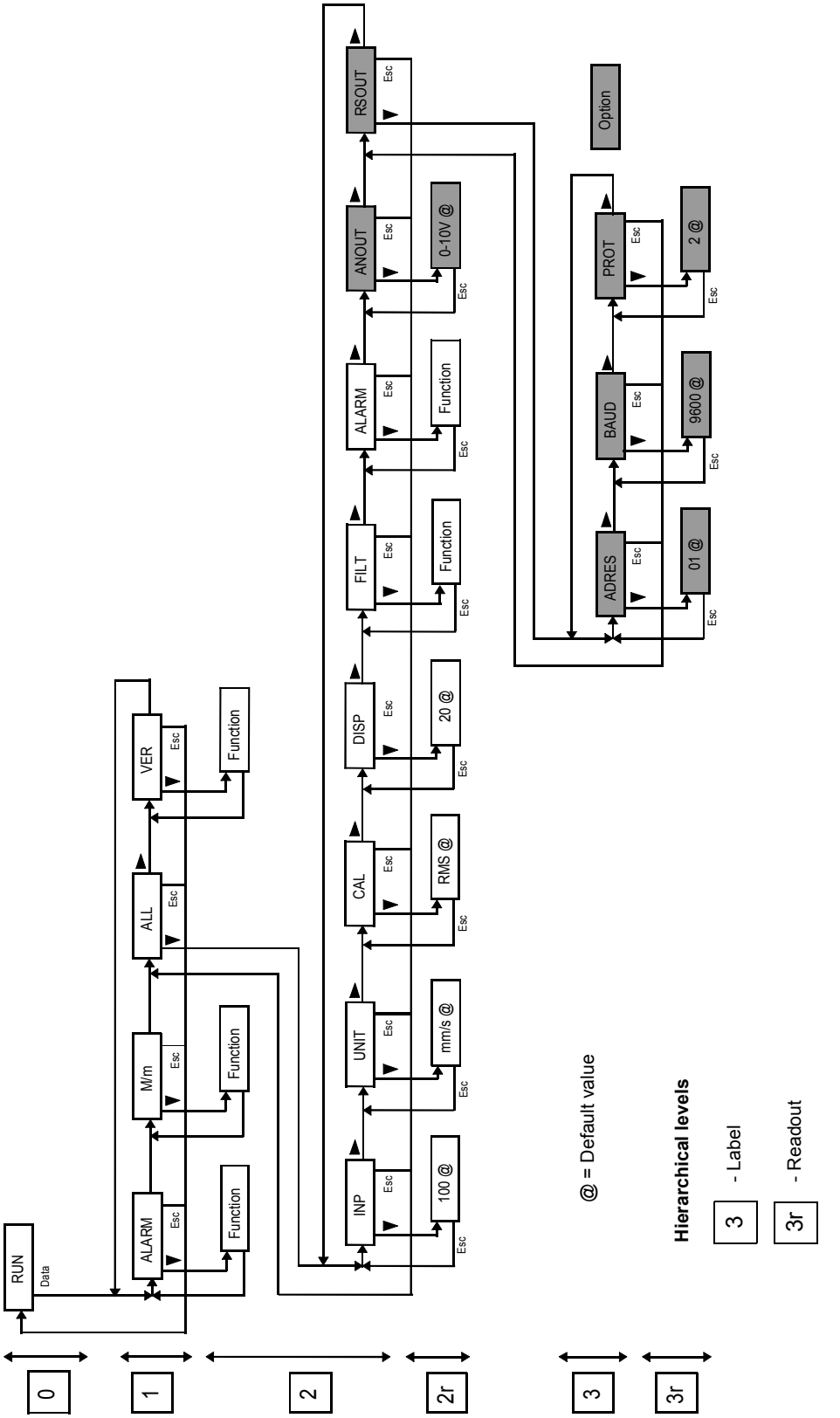


Figure 5-3: SL3 Readout flow-chart

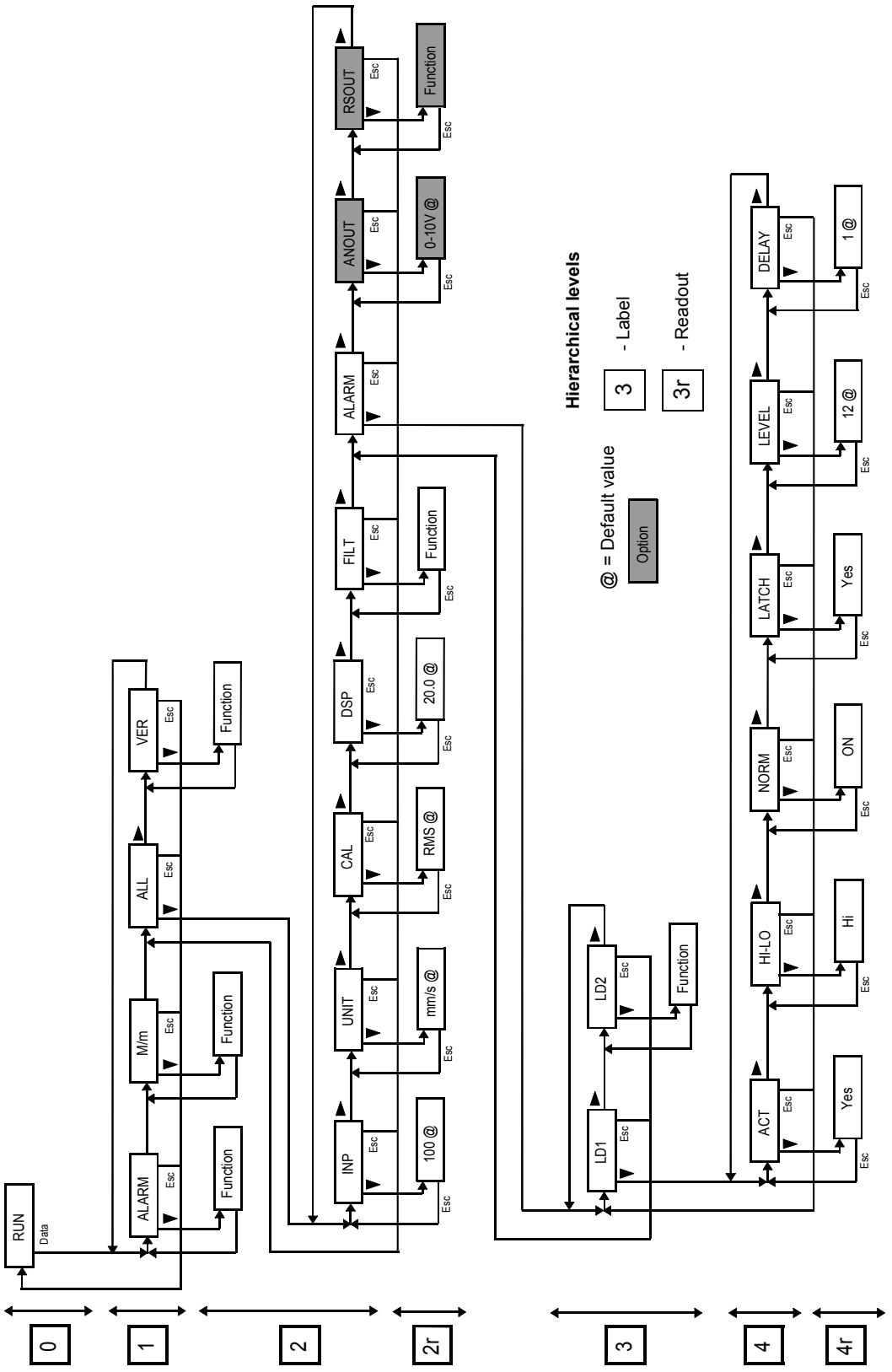


Figure 5-4: SL4 Readout flow-chart

6 PROGRAMMING MODE (PROG)

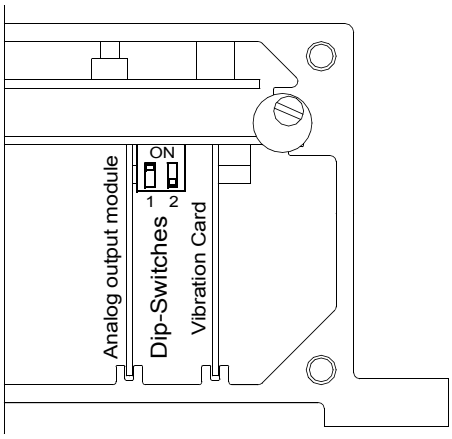
6.1 Programming Access

There are three programming access levels :

- Total: All of the system parameters can be modified
- Alarms: Only the alarm thresholds can be modified
- None: No parameters can be modified (i.e. read-only access)

The access level is defined by the position of two micro-switches located on the mother board. The micro-switches can be reached by removing the top cover. Their position defines the configurations listed below.

SWITCH 1	SWITCH 2	ACCESS LEVEL
OFF	OFF	Total
ON	OFF	Alarms
OFF	ON	Alarms
ON	ON	None



6.2 Total Programming Mode

Total programming can only be accessed if the configuration of the micro-switches is “OFF_OFF”, the procedure is as follows:

To enter programming mode :

From RUN mode, press ▶ and **DATA** at the same time.

The “**PROG**” indicator lights up and the “**RUN**” indicator goes out.

Select the programming access for all parameters (**PROGT**).

Then, and wherever you are in the hierarchy:

1) Go to the lower hierarchical level with ▼.
2) Enter the programming mode for each function starting with its “label” with ▼.
3) Once you have entered the programming mode of the function
   Changes of values are made by pressing ▼ (Decreasing values).
   Selections are made by pressing ▶.

4) Exit the programming of values or selections by pressing:
"**Esc**" to keep the original values or selections
"**ENTER**" validating the figures or selections displayed
Esc and **ENTER** return you to the function label

5) Go on to the next function at the same level or to the following row of figures with ▶.

6) To return to the higher hierarchical level, press "**Esc**" from the function label. You are automatically returned to the measurement display after a 20 second time-out since the last key press.

6.3 Programming the Alarm Thresholds

The programming limited to alarm thresholds is accessible if the position of the micro-switches is "ON-OFF" or "OFF-ON".

The procedure is the same as that above but you need to select the programming limited to alarm thresholds (**PROGRA**) instead.

NOTE : If access to the programming is total, **PROGRA** provides a shortcut to directly access the adjustment of the alarm thresholds.

6.4 Programming Flow-Charts

The following pages give the procedures for programming the different parameters using clear flow-charts. The table below lists the flow-charts corresponding to the parameters :

Parameter	Flow-chart
Sensitivity of the standard or special sensor	SP1
Measuring unit (mm/s or inch/s)	SP2
Calibration (RMS or Peak)	
Analog output (0-10V or 4-20mA) **	
Extent of measurement	SP3
Rounding up of display (resolution)	
High Pass (HP) or Low Pass (LP) filters	SP4
Alarms parameters	SP5
RS output parameters **	SP6
Initialization of Max/Min values	SP7

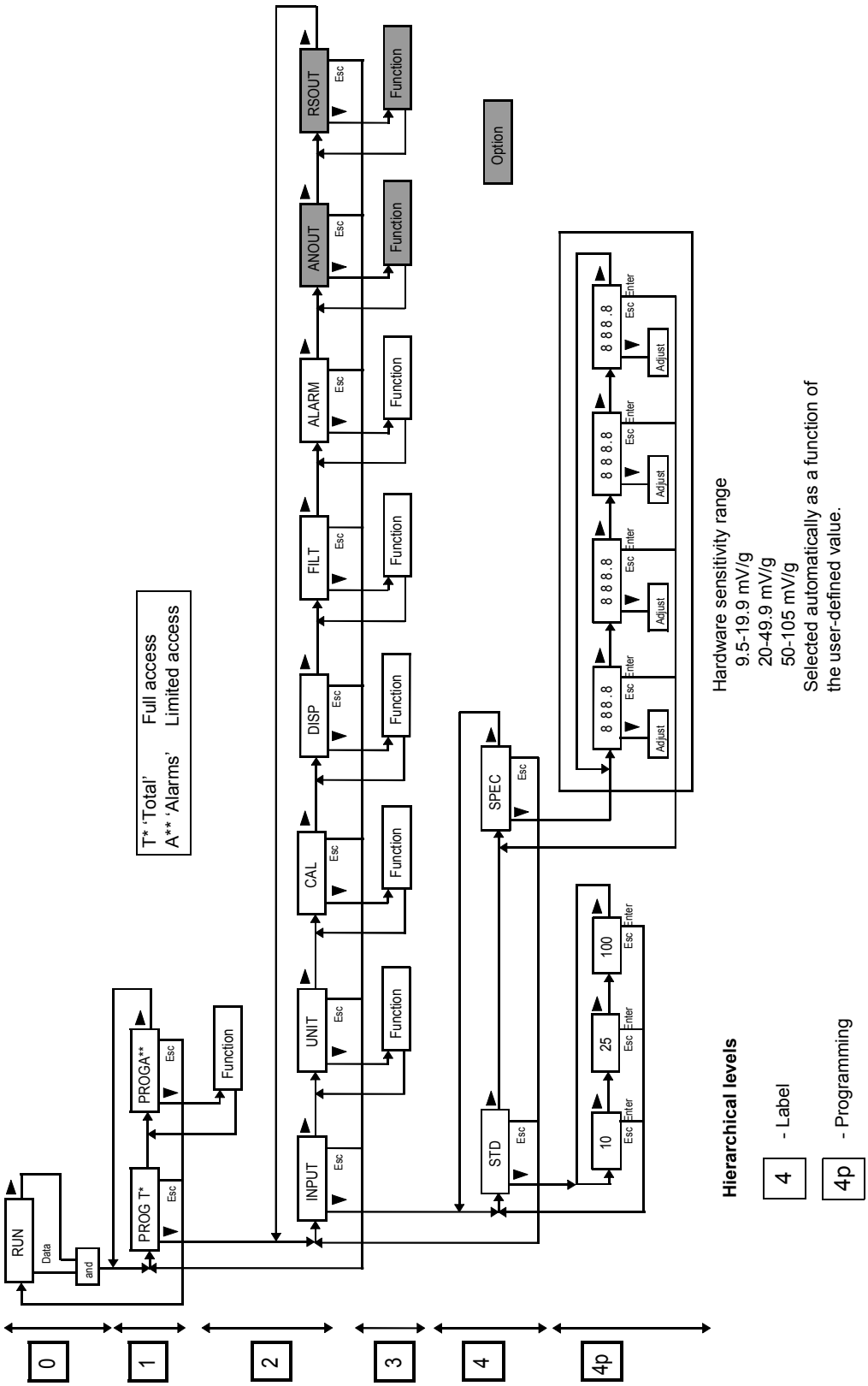


Figure 6-1: SP1 Programming flow-chart

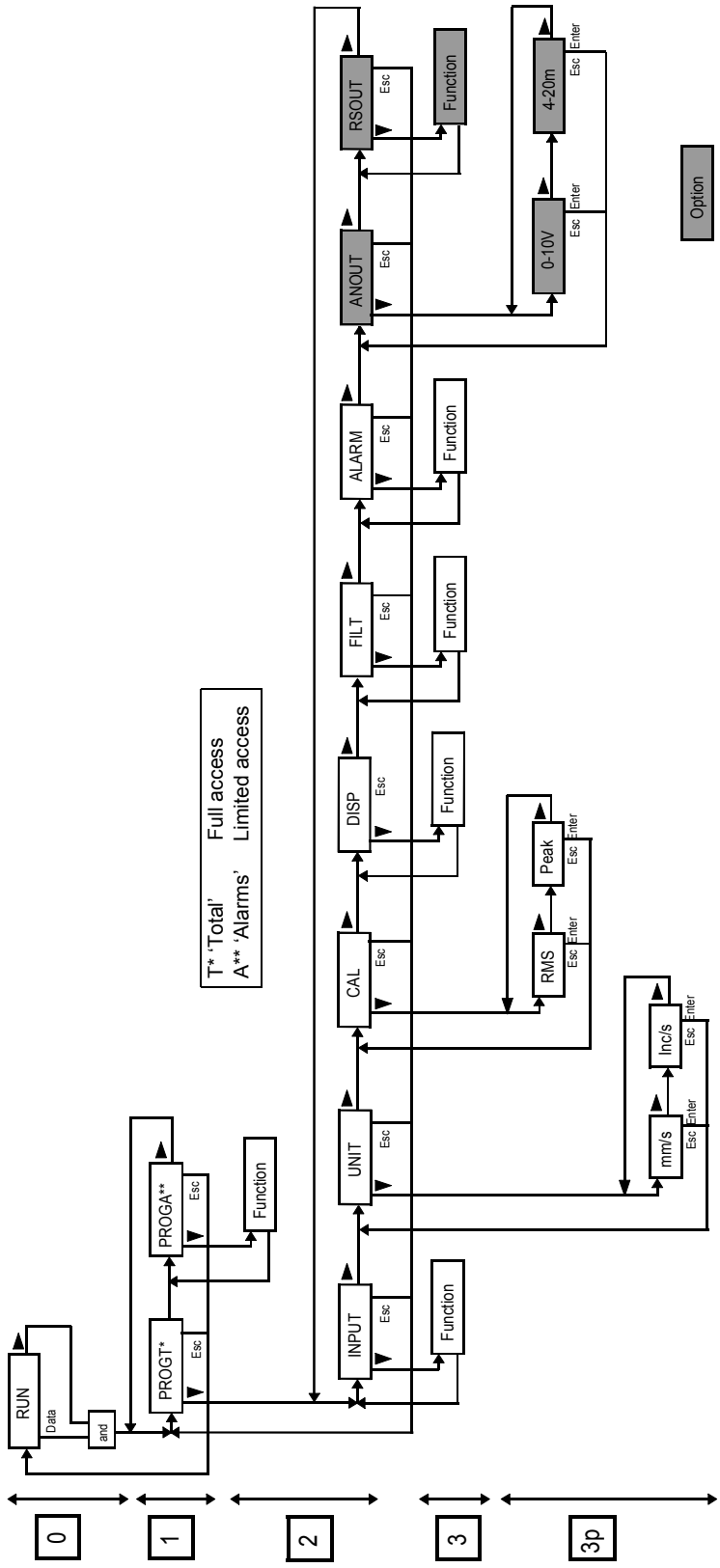


Figure 6-2: SP2 Programming flow-chart

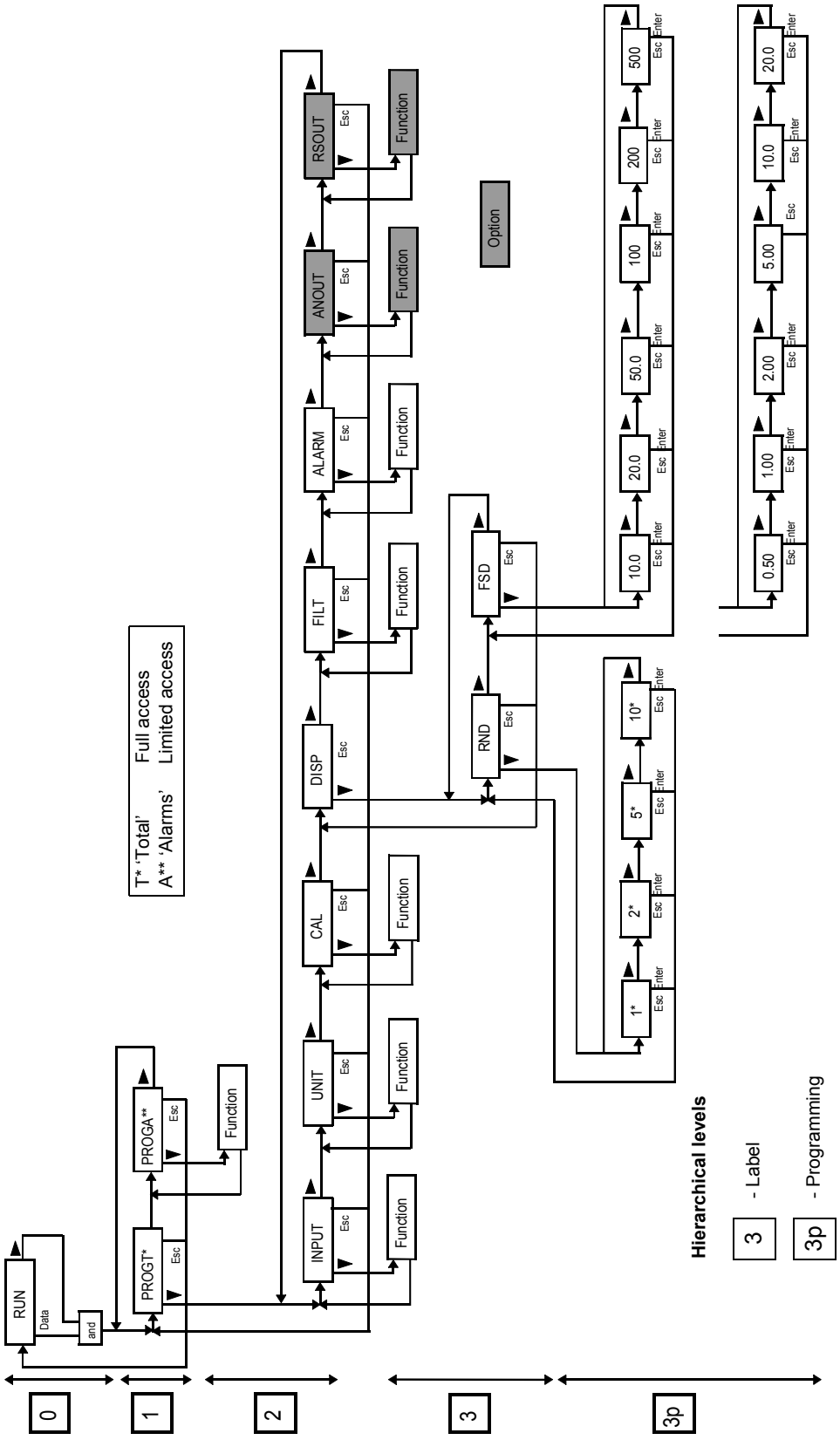


Figure 6-3: SP3 Programming flow-chart

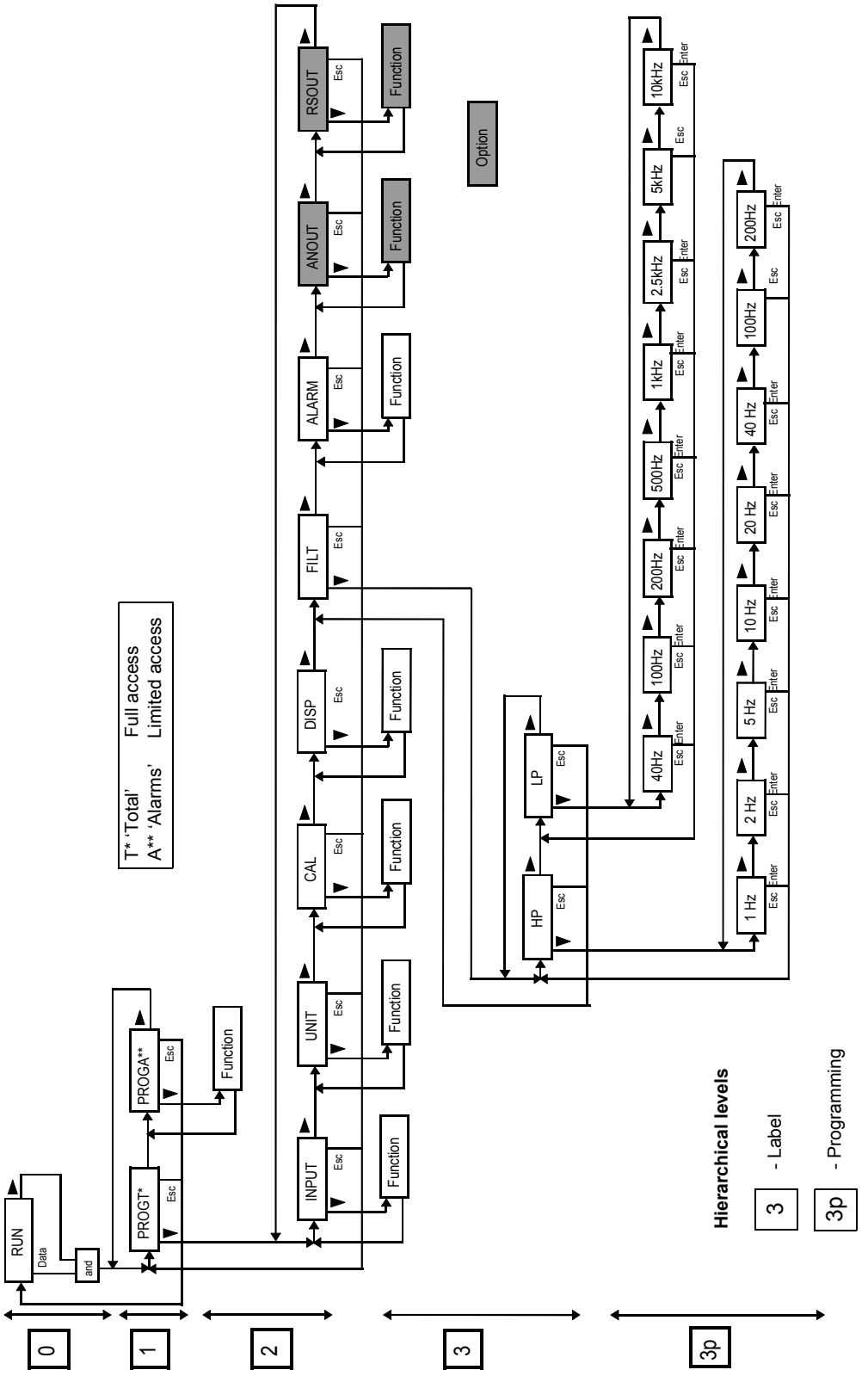


Figure 6-4: SP4 Programming flow-chart

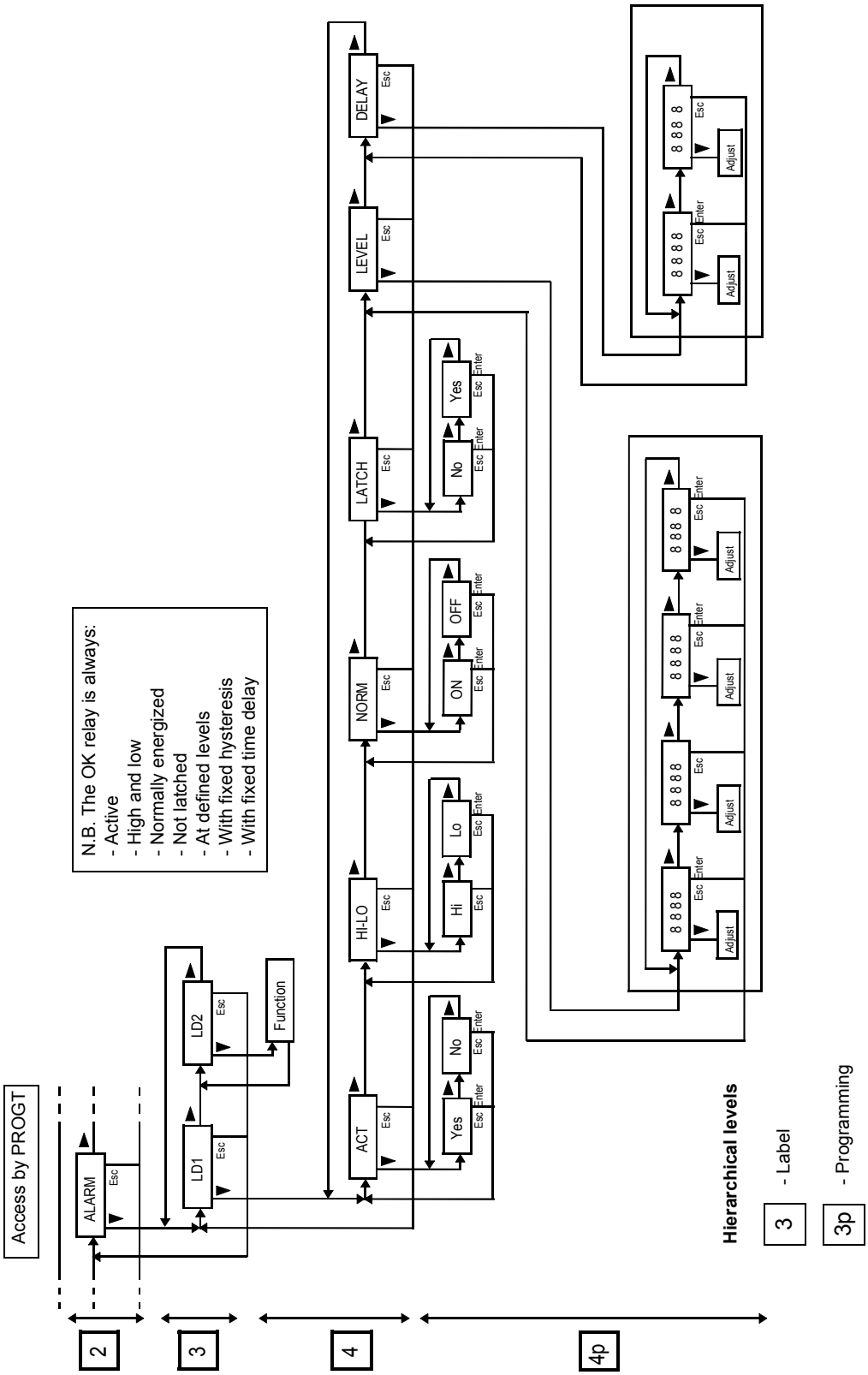


Figure 6-5: SP5 Programming flow-chart

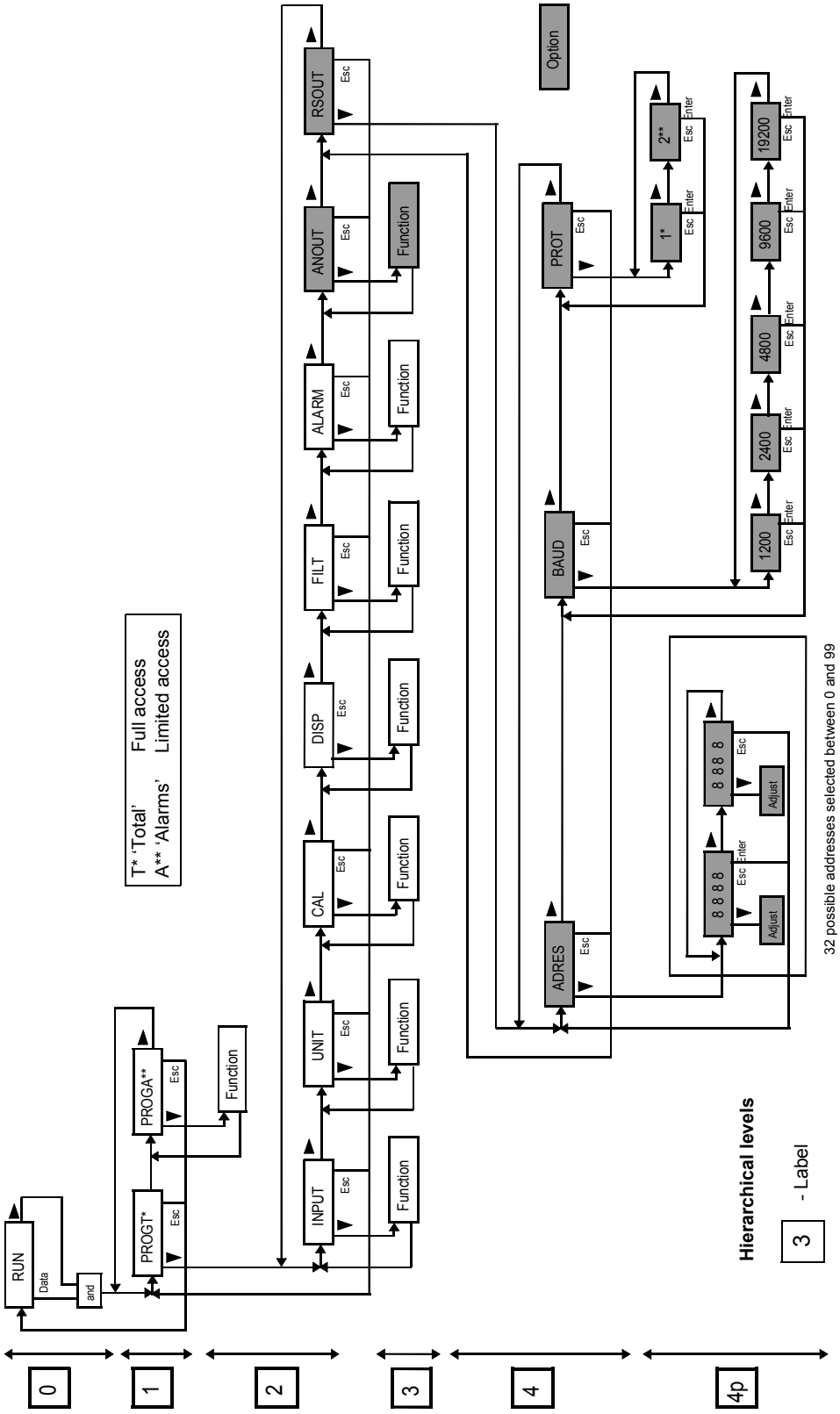


Figure 6-6: SP6 Programming flow-chart

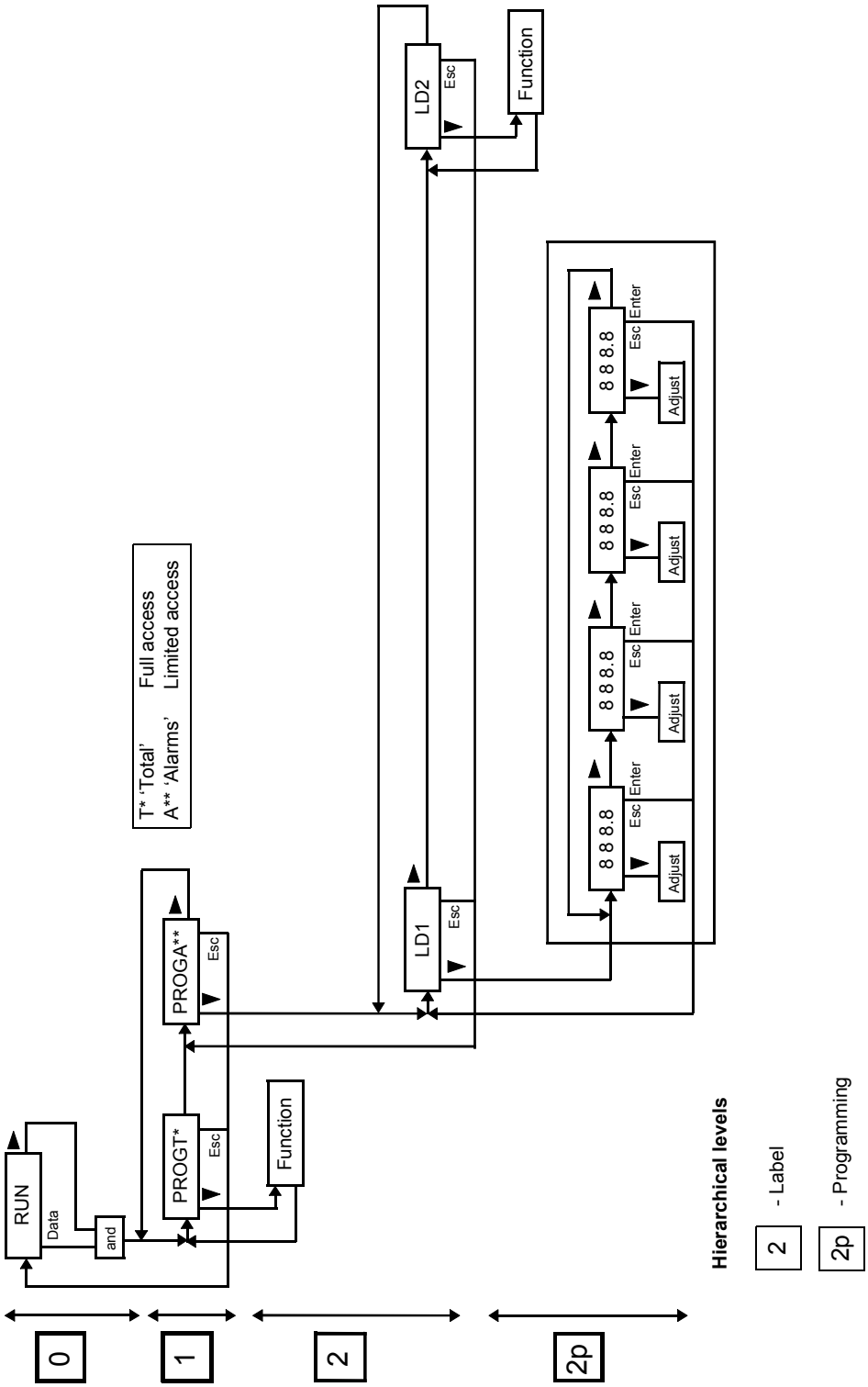


Figure 6-7: SP7 Programming flow-chart

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Appendices

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A MECHANICAL DRAWINGS

Designation	Drawing Number
Vibration Chain Diagram in Safe Area Configuration	P98-184A
Vibration Chain Diagram in Hazardous Area Configuration	P98-183A

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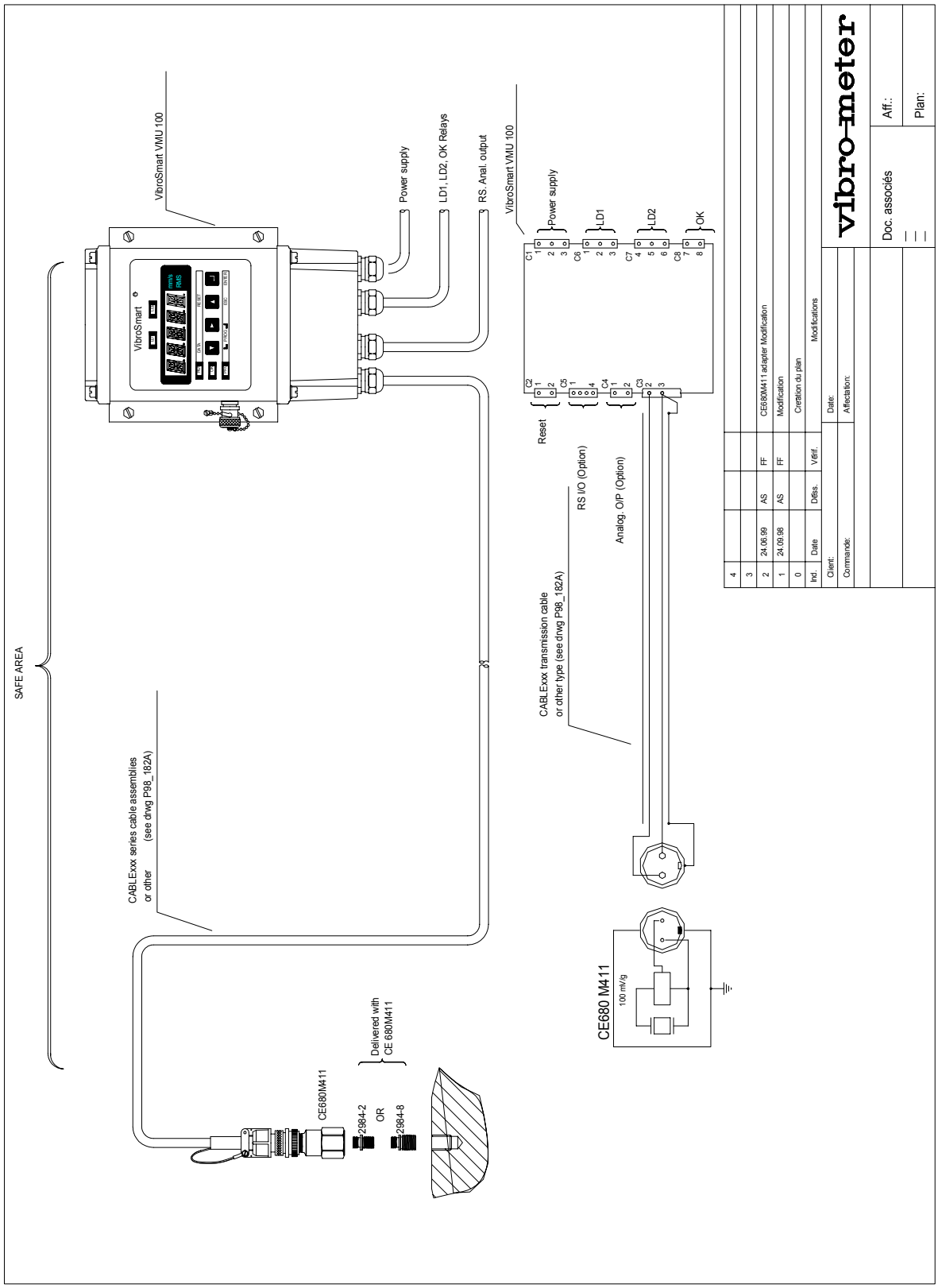

Figure A-1: Vibration Chain Diagram : Safe Area Configuration

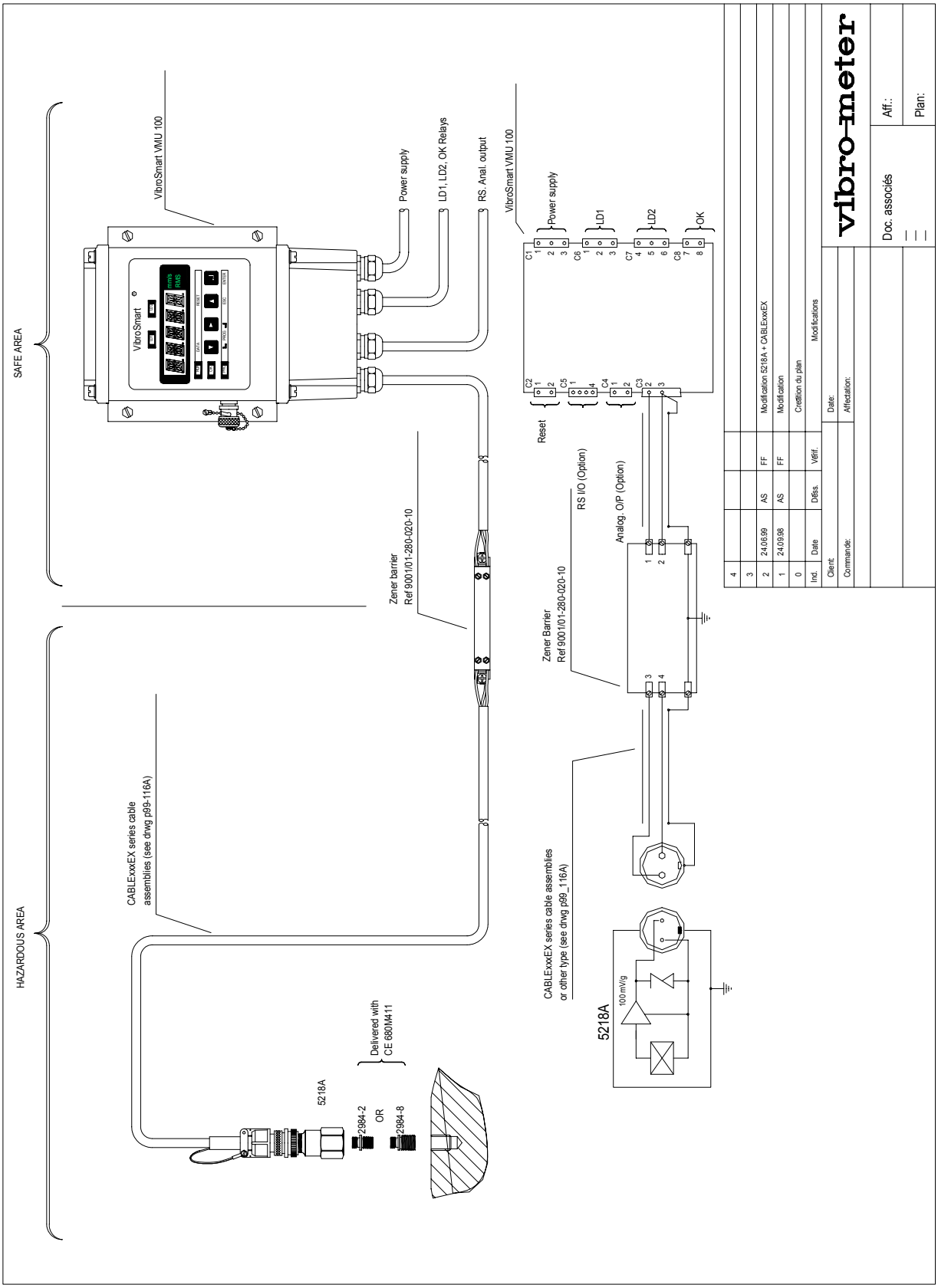

Figure A-2: Vibration Chain Diagram : Hazardous Area Configuration

B DATA SHEETS

This appendix contains the following data sheets:

Data Sheet		Document No.
VMU100	VibroSmart Vibration Monitor	266-650 E
CE 680 M411	Piezoelectric Accelerometer with Integrated Electronics	262-055 E
EC 318	Cable Assembly	262-645 E

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vibro-meter
A Meggitt company

vibro-meter
certified by
ISO 9001

VMU 100

Vibration Monitor
VibroSmart ®

FEATURES

- **Single-channel microprocessor-based monitor for mV/g accelerometer (constant current supply)**
- **Designed for reliable operation in severe industrial environments (IP 65 enclosure)**
- **5-digit display and 5 LED indicators**
- **Built-in HP and LP filters with 24 dB/oct slope, integrator and rectifier**
- **Field programmable functions or via RS link**
  - **3 sensor sensitivity ranges in mV/g**
  - **6 measuring ranges in mm/s or inch/s**
  - **8 individual HP and LP cut-off frequencies**
  - **2 level detectors : "ALARM" and "TRIP" levels**
  - **1 analog output available as option**
  - **1 digital RS output available as option (ISO 1745 and ModBus protocols)**
- **Self-check circuit ("OK System") with relay output**
- **BNC output for analysis**
- **Various AC/DC power supply options**
- **Conforms to CE, ISO 10 816, NF E90.300 & VDI 2056 standards and recommendations**

DESCRIPTION

The *VibroSmart* VMU 100 is a fully programmable vibration monitor. It is designed for auxiliary rotating machines such as pumps, fans, small hydro turbines, etc. It is housed in a rugged IP 65 enclosure which protects the electronic circuitry from the severe environments often found in the petro-chemical and power generation industries or in other industrial facilities.

It is a single channel monitor which fulfils any display, monitoring and alarm requirements. This microprocessor based monitor with 5-digit display, 5 LED indicators and front panel setup buttons offers a perfect combination of functions in a very small package.

The input processing module can match all accelerometers using a constant current power supply, such as Vibro-Meter's CE 680 series. This configuration allows long distances between the accelerometer and the monitor (up to 500 meters).

The *VibroSmart* VMU 100 monitors, the vibration signal and displays the RMS or peak value of the vibration velocity in mm/s or inch/s.

All configurable parameters are stored in a non-volatile memory and can be programmed with the front panel setup buttons or via an RS link. When an alarm level is exceeded, the corresponding LED will show the alarm status.

An optional analog output module converts the displayed value into a current or voltage based DC signal (4-20 mA or 0-10 V).

In addition, an optional RS-232 or RS-485 digital data link module allows the operator to request measured values (via ModBus/RTU or ISO 1745) and change all the configurable parameters from a remote computer.

A built-in self-check circuit ("OK System") with front panel LED indicator and a relay output provides continuous monitoring of open or short-circuited transducer line, dynamic overload/overflow, or lost power supply.

The front panel BNC output enables connection to a data collector or spectrum analyser.

SPECIFICATIONS

BASIC EQUIPMENT

Micro-processor mother board including display, processing, power supply, vibration input module, A/D converter and 3-relay output module.
Optionally, this basic equipment can accept an analog output module and/or an RS digital output module.

HARDWARE

Mother Board

Microprocessor type	: H8325, 8-bit at 20 MHz, with 32 kB RAM
Non-volatile static RAM	: EEPROM, 10 000 store cycles, 100 years data retention

Processing, Display and Analog Module

Display	: 5 red alphanumeric characters, 14 segments, 14 mm
Full scale (FSD)	: ± 9999 with decimal point user programmable
Accuracy	: 0.5% of FSD
Temperature stability	: 50 ppm/°C
Front panel buttons	: 4 set up buttons
Front panel indicators	: Green LED “OK System”
• *“ALARM” = LD1*	Yellow LED, first level
• *“TRIP” = LD2*	Red LED, second level

A/D Converter

Type	: Dual slope integrating
Conversion rate	: 16 conversions per second
Resolution	: ±15 bit
Accuracy	: 0.05% of reading

Power Supply

AC voltage	: 115/230 V ±15%, 50/60 Hz
DC voltage	: 20 to 30 V ±5%
Consumption	: 10 W max. with all options and all relays ON

Relay Output Module

“OK System” relay	: Relay NE, 1 NO contact
“ALARM” relay (LD1)	: Relay 1 NO and 1 NC contacts he NE or NDE relay status is programmable
“TRIP” relay (LD2)	: Relay 1 NO and 1 NC contacts The NE or NDE relay status is programmable
Relay type	: Fujitsu JS-12K.12V, 1 pole, 8 A

SOFTWARE

Calibration Mode

Sensor sensitivity	: 9.5 to 105 mV/g, 3 ranges with 0.1 mV/g step resolution: 1) 9.5 to 19.9 mV/g 2) 20 to 49.9 mV/g 3) 50 to 105 mV/g
Full scale measuring range (FSD)	: 10, 20, 50, 100, 200 or 500 mm/s RMS or peak **or** 0.5, 1, 2, 5, 10 or 20 inch/s RMS or peak

Filter cut-off frequencies

• *Low pass (LP)*	: From 40 Hz to 10 kHz 40, 100, 200, 500 Hz, 1, 2.5, 5, 10 kHz
• *High pass (HP)*	: From 1 Hz to 200 Hz 1, 2, 5, 10, 20, 40, 100, 200 Hz

Level Detectors

Alarm level	: User programmable, from 0 to 9999
Hysteresis	: Fixed at 5% of FSD
Time delay	: User programmable, from 1 to 99 seconds
Latch function	: User programmable, “Latch” or “Unlatch”
Output state	: Driver normally ON, relay NE or normally OFF, relay NDE

Input Characteristics

Input signal	: From 9.5 to 105 mV/g (CE 680 transducer or equivalent)
Circuit layout	: AC coupling, asymmetrical
Transducer supply	: 2 mA, 24 V_{DC}

Transfer Characteristics

Dynamic range	: 100 g peak
Filters	: Active HP and LP filters, 4-pole Tchebychev, 24 dB/octave skirt slope, 0.1 dB ripple
Cut-off frequencies	: At -3 dB (see above values)
Linearity error	: < 1%
Rectifier circuit	: True Root Mean Square (RMS) value rectifier

SPECIFICATIONS *(Continued)*

OUTPUT CHARACTERISTICS

Raw Signal BNC Output

Type : Acceleration, unfiltered

Sensitivity : According to the input signal range

Input in mV/g	Gain
9.5 to 19.9	1
20 to 49.9	0.5
50 to 105	0.2

Dynamic range : 2 V peak

Output impedance : 500 ohms

Raw Signal on Terminal

Type : Acceleration, filtered

Sensitivity : Same as on BNC output (see above values)

Dynamic range : 2 V peak

Output impedance : 500 ohms

OK System

Function : Continuous monitoring for open transducer line, short-circuited line, dynamic overlad/ overflow, or lost power supply.

"OK" LED (green) : Light ON = normal state

"OK" relay : Light OFF = indicates fault

OPTIONS

(See Ordering Information)

Analog Output Module

DC voltage output : 0 to 10 V for FSD impedance > 500 ohms

or

DC current output : 4 to 20 mA for FSD impedance < 800 ohms

Resolution : 12 bits

Accuracy : 0.1% (±1 bit)

Time response : 60 ms

RS Digital Output Module

Type : RS 232 C or RS 485

Baud rate in bps : Selectable from 1200 to 19 200

Bus interface : 3 wires for RS 232 C
2 wires for RS 485

Address (RS-485) : Programmable from 00 to 99

Bus structure : Slave which replies to commands

Protocol : ISO 1745, "start-stop" 7-bit code ModBus/RTU™

Network configuration : Up to 31 modules

Mode : Asynchronous serial transmission, half-duplex

PHYSICAL CHARACTERISTICS

Design standard : Complies with all essential specifications of CE, ISO10 816, NF E90.300 and VDI 2056 recommendations

Mechanical : Aluminium enclosure, IP 65 protection, 4 PG 11 input/ output stuffing glands, 4 mounting holes for M6 screws

Electrical connections : Removable terminals (for 1.5 mm^2 wire)

Dimensions

- *Height* : 226 mm
- *Width* : 150 mm
- *Depth* : 70 mm

Weight : ~ 1.5 kg

ENVIRONMENTAL

(According to IEC 68.2 recommendations)

Operating temperature : 0°C to +60°C

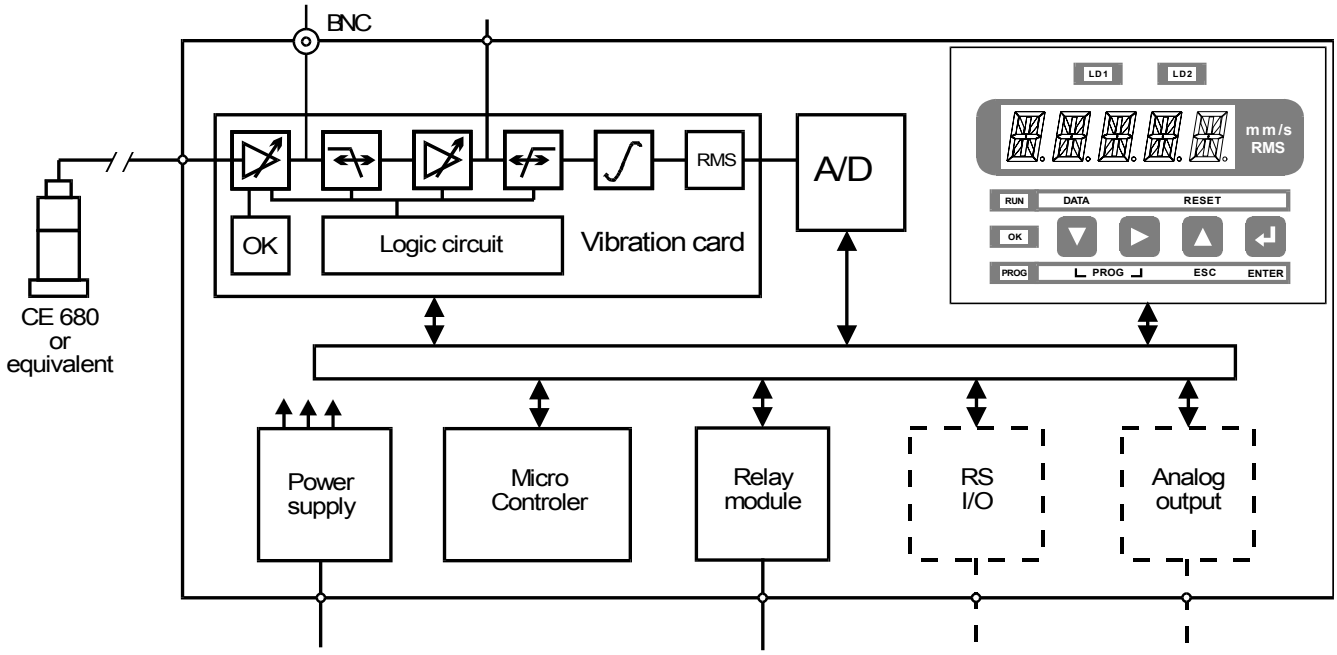
Storage temperature : -25°C to +85°C

Humidity : Max. 95% non-condensing

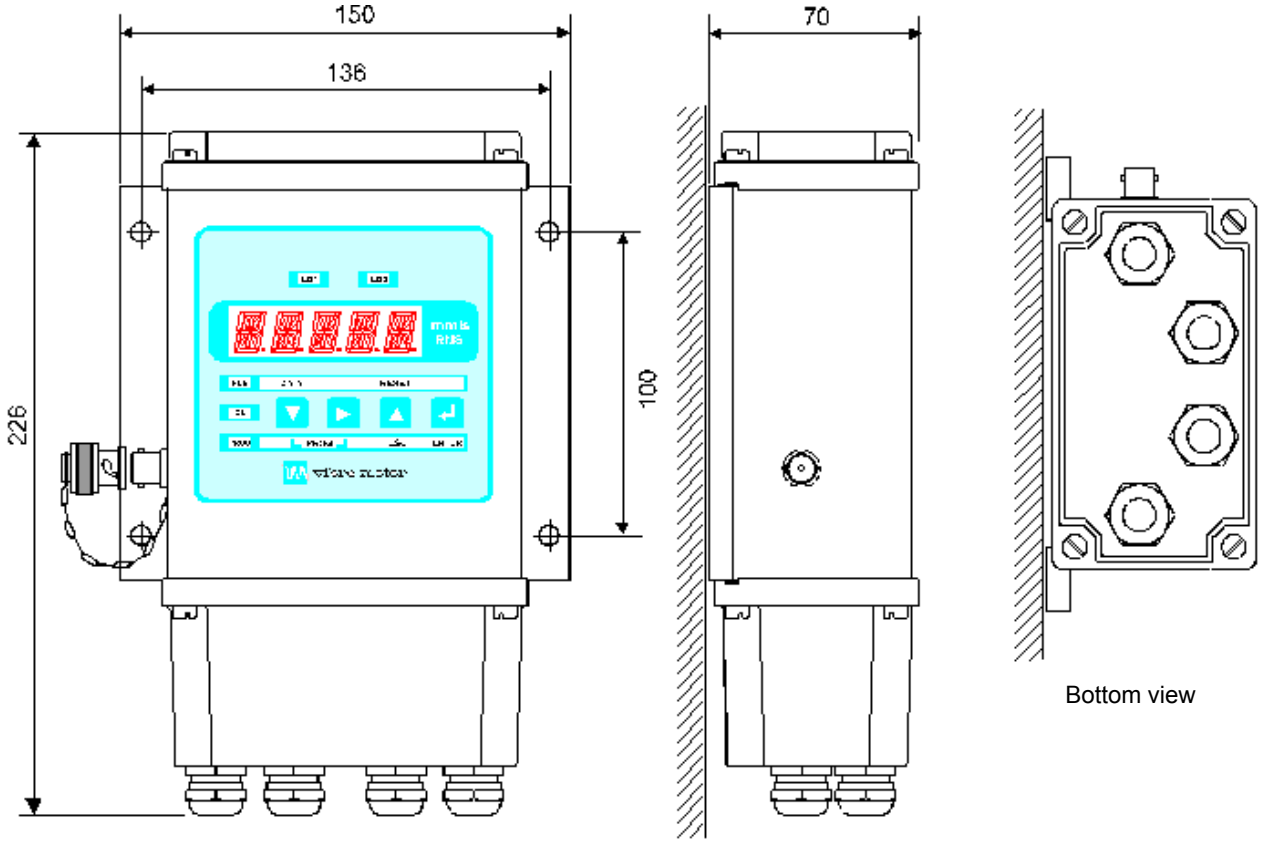
Vibration : 10 to 55 Hz, 0.35 mm peak, 6 hours in each direction

Shock : 15 g peak, 11 ms, half sine pulse

BLOCK DIAGRAM



DESIGN AND DIMENSIONS



Mounting: 4 x M6 screws

Bottom view

ORDERING INFORMATION

To order please specify :

Type	Designation	Ordering Number	
VMU 100	Vibration Monitor	204-100-000-011 / X1 / X2 / X3 / X4 / X5	
		Programmable parameters (if X4 = 1):	PP1 / PP2 / ... / PP23

IMPORTANT : The parameters X1, X2, X3, X4 and X5 must be defined when ordering.
PP1 to PP23 concern programmable parameters which can be defined in the field by programming the *VibroSmart*. If they are defined when ordering, the set-up will be done in the factory prior to delivery.

CONFIGURATION PARAMETERS

X1 (1)	Power Supply
1	115 V_{AC}
2*	230 V_{AC}
5	20-30 V_{DC}

X2	Analog Output Card
0*	None
1	0 - 10 V or 4 - 20 mA

X3	RS Output Card
0*	None
1	RS 232
2	RS 485

X4	Factory setup of programmable parameters
0*	No
1	Yes

X5 (2)	Programmation Rights
1*	Total
2	Limited
3	Blocked

* = Default setting

Notes :

(1) The power supply can be changed from 115 V_{AC} to 230 V_{AC} by adjusting a jumper on the base card of the *VibroSmart*.

(2) The programmation rights can also be changed by adjusting a jumper on the base card of the *VibroSmart*.

PROGRAMMABLE PARAMETERS

The following parameters can all be changed in the field by programming the *VibroSmart*. If they are defined when ordering, the set-up will be done in the factory prior to delivery.

Programmable parameters : PP1 / PP2 / ... / PP23

PP1	Input Sensitivity
1	10 mV/g
2	25 mV/g
3*	100 mV/g
9	Other

PP2	Unit
1*	mm/s
2	inch/s

PP3	Calibration
1*	RMS
2	Peak

PP4	Full Scale
01	5 mm/s
02	10 mm/s
03*	20 mm/s
04	50 mm/s
05	100 mm/s
06	200 mm/s
07	500 mm/s
51	0.5 inch/s
52	1.0 inch/s
53	2.0 inch/s
54	5.0 inch/s
55	10.0 inch/s
56	20.0 inch/s
57	50.0 inch/s

PP5	Rounding
1*	1
2	2
3	5
4	10

PP6	HP Filter
1	1 Hz
2	2 Hz
3	5 Hz
4*	10 Hz
5	20 Hz
6	40 Hz
7	100 Hz
8	200 Hz

PP7	LP Filter
1	40 Hz
2	100 Hz
3	200 Hz
4	500 Hz
5*	1 kHz
6	2.5 kHz
7	5 kHz
8	10 kHz

* = Default setting

PROGRAMMABLE PARAMETERS *(Continued)*

PP8	LD1 Activity
1*	Yes
2	No

PP9	LD1 Direction
0	Not applicable if PP8 = 02
1*	High
2	Low

PP10	LD1 Normal State
0	Not applicable if PP8 = 02
1*	On
2	Off

PP11	LD1 Latch
0	Not applicable if PP8 = 02
1*	Yes
2	No

PP12	LD1 Level
0	Not applicable if PP8 = 02
9*	Specify value in writing

(* 60% of Full Scale)

PP13	LD1 Delay Time
0	Not applicable if PP8 = 02
9*	Specify value in writing

(* 1 sec.)

PP14	LD2 Activity
1*	Yes
2	No

PP15	LD2 Direction
0	Not applicable if PP14 = 02
1*	High
2	Low

PP16	LD2 Normal State
0	Not applicable if PP14 = 02
1	On
2*	Off

PP17	LD2 Latch
0	Not applicable if PP14 = 02
1*	Yes
2	No

PP18	LD2 Level
0	Not applicable if PP14 = 02
9*	Specify value in writing

(* 80% of Full Scale)

PP19	LD2 Delay Time
0	Not applicable if PP14 = 02
9*	Specify value in writing

(* 1 sec.)

PP20	Analog Output
0	Not applicable
1*	0 - 10 V_{DC} (if X2 = 1)
2	4 - 20 mA (if X2 = 1)

PP21	RS Address (0-99)
00	00 (if X3 = 1 or 2)
01*	01 (if X3 = 1 or 2)
- - -	- - -
99	99 (if X3 = 1 or 2)

PP22	RS Baud Rate
0	Not applicable
1	1200 (if X3 = 1 or 2)
2	2400 (if X3 = 1 or 2)
3	4800 (if X3 = 1 or 2)
4*	9600 (if X3 = 1 or 2)
5	19 200 (if X3 = 1 or 2)

PP23	Protocol
0	Not applicable
1*	ISO 1745 (if X3 = 1 or 2)
2	ModBus/RTU (if X3 = 1 or 2)

* = Default setting

ORDERING EXAMPLE

VMU 100 Vibration Monitor	: 204-100-000-011 / 1 / 0 / 2 / 1 / 1
Programmable parameters	: 3 / 1 / 1 / 03 / 4 / 3 / 8 / 1 / 1 / 1 / 1 / 9 / 9 / 1 / 1 / 2 / 1 / 9 / 9 / 1 / 01 / 4 / 1

where PP12 = 12 mm/s (60% of FSD) PP18 = 16 mm/s (80% of FSD)
PP13 = 1 second PP19 = 1 second

ACCESSORIES

CE 680 series accelerometers	See data sheet 262-055
EC 318 cable assembly	See data sheet 262-645
EC 319 cable assembly	See data sheet 262-646

In this publication, a dot (.) is used as the decimal separator and thousands are separated by spaces. Example : 12 345.678 90
Although care has been taken to assure the accuracy of the data presented in this publication, we do not assume liability for errors or omissions.
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CE 680 M411

Piezoelectric Accelerometer with Integrated Electronics Type CE 680 M411

FEATURES

- **Designed for medium temperature industrial applications (-55°C to +120°C)**
- **Shear mode operation, therefore no output due to thermal transients**
- **2-pole low-pass filter for resonance suppression**
- **Hermetically sealed for harsh environments**
- **Ground isolated from case and connected to a Faraday shield**
- **Bias voltage stability at elevated temperatures**
- **Frequency response ±10% 3 to 5000 Hz**
  ±3 dB 0.5 to 10 000 Hz

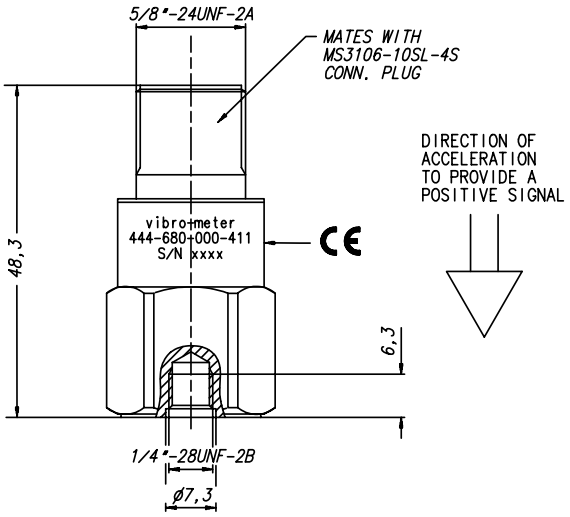
DESCRIPTION

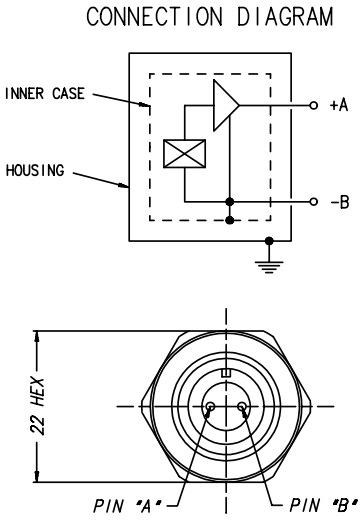
The CE 680 M411 is an all-purpose vibration sensor designed for use in harsh industrial machinery environments. It uses the industry standard 2-wire voltage transmission technique with a 4 mA constant current supply. The output signal has a sensitivity of 100 mV/g.

Thanks to the accelerometer's isolated ground and Faraday shield, no ground loops or frame voltage are present to disturb the measurement.

The CE 680 M411 shows extremely low noise levels and exceptional bias voltage stability at elevated temperatures.

PHYSICAL DIMENSIONS AND CONNECTING DIAGRAM





SPECIFICATIONS

Note: Unless otherwise stated, all values listed are typical values, referenced at +24°C, 24 VDC supply, 4 mA constant current and 100 Hz

OPERATING

(at +23°C ±5°C)

Sensitivity (at 120 Hz)	: 100 mV/g ±10%
Dynamic range	: 80 g
Transverse sensitivity	: < 5%
Linearity	: < 1% up to full-scale
Resonant frequency	: Nominal 25 kHz, +15 dB max. at resonance

ELECTRICAL

Input supply current	: 2 to 10 mA
Supply voltage for current source	: 22 to 30 V_{DC}
DC output bias voltage	
• *From -50 to +99°C*	: 11 to 14 VDC
• *From +100 to +120°C*	: ≤ ±100 mV/°C
Output impedance	: 50 Ω
Residual noise (+25°C or +120°C)	: 0.0005 g (from 2.5 Hz to 25 kHz)
Isolation between inner case and housing	: ≥ 10 MΩ
Over-voltage protection	: > 40 V_{DC}
Reversed polarity	: Protected

ENVIRONMENTAL

Temperature range	: -55°C to +120°C
Humidity	: Hermetically sealed
Simusoidal vibration limit	: 500 g peak
Shock limit	: 5000 g peak
Base strain sensitivity	: 0.002 μg peak/με
ESD protection	: > 36 V
EMC (10 V/m, 150 kHz to 1000 MHz with 80% AM at 1000 Hz)	: 0.003 g peak to peak
MTBF	: 197 000 hours (+25°C) 35 000 hours (+125°C)

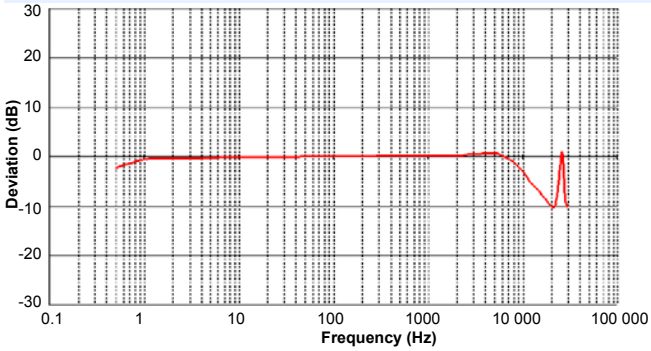
PHYSICAL

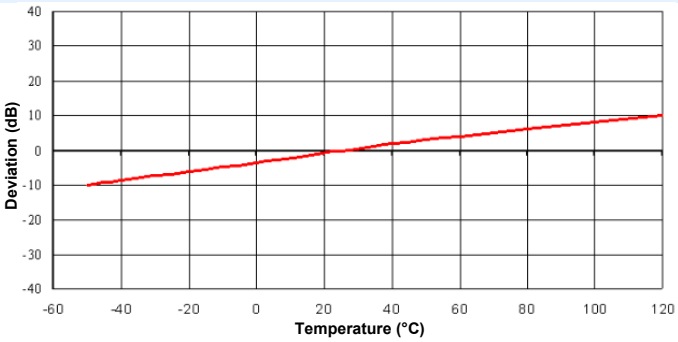
Weight	: 90 g
Case material	: 316 L stainless steel
Mounting torque	: 2.9 Nm
Mating connector	: MS3106F-10SL-4S or equiv.

CALIBRATION

Dynamic calibration at factory. No subsequent calibration necessary.

TYPICAL RESPONSE CURVES





ACCESSORIES

Supplied Accessories

Adaptor stud	Type 1/4-28 UNF	P/N 2984-2
Adaptor stud	Type 1/4-28 to M8 x 1.25	P/N 2984-8

Optional Accessories

Cable	Type EC 318	P/N 922-318-000-0XX
Cable	Type EC 319 (with boot)	P/N 922-319-000-0XX

ORDERING INFORMATION

To order please specify :

Type	Designation	Ordering Number
CE 680 M411	Piezoelectric Accelerometer	444-680-000-411

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EC 318

Cable Assembly Type EC 318

FEATURES

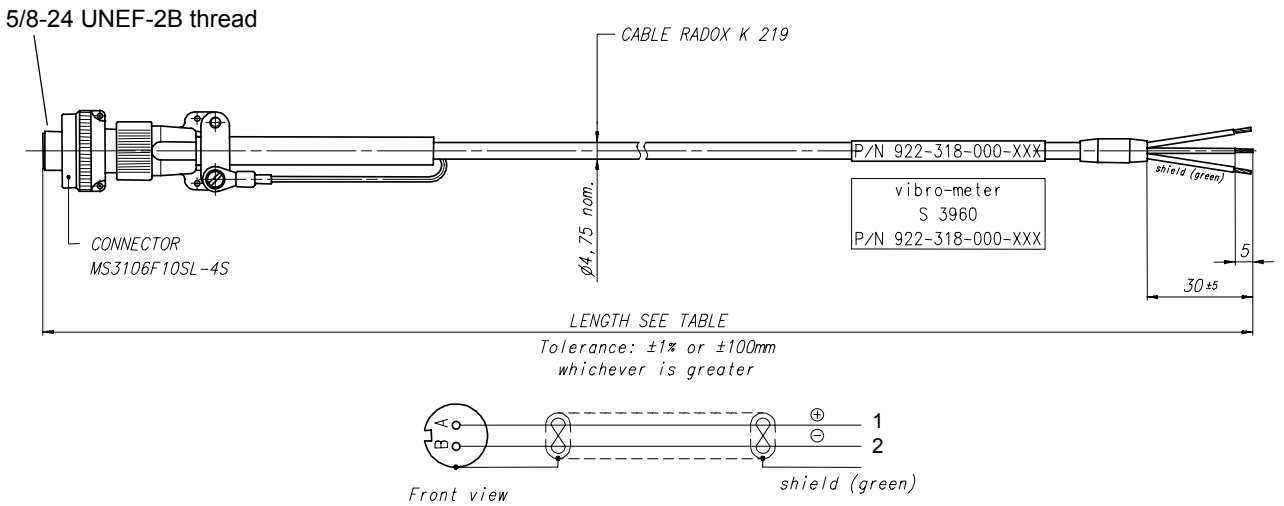
- **Extension cable for CE-type accelerometer**
- **Temperature range -54°C to +120°C**
- **Mates to transducer with MIL-C-5015 connector (or equivalent)**

DESCRIPTION

Designed for industrial or laboratory environments, these cable assemblies facilitate the connection of an accelerometer with integrated electronics and MIL-C-5015 type connector.

The EC 318 cable assembly incorporates a 22 AWG (0.34 mm²) shielded, twisted pair cable. It is terminated by an MS3106F10SL-4S connector at one end and has a pigtail termination at the other.

MECHANICAL DIAGRAM



SPECIFICATIONS

Physical Specifications of Cable

Cable type	: K 219
Construction	: According to IEC 228 specifications

Connector

Type	: MS 3106F-10SL-4S
Construction	: Alluminium alloy
Finish	: Cadmium olive
Insert material	: Neoprene
Operating temperature	: Max. 125°C

Refer to drawing on page 1 and the data sheet K 219 (262-586) for full specifications.

ORDERING INFORMATION

To order please specify :

Type	Designation	Ordering Number	
EC 318	Cable Assembly	922-318-000-011	Length 1 m
		922-318-000-021	Length 3 m
		922-318-000-031	Length 5 m
		922-318-000-041	Length 8 m
		922-318-000-051	Length 10 m
		922-318-000-001	Length to be defined on order

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C GLOSSARY

This appendix contains an explanation of the terms displayed by the VibroSmart VMU100 and/or used in the present user manual :

Display	Term	Comments
ACT	Activity	Readout or programming of the activity of the alarm (Active or inhibited)
Adjust	Adjust	Adjustment of each digit to obtain the required value
ADRES	Address	Readout or programming of the address of the VibroSmart in an RS 485 network
ALARM	Alarm	Readout or programming of the alarm parameters
ALL	All	Access to all the programmed parameters
ANOUT	Analog Output	Readout or programming of the analog output
BAUD	Baud	Readout or programming of the transmission speed in RS
CAL	Calibration	Readout or programming of the peak or effective crest value calibration
DATA	Data	Entry into the function of readout of the parameters and stored values
DELAY	Delay	Readout or programming of the time delay of the alarm
DISP	Display	Access to the parameters of the display
ENTER	Enter	Validation of the parameter displayed and return to the higher hierarchical level
ESC	Escape	Return to the higher hierarchical level keeping the original parameter
FILT	Filter	Access to the filter parameters
FSD	Full Scale Deflection	Readout or programming of the extent of measurement
HI-LO	High-Low	Readout or programming of the direction of alarm (High or low)
HP	High Pass (filter)	Readout or programming of the high cutoff frequency
Inc/s	Inch/s	Choice of unit inch/s
Init	Initialize	Initialization of the max and min values for a new period
INP	Input (Sensor)	Readout or programming of the sensitivity of the accelerometer
LATCH	Latch	Readout or programming of the latching of the alarm
LD1	Level Detector 1	Readout or programming of the 1st alarm
LD2	Level Detector 2	Readout or programming of the 2nd alarm
LEVEL	Level	Readout or programming of the level of the alarm
LP	Low Pass (Filter)	Readout or programming of the low cutoff frequency
M/m	Max/min	Access to the Max and min measurements for the period

Display	Term	Comments
MAX	Maximum	Readout and reinitialization of the max values of measurement for the period
MIN	Minimum	Readout and reinitialization of the min values of measurement for the period
mm/s	mm/s	Selection of unit mm/s
No	No	Negative response to a selection (activity, storage etc)
NORM	Normally	Readout or programming of the state of the relay without alarm
OFF	Off (de-energized)	Relay normally de-energized - NDE
OK	OK	Inidicates the absence of any anomaly in the equipment (VibroSmart VMU100, line and accelerometer)
ON	On (energized)	Relay normally energized (NE)
Peak	Peak	Calibration selection at peak value
PROG	Programming	Indicates the two keys enabling entry into programming mode
PROGA	Alarm Programming	Access to the programming limited to the alarms threshold routine
PROGT	Total Programming	Access to the complete programming routine
PROT	Protocol	Readout or programming of the RS transmission protocol
RESET	Reset	Reset or clearance of a stored alarm
RMS	Root Mean Square	Selection of calibration in effective value
RND	Rounding-up (resolution)	Readout or programming of the protocol for the rounding up resolution of the display
RSOUT	RS Output	Readout or programming of the RS 232 or RS 485 serial output
RUN	Run	Operation under normal monitoring
SPEC	Special	Readout or programming of a non-standard accelerometer sensitivity
STD	Standard	Readout or programming of a standard accelerometer sensitivity
UNIT	Unit	Readout or programming of the measuring unit
VER	Version	Readout of the reference of the software version used
Yes	Yes	Positive response to a selection (activity, storage etc)

PRODUCT DEFECT REPORT

If you have any problems with your Vibro-Meter product would you please contact your **Vibro-Meter agent**. You may need to return a defective unit to Vibro-Meter. If you do, please **photocopy then fill in this form (in English) and attach it to the defective unit.** Your completed Product Defect Report is important because it can help us rapidly solve the problem.

NOTE : Always provide a filled-in photocopy of the Product Defect Report for each defective unit. The report must accompany the unit at all times.

Contact Details: You or the designated Contact Person for your company.

Name _____ Job Title _____

Company _____ Email _____

Address _____

Country _____ Post Code _____

Telephone _____ Fax _____

Signature _____ Date _____

Product Details: Plug-in modules display Product Detail information on a sticker stuck on the unit.

Module type: _____

Serial number (S/N): _____ Part number (P/N): _____

Vibro-Meter order number: _____

Date of purchase: _____ Site where used: _____

Problems Observed:

_____

_____

_____

_____

_____

_____

_____

_____

(Please continue on back of sheet if necessary)

Is the problem (put an ☒ where appropriate) :

☐ Always evident ? ☐ Intermittent ? ☐ Temperature dependent?

Please use this space for any additional information:

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Document Title VibroSmart VMU100 Vibration Monitor User Manual

Reference MAVMU100/E Edition 6 Date of Issue 01.03.2005

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• Is the document well organized?	**Yes**	**No**
• Is the information technically accurate?	**Yes**	**No**
• Would you like more technical detail?	**Yes**	**No**
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• 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**
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