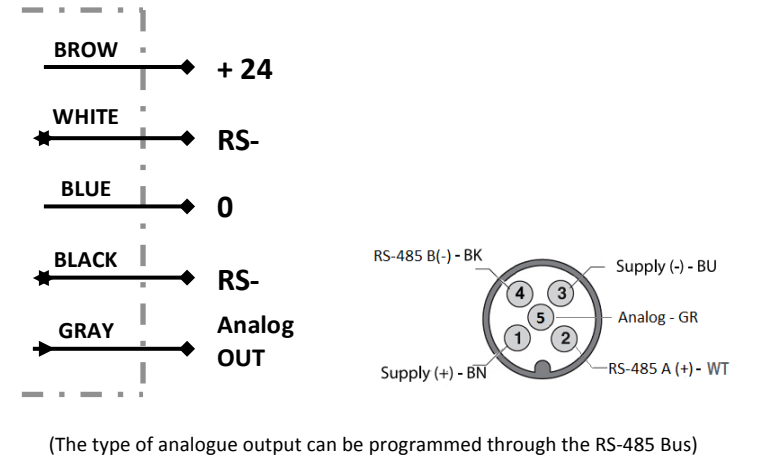


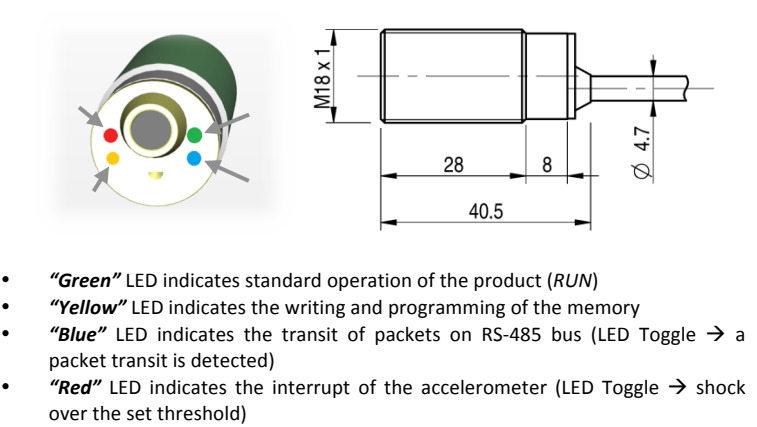
GENERAL DESCRIPTION

Sensor based on MEMS technology (*Micro Electro-Mechanical Systems*) to monitor shock, vibrations and tilt.

ELECTRICAL DIAGRAM OF THE CONNECTIONS



USER INTERFACE



RS-485 COMMANDS LIST

During the standard operation of the product (*RUN*), it is always possible to send RS-485 command to the product if the RS-485 communication is available.

COMMANDS WITH EXTENDED SYNTAX (HEX)

- (0x70) SET of the value sent as “node number”.
- Ex. 0x23 0x74 0x80 0x70 0x00 0x01 0x88 0x65 → 0x40 0x70 (ACK)

- NB. The node numbers may change in the range “0..126”.
- (0x36) SET of the threshold value of the accelerometer (0..127)
 - (0x37) SET of the minimum value of the recognized interrupt duration (0..127)
 - (0x38) SET of the accelerometer full scale value (0..3)

- NB. The possible full scale value of the accelerometer are:
- 0 → +/- 2 g
 - 1 → +/- 4 g
 - 2 → +/- 8 g
 - 3 → +/- 16 g

- Ex. SET of the full scale value at +/- 2 g:
- 0x23 0x74 0x80 0x38 0x00 0x00 0x4F 0x65 → 0x40 0x38 (ACK)
- (To store the parameters, send always the save command)

COMMANDS WITH SHORT SYNTAX (HEX)

- (0xAA) Save the current configuration of the product
- (0xBB) Re-call last saved configuration
- (0xBC) Restore factory settings
- (0x4D) GET sensor model (*reserved*)
- (0x4E) GET sensor hardware revision (*reserved*)

NB. Restoring the factory settings brings the product to the default values and overwrites all saved configurations.

- (0x80) SET of the voltage analogue output with scale 0..10V
- (0x81) SET of the voltage analogue output with scale 0..5V
- (0x82) SET of the current analogue output with scale 4..20mA
- (0x83) SET of the analogue output in high impedance
- (0x84) SET of the current analogue output with scale 0..20 mA
- (0x85) SET of the current analogue output with scale 0..24 mA

- (0x46) SET of NORMAL behaviour
- (0x47) SET of TOGGLING behaviour
- (0x48) SET of IMPULSE behaviour

- (0x28) ECHO command
- (0x34) SET of the interrupt state on RS-485 ON
 - (0x44) SET of the interrupt state on RS-485 and ANALOGUE ON
 - (0x45) SET of the interrupt state on ANALOGUE ON
 - (0x35) SET of the interrupt state OFF

- (0x90) SET analogue output on values of X axes acceleration
- (0x91) SET analogue output on values of Y axes acceleration
- (0x92) SET analogue output on values of Z axes acceleration

- (0x30) GET of the interrupt state:
0x00 → OFF
0x01 → ON RS-485
0x02 → ON ANALOGUE OUT
0x03 → ON ANALOGUE + RS-485

- (0x4A) GET of the reference axes for the analogue output:
0x00 → X Axes
0x01 → Y Axes
0x02 → Z Axes

- (0x4B) GET of analogue output typology:
0x00 → High impedance
0x01 → Voltage with scale 0..5 V
0x02 → Voltage with scale 0..10 V
0x03 → Current with scale 4..20 mA
0x04 → Current with scale 0..20 mA
0x05 → Current with scale 4..24 mA

- (0x4C) GET behaviour typology:
0x00 → NORMAL
0x01 → TOGGLING
0x02 → IMPULSE

- (0x31) GET of the threshold value of the accelerometer (0..127)
- (0x32) GET of the minimum value of the recognized interrupt duration (0..127)
- (0x33) GET of the accelerometer full scale value (0..3)

These GET commands respond with an ACK followed by 1 byte containing the requested value.

- Ex. GET THRESHOLD → 0x40 0x23 (= 35 decimal)
- (0x39) GET of the positive peak values
 - (0x3A) GET of the negative peak values
- (0x3B) GET of the average values (in a slot of 1024 samples)

The GET of the values responds with an ACK followed by 6 bytes containing the values of the recorded accelerations. The first 2 bytes of data (16 bits expressed in a complement of 2) are referred to the X axis, the following 2 bytes to the Y axis and the remaining 2, to the Z axis:

GET POSITIVE PEAK → 0x40 0x00 0x01 0x00 0x02 0x00 0x03

(X=1, Y=2, Z=3)

Each reading of the peak values (positive or negative) resets the value of the related variable in order to recalculate the data since the last query.

- (0x50) GET CONTINUOUS of the values of the 3 axis
- (0x55) GET BURST of 1000 data of the values of the 3 axis

NB. The "CONTINUOUS" command stops the bidirectional communication with the sensor and saturates the RS-485 bus with the data of acceleration at the maximum sampling rate of the sensor: 400Hz. To restore communication it is necessary to switch off and on the sensor.

- (0x51) GET of the current values of acceleration of the 3 axes
- (0x52) GET of the current values of acceleration of the X axis
- (0x53) GET of the current values of acceleration of the Y axis
- (0x54) GET of the current values of acceleration of the Z axis

The GET of these values are for polling management at a low frequency and when they are referred to the single axis (X or Y or Z), the command responds with an ACK followed by 2 bytes which contain the values of the recorded accelerations:

- Ex. GET VALUES X AXIS → 0x40 0x00 0x01 (X = 1)
- (0x59) GET accelerometer temperature

The GET temperature value responds with an ACK followed by 1 byte that contains the required value in complement of 2 and 0x00 corresponding to 25 ° C. The boundary values are -40°C and + 85°C.

Ex. GET TEMPERATURE → 0x40 0x0A (= +35°C)

INTERRUPT (Threshold and Duration)

The "interrupt" function works in an continuous basis and all the values within the sampling frequency (400 Hz) are compared with the "threshold" and "duration" parameters. If an acceleration exceeds the set "threshold" for a period longer than the "duration" an alarm is generated.

DURATION

The “duration” value is selectable on 128 levels (0..127) with a step of approximately 2,5msec.

Ex. To get an alarm by an acceleration exceeding the "threshold" for a period longer than 30msec it is necessary to set the value of "duration" to 12:

30msec / 2,5msec = 12

THRESHOLD

Since the accelerometer can be programmed with 4 different full scale values (2g, 4g, 8g and 16g) and the threshold value is 128-level, the step of resolution is calculated by dividing the full scale value for 128:

- 2g → 2000mg / 128 = 15,625 mg
- 4g → 4000mg / 128 = 31,25 mg
- 8g → 8000mg / 128 = 62,5 mg
- 16g → 16000mg / 128 = 125 mg

Ex. To get an alarm by an acceleration exceeding the "threshold" of 2g with a full scale of 4g:

2000 mg / (resolution of 4g) = level → 2000 mg / 31,25mg = 64 (decimal)

The “Red” LED of the transmitter is switched on at each "interrupt" event. This can be associated or not to the sending of an alarm packet on RS-485 bus.

INTERRUPT ON RS-485

NB. In order to have the alarms propagation on the bus, it is necessary to enable one of the following management interrupt:

- interrupt enabled only on RS-485
- interrupt enabled on RS-485 and ANALOGUE

(make reference to the RS-485 commands list)

NB. Take into account that, if the system was configured with too low alarm values, these values would be generated on a continuous basis up to saturate the RS-485 bus.

Ex. Alarm packet on RS-485 → 0x40 0x00 0x3C (ACK + NODO + 0x3C)

Each alarm on RS-485 bus generates a packet consisting of an ACK followed by the NODE number of the sensor and the byte 0x3C (= alarm).

INTERRUPT WITH ANALOGUE OUTPUT

The analogue output of the sensor has 3 different functioning modalities:

- NORMAL
- TOGGLING
- IMPULSE

In the TOGGLING and IMPULSE mode, the analog output does not show the trend of vibration and it operates only with the minimum and maximum level of its configuration.

Ex. Output configured in VOLTAGE 0..10 V:

- minimum → 0 V
- maximum → 10 V

NB. In order to have the alarms propagation on the analogue output it is necessary, first of all, to choose the desired behaviour (TOGGLING or IMPULSE) and then enable one of the following interrupt management:

- interrupt enabled only on ANALOGUE
- interrupt enabled on RS-485 and ANALOGUE

(make reference to the RS-485 commands list)

NORMAL

The analog output does not propagate any alarm and it follows the standard trend of the acceleration both if the interrupt on analogue is enabled or not.

TOGGLING

Any acceleration that exceeds the value of "threshold" and "duration", causes the alarm condition and therefore, the output state is alternately switched between a "minimum" and a "maximum" value.

IMPULSE

In this behavior, the analog output is always on the "minimum" value. Each excess of the "threshold" and "duration" value, the output is switched to the "maximum" and maintained "high" for at least 5msec and then back to the "minimum".

NB. This behavior limits the frequency of alarm acknowledgment.

Ex. Two consecutive alarms with a time interval less than 5msec can’t be both reported in the output.