

OneProd MVX

*8 to 32 channels
Monitoring and Predictive Maintenance System*



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1 Preamble

This technical datasheet includes some specifications that are specifically linked to the product firmware **V5.0.x** version.

2 General Presentation of the product

OneProd-MVX results from 01dB-Metravib's long-time experience in the permanent monitoring of industrial machines of all sectors.

OneProd-MVX is a signal acquisition system that can acquire up to 32 channels simultaneously in the 0-20 kHz range in order to monitor rotating machines and/or provide data to a predictive maintenance platform.

OneProd-MVX is available with 8, 16, 24 or 32 channels. Each version is available with two operating levels, depending on its use: "Easy" or "Premium".

3 Operating

3.1 General principle

MVX continuously achieves:

- The simultaneous acquisition of all measurement channels
- The immediate post-processing of data

MVX can carry out 2 types of measurements:

- *Monitoring measurements*, designate to machinery monitoring
- *Maintenance measurements*, designate to conditional maintenance database feeding.

Monitoring measurements are performed continuously, allowing scalar indicators building-up and alarm triggering. The indicator values are available, as they come along, on the Ethernet and RS485 ports in order to be transmitted to an external display and/or storage device. They are not stored in **MVX**.

Since V5.xxx firmware version, **MVX Premium** is able to achieve in real time some indicators, which means that 100% of the corresponding signals is really monitored.

Besides this real time monitoring function, specific “time wave on event” signals can be recorded. These signals can include what happened before the trigger event (pre-trigger function).

Maintenance measurements are indicators, spectrum and time waveform signals to be transferred to the **OneProd-XPR** platform database. These measurements are carried out periodically or on event (detection of an alarm, change of operating conditions). They are stored into **MVX** until complete transmission is achieved.

3.2 Operating modes

- Stand-alone monitoring:
 - **MVX** performs monitoring measurements only
 - **MVX** works out scalar indicators
 - **MVX** set-up is achieved with the **OneProd-CSM** tool
 - Once set up, **MVX** operates on a fully stand-alone mode
 - Indicators can be displayed in **OneProd-VIO**
 - Indicators & status can be transmitted via MODBUS
- Monitoring and Predictive Maintenance:
 - **MVX** performs monitoring and maintenance measurements
 - Maintenance measurements (scalar values, spectra, time signals) are stored in **MVX**, and then transferred to **OneProd-XPR**.
 - The presence of **OneProd-XPR** is required to set up, drive and download **MVX**.
 - **MVX** operates in a partially stand-alone mode
 - Real time indicators (that are effective on 100% of signal) can be monitored, as well as time waves on event (with or without pre-trigger) can be recorded
 - Indicators can be displayed in **OneProd-VIO**
 - Indicators & status can be transmitted via MODBUS

In both modes, measurements can be grouped (usually by machines). Each measurement group can then be assigned to the operating conditions of the machine

3.3 Measurement conditions

Each measurement group can be associated with conditions as follows:

- One rotation speed (trigger input)
- Two continuous process levels (DC input)
- Tree logical input statuses

Operating conditions are automatically monitored permanently and in real time.

3.4 Acquisition features

- Anti-aliasing filtering: yes
- Conversion technology: Delta-sigma
- Number of bits: 24
- Sampling frequency: 51.2 kHz
- Measurement acquisition time: from 1s to 255s
- Size of elementary acquisition blocks: 1024 samples

3.5 Processing functions

3.5.1 Direct elaboration of indicators on time blocks

- Filtering
 - High-pass (3rd order): none, 2 Hz, 10 Hz, 3 kHz.
 - Low-pass (3rd order): 300 Hz, 1 kHz, 2 kHz, 3 kHz or none,
- Integration
 - Simple
 - Double
- Detection
 - RMS
 - Peak
 - Peak-to-peak
 - Equivalent peak
 - Equivalent peak-to-peak
 - Average value
- Calculation mode
 - Average value of acquisition blocks
 - Maximum value of acquisition blocks
- Specific processing
 - $S_{max_{pp}}$
 - Bearing defect factor
 - Kurtosis

3.5.2 Calculation of rotation speed

- Calculation from the frequency of a synchronisation signal
- Meshing ratio: from 1 / 1 to **65535 / 65535**

3.5.3 Time acquisition

- Sampling frequency (by decimation): 128 Hz ; 256 Hz ; 512 Hz ; 1.28 kHz ; 2.56 kHz ; 5.12 kHz ; 12.8 kHz ; 25.6 kHz ; 51.2kHz.
- Number of samples: 1024 ; 2048 ; 4096 ; 8192

- Possible extension with DAT recording option: see Paragraph 3.8
- Free or synchronised acquisition
- Synchronous average (except for DAT recording)

3.5.4 Spectral acquisition

- Frequency range: 50 Hz ; 100 Hz ; 200 Hz ; 500 Hz ; 1 kHz ; 2 kHz ; 5 kHz ; 10 kHz ; 20 kHz.
- Number of lines: 400 ; 800 ; 1600 or 3200
- Number of averages: from 1 to 4096
- Free or synchronised acquisition
- Type of average: linear, exponential, peak
- Overlap: 0% ; 50% ; 75%
- High-pass filter: 2 Hz ; 10 Hz ; 3 kHz
- Integration: none, 1 or 2
- Zoom factor: none; x2; x4; x8; x16; x32; x64; x128; Maximum resolution: 30 mHz
- Windowing: Hanning; Rectangular; Flat-top
- Synchronous analysis: yes / no
- Envelope detection: yes / no

3.5.5 Elaboration of indicators from a spectrum

- Up to 10 indicators can be defined from a spectrum
- “Broadband” indicators: RMS, equivalent peak or equivalent peak-to-peak level between two fixed frequencies
- “Narrow band” indicators: RMS, equivalent peak or equivalent peak-to-peak level defined over a few spectral lines centred on a fixed or variable frequency
 - the number of lines can be parameterised
 - the centre frequency is defined by two coefficients, A and B (integer), and by the following formula: $F_c = A.F_0 + B$ (with F_0 = rotation frequency)

3.5.6 Elaboration of indicators from a time wave

- SFI (**Shock Finder**): unique binary indicator that can alert automatically when shocks are detected into a waveform signal. The result is smoothed thanks to a tuneable function in order not to take into account possible random and non significant shocks. SFI is particularly dedicated to low speed shaft machines, like wind turbines, radars etc.

Nota: SFI requires DAT option

- BGI (**Blade Guard Index**): Specific indicator dedicated to the monitoring of structural resonance, particularly suitable for wind turbine blades

Nota: BGI requires DAT recording option in order to get the signals on alarm.

3.5.7 Specific acquisitions for Electrical Signal Analysis (ESA)

- MVX provides XPR with suitable data for ESA automatic diagnosis elaboration

3.5.8 Elaboration of real time indicators

The following category of processing items can be set up to achieve real time indicators (with MVX Premium only, in the limit of MVX maximum processing capability).

An internal automatic procedure includes maximum charge checking and informs the operator before launching monitoring.

- High pass filter : 2Hz or 10Hz
- Signal integration : 0 or 1
- Low pass filter : 1000Hz or no filter (i.e.20kHz)
- Processing : RMS, pk or pk-pk
- Averaging : continuous exponential with time constant between 1s and 25s
- Averaged DC level (for process and GAP signals)
- BGI indicator (*Blade Guard Index*)
- GCI indicator (*Gearbox Condition Index*, see next §)
- Broad band and narrow band extraction on real time FFT :
 - FFT 400 pts, 800 pts, 1600 pts ou 3200 pts
 - FFT 1kHz, 2kHz, 5kHz, 10kHz ou 20kHz,
 - FFT with 50% fixed overlapping

3.5.9 Time wave on event

MVX Premium with DAT option is required

Besides real time monitoring MVX can record specific time waves that can be triggered at all time and that includes « pre-trigger » capability. I.e. possibility to include what happened BEFORE the trigger event.

Possible trigger events:

- Real time indicator alarm level violation,
- Change in the operating condition,
- Manual measurement request (from XPR)

Time wave on event parameters:

- Fixed sampling rate: 51.2 kHz.
- Length: 1s to 30s on 32 channels
- Maximum length can be overstepped if less than 32 channels have to be recorded at the same time:

Number of channels concerned by time wave on event	32	24	16	8	4	3	2	1
Maximum duration (s)	30	40	60	120	240	320	480	480

- Pre-trigger duration: 0 to total wave length (*).

(*) For first generation MVX which have been updated with V5.xx. please consult user manual.

3.5.10 GCI specific indicator

GCI (***Gearbox Condition Index***) is dedicated to particles counting.

Particle sensor (i.e. GASTOPS / MetalSCAN) are especially useful for degradations of the wind turbine gearboxes.

GCI is performed on 100% of time.

GCI is made with 3 sub-indicators:

- GCI-h : number of particle detected in the last hour
- GCI-d : number of particle detected in the last 24 hours (performed in a slipping mode)
- GCI-t : Total number of detected particle

Each sub-indicator is monitored regarding its own threshold values.

3.6 Alarm processing

- Alarm modes: none; high; low; within window; off window
- 2 alarm thresholds for high or low alarm modes
- 4 alarm thresholds for “within window” and “off window” alarm modes
- Selectable activation of an “alarm” logical output and of a “danger” logical output for each indicator
- Direction of command for logical outputs: normally active / inactive
- Automatic acknowledgement with hysteresis adjustment
- Manual acknowledgement with selection of a logical input

3.7 Short term trend

MVX stores regularly its calculated indicator values into a FIFO memory, which allows for transmitting to XPR a set of spent data when an Alarm event occurs.

- Available with XPR only
- Storage: 1 to 1000 measurements
- Periodicity: 1mn to 10mn
- Type of data: Scalar data

3.8 Long time acquisition (“DAT” option)

- Extension of the number of points for the time acquisition
- For each channel, one can select among: 16k; 32k; 64k; 128k; 256k; 512k; 1024k; 2048k; 4096k
- Limit: ~ 82s of signal on 30 channels whatever the sampling frequency
- This limit may be downgraded if time waves on event are used.

3.9 Processing performances

Real time indicators are performed « as one goes along » during acquisition. Corresponding processing is achieved with the highest priority level.

Other indicators (named « cyclic » ones) are performed after dedicated acquisition period.

When MVX ends cyclic indicators processing, then it starts another acquisition cycle, and so on.

Calculation period for the cyclic indicators depends on global MVX load:

- Total number of real time indicators.
- Number and complexity of cyclic indicators and signals.

The more real time indicators are to be computed, the longest is the period for cyclic indicators.

4 Electrical characteristics

4.1 Power supply

Magnitude	Specification	Conditions
Voltage supply	from 18V to 28V dc	Permanent
	from 18V to 36V dc	< 30s
	from 18V to 50V dc	< 100 ms
	from 20V to 28V dc	Recommended
Galvanic insulation / earth	Checked at +/- 108V dc	Permanent

Typical power consumption: 40W

Maximum power consumption: 60W

The system will reboot in case of a voltage supply < 18V dc.

4.2 Analog inputs

All **MVX** inputs are single ended inputs, which means their cold points are connected together to **MVX** earth terminals.

Number: 8, 16, 24 or 32 depending on the option.

Inputs can be parameterised according to different input types:

4.2.1 IEPE input

- Open-loop voltage: ca. 23 V=
- Constant current: 4mA +/- 0.5mA=
- Coupling: AC
- Lower cut-off frequency: 0.1 Hz (slope: 6 dB/octave)
- Input impedance: > 60 kOhms in AC
- AC input voltage: up to 16 V peak-to-peak
- Overload protection: up to +/- 40 V

4.2.2 AC-DC or “process” input

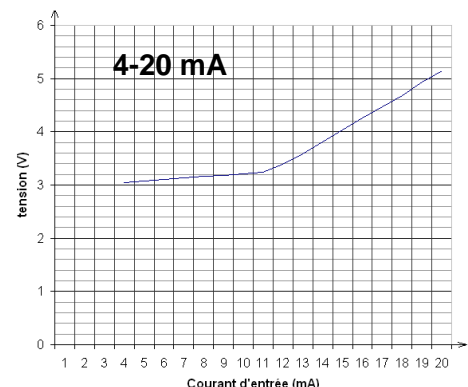
- Coupling: DC
- Input impedance:
 - > 60 kOhms in AC
 - > 150 kOhms in DC
- Max. measurable voltage: +/- 23.5 Vdc
- Overload protection: up to +/- 40 V

4.2.3 4.2.3 -20mA input

- Type of input: passive
- Max. allowed voltage: 13 V
- Input resistance : see opposite

4.2.4 Tachometric input

- Input impedance: > 60 kOhms
- Max. voltage: +/- 23,5 V
- Lower cut-off frequency: 0 Hz
- Number of pulses per revolution: from 1 to 65535

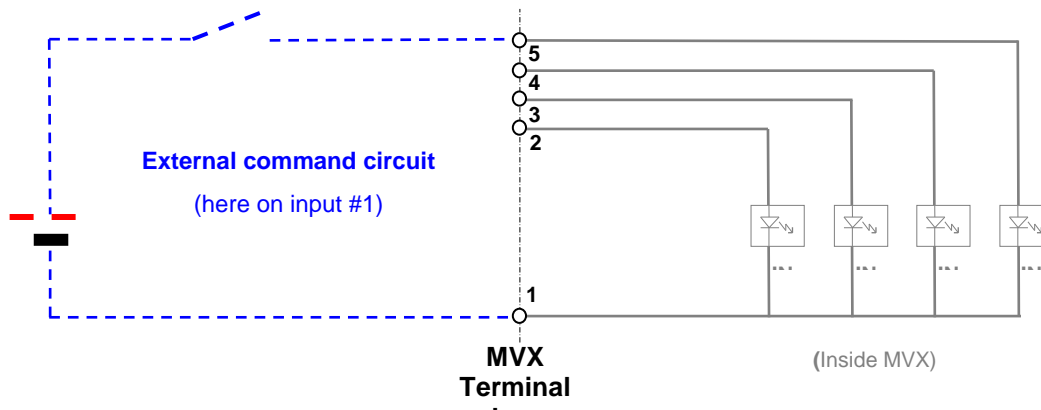


4.3 Logical inputs

- Type: Optocoupler
- Maximum common mode voltage: +/- 100 Vdc
- Maximum differential voltage: 35 V
- Minimum voltage for guaranteed High level: 13 V
- Minimum voltage for guaranteed Low level: 8 V
- Input current under 13 V: 6 mA
- Input current under 35 V: 21 mA
- Number: 4 for MVX-160 or 8 for MVX-320

Logical inputs are grouped by four, with a common cold point.

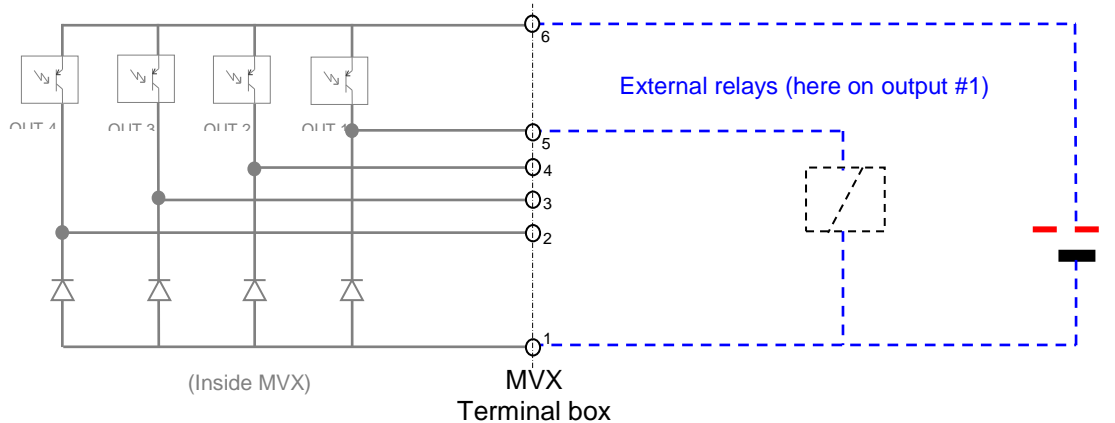
Equivalent diagram for a group of inputs:



4.4 Logical alarm outputs

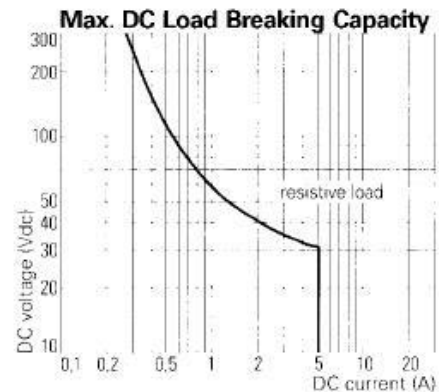
- Type: Optocouplers
- Maximum common mode voltage: +/- 100 Vdc
- Maximum gated voltage:
- Maximum switched current: 30 mA
- Protection against short circuits
- Built-in free wheel diode
- Voltage drop: ~ 1,25 V for 30 mA
- Number: 4 for **MVX-160** or 8 for **MVX-320**

Logical outputs are grouped by four, with a common cold point.



4.5 Integrity relay output

- 1 C/O contact
- Rated voltage: 250 Vac
- Cut-off power: 1250 VA



5 Measurement specifications

5.1 Voltage input type measurements (AC + DC)

- Typical error for DC voltage: < 1% of Full scale (With gain=1)
- Typical error for AC voltage: < 1% of full scale (With gain = 1 & signal = 80% of full scale)
- Noise to Signal ratio: > 100 dB (With gain = 1)
- Crosstalk: > 100 dB

5.2 IEPE input type measurements

- Typical error for AC voltage: < 1% of full scale (With gain = 1 & signal = 80% of full scale)
- Noise to Signal ratio: > 95 dB (With gain = 1)

5.3 4-20 mA input type measurements

- Offset: < 10 μ A
- Typical error: < 0,8% of full scale

6 Communication

6.1 RS485 port

- Type: 2 wires,
- Communication: half-duplex
- Galvanic insulation: YES
- Transfer rate: 9600 bauds
- Format: 8 bits, 1 stop-bit, no parity

6.2 Ethernet ports

Two 10/100 base T ports can be used:

- Port A:
 - Located on the left side
 - Requires an Ethernet cross cable to communicate with a PC
- Port B:
 - Located on the right side
 - Requires a “straight” Ethernet cable to communicate with a PC

These two ports can be used simultaneously if the information network (Server XPR) is different from the process network ((Modbus TCP)

6.3 USB ports

The 2 existing connectors are not used.

6.4 MODBUS communication

6.4.1 Medium selection

- RS485 port (MODBUS-RTC)
- Ethernet port (MODBUS-TCP)

6.4.2 Transmission mode selection

- MVX is Modbus Slave. In this case MVX can exchange data in both direction (input and output) with one PLC.
- MVX is Modbus Master. In this case MVX can read data (input) on 1 to 3 PLCs.

6.4.3 Available data on Modbus output

- Number of indicators
- Values of indicators
- Status of indicators
- Units of indicators
- Values of operating parameters

6.4.4 Available data on Modbus input

- Values of operating parameters
- Values of indicators

7 Marking & Standards

7.1 CE marking

7.1.1 EMC immunity

Disturbing phenomenon	Application mode	Standard	Specification
Electromagnetic field	Envelope	EN61000-4-3	Field level = 10 V/m Modulation frequency: 1 kHz Modulation depth: 80% Carrier: 80 MHz at 1000 MHz Criterion A
Shock waves	Power supply input in continuous current	EN61000-4-5	Wave 1.2 / 50 μ s 500V between line & earth 500V between lines Criterion B
Shock waves	Signal lines	EN61000-4-5	Wave 1.2 / 50 μ s 1kV between line & earth Criterion B
Fast transient	Signal lines	EN61000-4-4	Wave 5/50 ns of 1 kV Repetition frequency: 5 kHz Injection into the capacitive clamp Criterion B
Fast transient	Power supply input in continuous current	EN61000-4-4	Wave 5/50 ns de 2kV Repetition frequency: 5kHz Direct injection Criterion B
RF voltage	Signal lines	EN61000-4-6	Disturbing voltage: 10V Amplitude modulation: 1kHz Modulation depth: 80% Carrier: 150 KHz to 80 MHz Criterion A
RF voltage	Power supply input in continuous current	EN61000-4-6	Disturbing voltage: 10V Amplitude modulation: 1kHz Modulation depth: 80% Carrier: 150 kHz to 80 MHz Criterion A
Electrostatic discharges	Envelope	EN61000-4-2	8kV in air 4kV at contact Criterion B

7.1.2 EMC emission

Accès	Norme	Frequencies	Limits	Conformity
Envelope	EN 55011	30 MHz à 230 MHz	40 dB μ V/m at 10m 47 dB μ V/m at 10m	YES
Power lines	EN 55011	0,15 MHz à 0,5 MHz	79 dB μ V in QC 66 dB μ V average value	YES
		0,5 MHz à 5 MHz	73 dB μ V in QC 60 dB μ V average value	YES
		5 MHz à 30 MHz	73 dB μ V in QC 60 dB μ V average value	YES

7.2 Explosive atmosphere

For an installation in ZONE 2:

- ATEX : CE **Ex II 3 G** Ex nA II T4
- CSA : CL1 – DIV2 – Group A to D

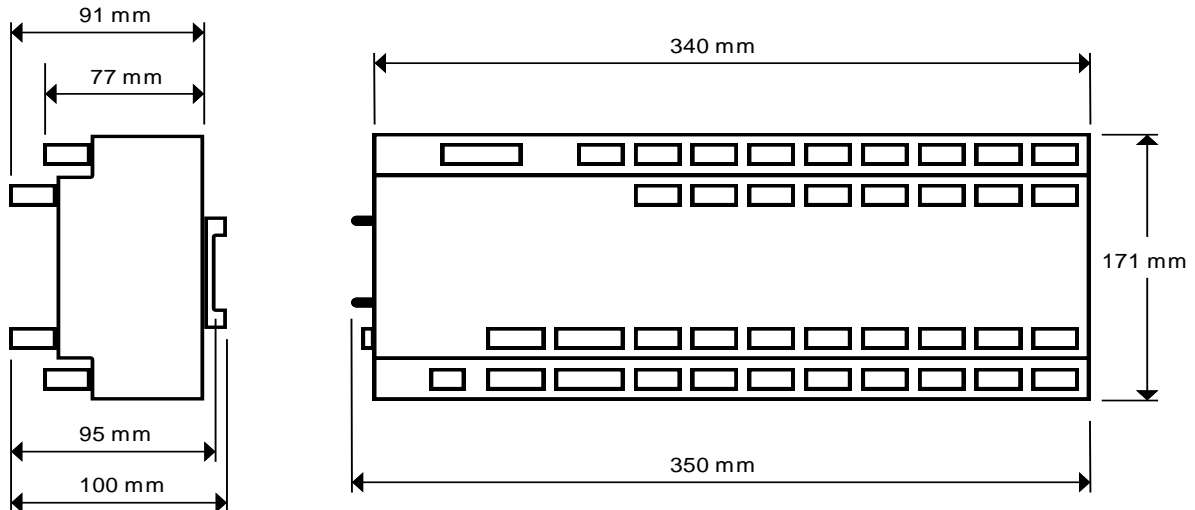
8 Physical characteristics

- Overall dimensions:
 - **MVX-160:** 350 x 171 x 86 mm
 - **MVX-320:** 350 x 171 x 100 mm
- Weight: about 3.1kg (or 6.8 lbs)
- Casing matter: galvanised steel
- Mounting: DIN TS 35 rail
- Optional mounting using screws with accessory *MVX-ACC-SUP-01*

Connections:

- Terminal boxes with disconnectable screwed-on connectors (*)
- Wire section: 0.2 to 2.5 mm² (28 – 12 AWG)
- Screw tightening torque: 0.5 Nm

(*): except for Ethernet connection: 2 RJ45 connectors



9 Environmental characteristics

- Protection: IP 20
- Operating temperature: from -20 to +60 °C
- Humidity: 95% max, with no condensation
- Storage temperature: from -20 to +75°C
- Vibrations: NF60-002 compliant according the following limits
 - 0,4m/s between 5 Hz and 20 Hz
 - 5g pick between 20 Hz and 120 Hz
- Cooling: through forced air
- Air flow rate: up to 35 m3/h

10 Ordering information

Reference code	Commercial reference	Name
MVX3001000	MVX-160-EAS-08	OneProd MVX-160 Easy 8 channels
MVX3002000	MVX-160-EAS-16	OneProd MVX-160 Easy 16 channels
MVX3021000	MVX-320-EAS-24	OneProd MVX-320 Easy 24 channels
MVX3022000	MVX-320-EAS-32	OneProd MVX-320 Easy 32 channels
MVX3011000	MVX-160-PRE-08	OneProd MVX-160 Premium 8 channels
MVX3012000	MVX-160-PRE-16	OneProd MVX-160 Premium 16 channels
MVX3031000	MVX-320-PRE-24	OneProd MVX-320 Premium 24 channels
MVX3032000	MVX-320-PRE-32	OneProd MVX-320 Premium 32 channels
MVX2021000	MVX-OPT-REC	DAT recorder option for MVX
MVX3305000	MVX-ACC-SUP-01	Baseplate for screw mounting
MVX3304000	MVX-ACC-SUP-02	19" Adapter for MVX
MVX1024000	MVX-ACC-PWS-3A0	230 Vac/24Vdc 3.0 A power supply
MVX1025000	MVX-ACC-PWS-5A	230 Vac/24Vdc 5.0 A power supply
MVX3301000	MVX-ACC-RELAY-4M1	Set of 4 x 1-relay modules (4X1 C/O contact)

Upgrades:

MVX can be upgraded to a more performing model or to a model with more measurement channels (please contact us).

Contents:

OneProd-MVX is delivered with:

- A 5-meter Ethernet cable
- The **OneProd-CSM** configuration software
- The **OneProd-VIO** visual display software, version limited to a single MVX unit
- The **OneProd-CAST** software toolbox
- User manuals in French and English (on CD-ROM)

11 Appendix: Easy / Premium operating differences

Function	OneProd-MVX EASY	OneProd-MVX PREMIUM
Time acquisition	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Spectral acquisition	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Continuous monitoring	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Periodic acquisition	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Taking into account of operating conditions	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Elaboration of “standard” indicators (*)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Elaboration of indicators based on other filters		<input checked="" type="checkbox"/>
Elaboration of Kurtosis indicators		<input checked="" type="checkbox"/>
Elaboration of Smax _{pp} indicators		<input checked="" type="checkbox"/>
Elaboration of <i>Blade Guard Index</i> (BGI)		<input checked="" type="checkbox"/>
Elaboration of <i>Shock Finder Index</i> (SFI)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Elaboration of <i>Gearbox Condition Index</i> (GCI)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Calculation of the RMS value	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Calculation of the “equivalent peak” value	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Calculation of the “equivalent peak-to-peak” value	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Calculation of the “true peak” value		<input checked="" type="checkbox"/>
Calculation of the “true peak-to-peak” value		<input checked="" type="checkbox"/>
Calculation of broad-band indicators from spectrum		<input checked="" type="checkbox"/>
Calculation of narrow-band indicators from spectrum		<input checked="" type="checkbox"/>
Envelope spectra		<input checked="" type="checkbox"/>
Short term trend	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ESA (requires DAT option and XPR software)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Real time monitoring capability : 100% of signal		<input checked="" type="checkbox"/>
Time wave on event with pre-trigger		<input checked="" type="checkbox"/> Requires DAT option
DAT mode (long time signal)	(Option)	(Option)

(*): List of “standard” indicators:

- Broad-band 2Hz / 20kHz acceleration
- HF 3kHz / 20kHz acceleration
- 2Hz / 1000Hz velocity
- 10Hz / 1000Hz velocity
- 2Hz / 1000Hz absolute displacement
- 10Hz / 1000Hz absolute displacement
- 2Hz / 20kHz relative displacement
- Relative position (GAP)
- Bearing defect factor