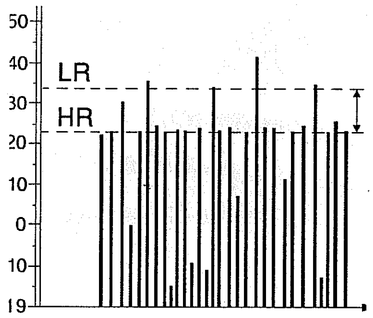
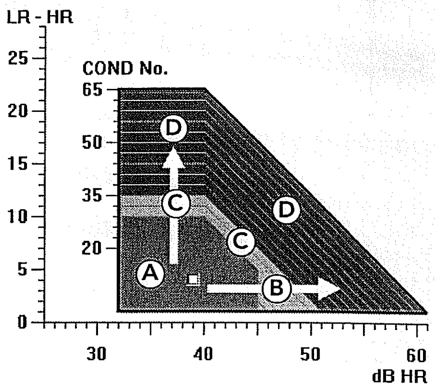
LR/HR





LR measured value for strong shock pulses

HR measured value for weak shock pulses

LR-HR delta value

dBsv unit for absolute shock pulse value

CODE A good condition

CODE B caution, dry running

CODE C caution, damage developing

CODE D bad condition

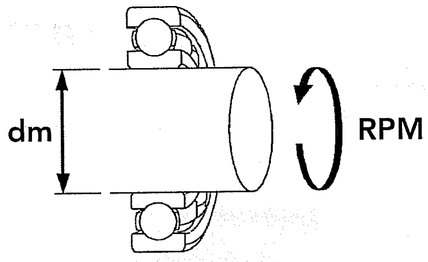
The LR/HR technique

The value for the noise carpet (HR) is read at an occurrence rate of approx. 1000 pulses/second, the value for the strong shock pulses (LR) at approx. 40 pulses/second. This makes LR an average value of the strong pulses, lower than the maximum, and thus reduces the dynamic range. Both HR and LR are "raw values" in dBsv (unnormalized shock value). They do not express bearing condition directly.

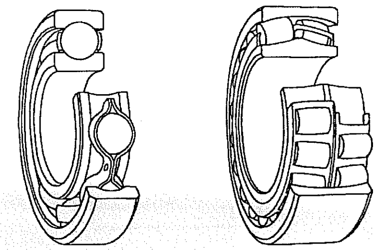
The evaluated measuring result is given as three codes:

- CODE A, B, C, D where A = good condition, B = dry running, C = beginning damage, D = damage. With CODE A, the green LED is lit, with CODE B and C, the yellow LED, with CODE D, the red LED.
- LUB lubrication number, shown with CODE A, B, C. LUB 0 = dry running, 3 = good lubrication for ball bearings, 5 = good lubrication for roller bearings. The higher the number, the thicker the oil film in the rolling interface.
- COND condition number, shown with CODE C, D and increasing with the degree of bearing damage.

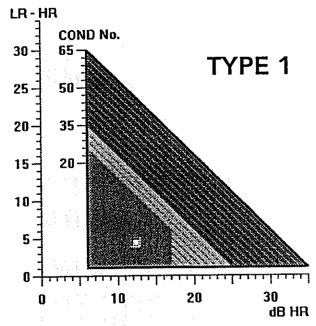
LR/HR

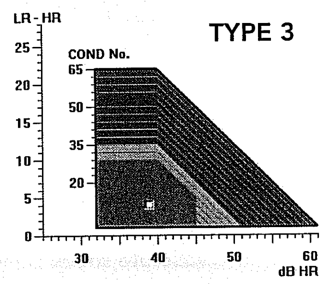


The NORM no. depends on RPM and mean bearing diameter dm.



The TYPE no. depends on bearing geometry





NORM and TYPE determine the scale and shape of the evaluation frame

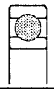
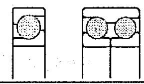
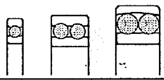
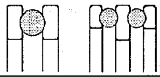
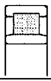
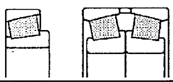
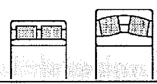
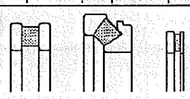
NORM and TYPE for LR/HR evaluation

To evaluate the measured shock pulse pattern, one needs the NORM number and the TYPE number of the bearing. The absolute shock pulse level of a bearing, measured in dBsv (decibel shock value), is both a function of rolling velocity and of bearing condition. To neutralize the effect of rolling velocity on the measured value, the MG4 has to be programmed with mean diameter (in millimetre or inch) and rotational speed (in rpm). From this data it calculates the NORM no. (which can also be input directly if known).

The SPM TYPE no. defines the bearing geometry (see next page). The TYPE number determines the shape of the evaluation frame, while the NORM number moves the frame in relation to the unnormalized measuring scale for shock pulses.

An undamaged, correctly installed, lubricated and loaded bearing should have LR/HR values which place it close to the centre of the green zone inside the evaluation frame. Please note that this also requires a signal from a correct SPM measuring point. A dampened signal (or a minimal load on the bearing) tends to place the bearing too far to the left of the centre.

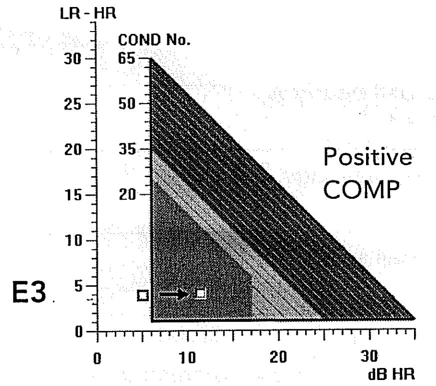
LR/HR

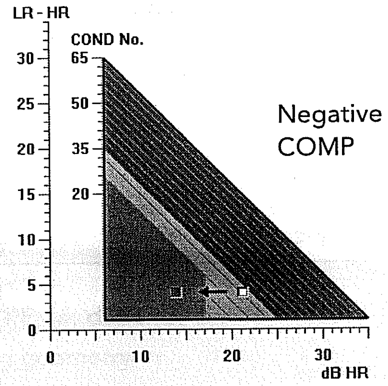
	1	Deep groove ball bearings, series 62, 63, 64
	2	Angular contact bearings, all series
	3	Deep groove ball series 60, 160, 618, double row and self-aligning ball bearings
	4	Thrust ball bearings, all types
	5	Cylindrical roller bearings, single row
	6	Taper roller bearings, all radial types
	7	Spherical roller bearings Double row cylindrical roller bearings
	8	Thrust roller bearings

Bearing TYPE numbers

The HR level shock pulses vary with the shape and number of the rolling elements in the bearing. This becomes important when estimating the oil film thickness in the rolling interface. The largest influencing factor is the shape of the contact area. In ball bearings, the rolling element has point contact with the raceways. In roller bearings, there is line contact, which means that the area under pressure, where the shock pulses occur, is much larger.

For SPM purposes, bearings are grouped into 8 different types, each with a TYPE number 1 through 8. The types are described in the table above.





LR/HR

Acc (accumulation): 1 to 9

COMP (compensation): –15 to 30

Calculate COMP with LUBMASTER, else do not use this function

Avoid negative COMP numbers!

COMP and Acc

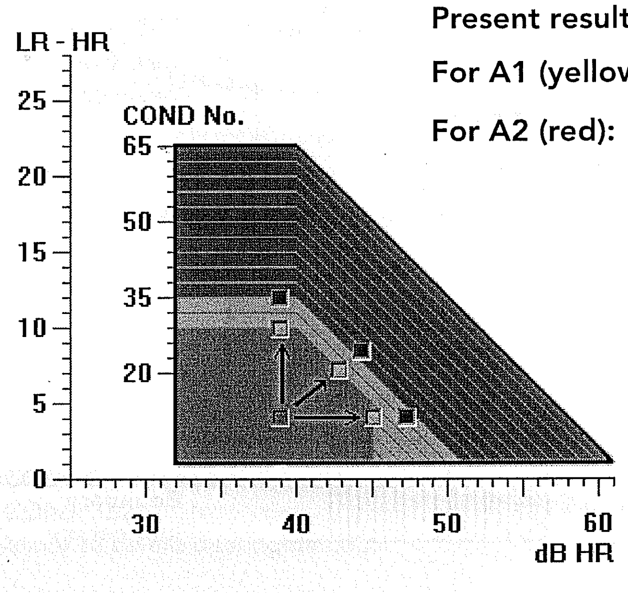
Above the basic input data, you can set a value for COMP and Acc.

Acc (accumulation) determines the number of measuring cycles before the MG4 displays the reading with the mean LR value as result. Acc can be set from 1 to 9. Especially on bearings with a low RPM, set Acc to at least 3.

The COMP no. (compensation number) is used to calibrate the measuring point, to compensate for a somewhat weaker signal from a measuring point that does not quite comply with the SPM rules. A weak signal can place the bearing outside of and to the left of the evaluation frame. Typical cases are fan side bearings on electric motors, which often do not carry any load. The result is the error code E3, meaning "signal too low". The COMP number is automatically added to the values for LR and HR before these are evaluated. Thus, it will influence the evaluation results CODE, LUB, and COND, but not the displayed values for HR and LR.

To find the correct COMP no., you should use the LUBMASTER function in Condmaster® or a Shock Pulse Analyzer). If you cannot do that, only used the COMP to get rid of the error code E3. First make sure that your transducer is working (by knocking on the bearing housing to produce a signal), then increase COMP to the value where you get a CODE A instead of E3. Relubricate the bearing. This should, at least temporarily, produce lower shock values. Increase COMP in case you are back on E3.

It is possible to set negative COMP nos., but you should avoid that. With a positive COMP no., you make the evaluation results worse than apparent from the measured LR/HR values. With a negative COND. no., you "improve" bearing condition, which can have unpleasant consequences if you are wrong in assuming that the signal from this bearing is stronger than normal. To avoid alarm from a bearing with stable high readings, it is better to change the alarm levels.



Present result:	**CODE A**
For A1 (yellow):	**LR or HR +6**
For A2 (red):	**LR or HR +8**

Alarm values on LR or HR

The alarm limits A1 (yellow alarm) and A2 (red alarm) must be set on either the LR or the HR value of the bearing. Without using the LUBMASTER functions in Condmaster®, you cannot know the precise location of the bearing within the evaluation frame. Receiving a CODE A, however, tells you that it is within the green zone, so you can take the present LR/HR values as a baseline and add a standard value to determine the alarm setting.

At best, the dynamic range between green and yellow is about 10 dBsv. To be on the safe side, SPM recommends to use the LR (or HR) value displayed with CODE A and add 6 for yellow alarm and 8 for red alarm.

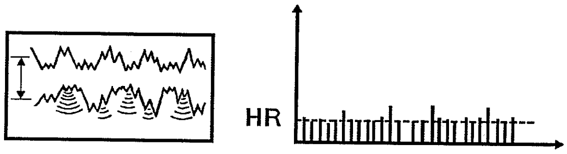
On receiving CODE B or C, you already have a yellow alarm, and CODE D means red alarm, so you know the significance of the corresponding values for LR and HR.

Please note: The general SPM rule, that high shock pulse values must be verified by trying to exclude disturbance, making a lubrication test, etc., is also valid for the MG4. If you cannot use an SPM hand-held instrument for making these tests, please request your SPM representative to help you obtain reliable base line readings before installing the MG4.

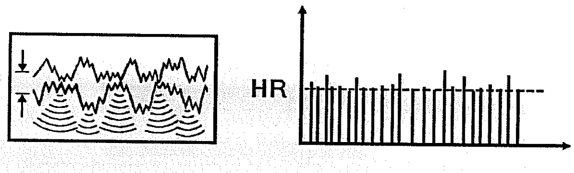
LR/HR

LUB	Ball	Roller
0	Dry running	Dry running
1 to 2	Boundary lubrication	Boundary lubrication
3 to 4	Full lubrication	
> 4		Full lubrication

LUB no. for ball and roller bearings



Full lubrication



Boundary lubrication

The LUB number

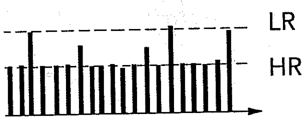
The most important influence on the service life of a bearing is the lubricant film between the load carrying rolling elements and the raceway. By preventing or inhibiting metallic contact between the loaded bearing parts, the lubricant film reduces the local peak stress in the rolling interface. The greater the lubricant film thickness, the more even the load distribution in the contact area, and the better the fatigue life of the bearing.

Irregularities in the bearing surfaces will always cause pressure variations in the contact area, and thus shock pulses, even when metallic contact is prevented by a separating lubricant film. A thinner film will result in an increase of the bearing's HR value.

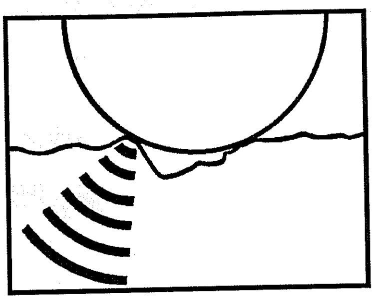
The LUB no., displayed with CODE A and B, is directly proportional to oil film thickness. LUB no. 0 means dry running condition. The interpretation of LUB nos. between 1 and 4 depends on the bearing type. For ball bearings, a LUB no. greater than 2 mean full lubrication (a load carrying oil film). For roller bearings, a LUB no. greater than 4 indicates full lubrication.

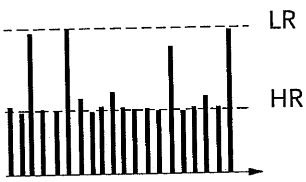
The term boundary lubrication implies that part of the load is carried by metal to metal contact. The amount of lubricant in or supplied to the bearing is only one of the many factors that determine lubricant film thickness. Lubricant type and the bearing's rpm are of great importance, but also the geometry of bearing parts and housing, as well as the load put on the bearing by alignment and fitting.

LR/HR



CODE C
COND <32
Beginning bearing damage





CODE C
COND >32
Minor to severe bearing damage

Error codes
E2 Disturbance
E3 Signal too low

The COND number and error codes

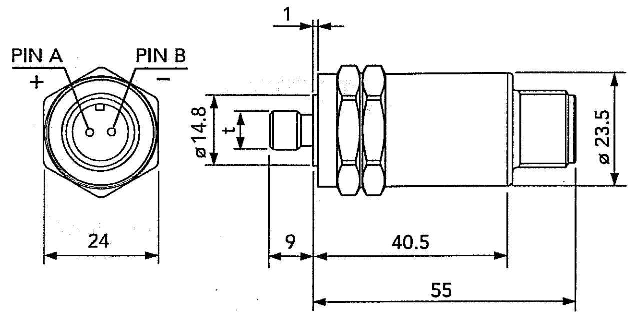
The COND no. (condition number) is displayed with CODE B, C, and D, i.e. for all bearings with reduced or bad condition. It indicates the degree of surface deterioration or damage in the rolling interface. When delta values are low and the CODE goes from A to B because of poor lubrication, you can get COND nos. as low as 11, 12. With CODE C, the Cond no. will start at about 29, 30.

When a CODE D and a COND number is displayed, the bearing should be watched very carefully. Once damage has started, it cannot be reversed. Temporary improvements of the COND no. only mean that the edges of fresh spallings or imprints have been rounded off. Soon, there will be new spallings. The time left to plan a bearing replacement depends on the trend of the COND no. As a rule, COND nos. should be interpreted as follows:

COND no. < 30	Minor damage
COND no. 30 to 40	Increasing damage
COND no. > 40	Severe damage

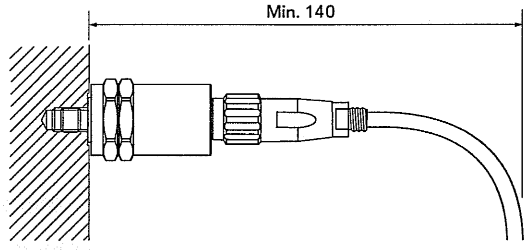
When the measured signal is not within the evaluation frame, the MG4 will display error codes. E2 is displayed when HR > LR, which normally means a high, even disturbance signal such as pump cavitation or a screaming steam box. E3 = signal too low can often be remedied by setting a COMP number.

SPM Instrument AB • Box 504 • SE-645 25 Strängnäs • Sweden
Tel +46 152 225 00 • Fax +46 152 15075 • info@spminstrument.se • www.spminstrument.com



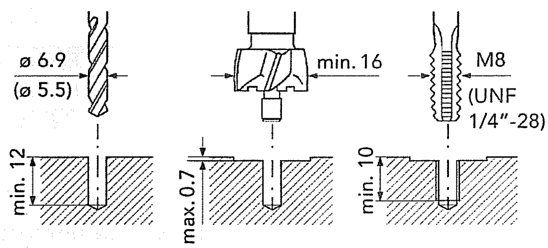
VIB Transducers, Series SLD

The vibration transducers series SLD100 are piezo-electric accelerometers of compression type with built-in electronics, designed for vibration monitoring of industrial machinery. The transducer is mounted against a smooth, flat surface on the machine. The electrical signal is isolated from the transducer housing.



Technical data

Transverse sensitivity:	max. 10%
Typical base strain sensitivity:	0.01 m/s²/µ strain
Max. peak acceleration:	600 m/s² = 60 g
Settling time:	3 sec
Temperature range:	–40° C to +125° C (–40° F to 260° F)
Power requirements:	12 to 24 V, 2 to 5 mA
Casing:	Stainless acid proof steel
Sealing:	IP 67 together with appropriate connector
Isolation:	Case isolated, > 1 Mohm
Torque limit:	10 Nm (7.4 lbf·ft)
Weight:	110 grams (4 oz)



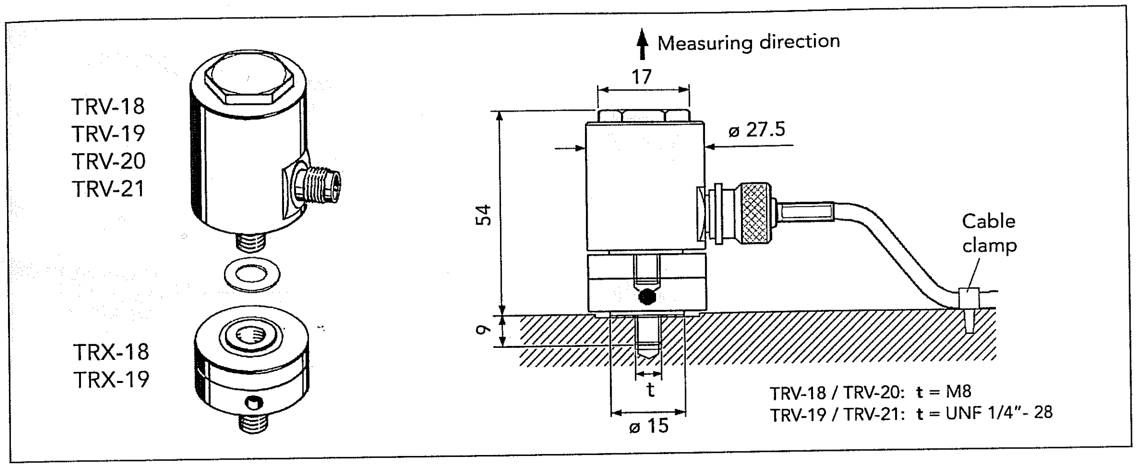
Mounting tools

81027 Holder for counterbore
81057 Counterbore, diameter 20 mm
81030 Pilot for UNF 1/4"
81031 Pilot for M8

To drill the mounting hole, use drill bit 6.9 mm (M8) or 5.5 mm (UNF 1/4"). Torque the transducer with a 24 mm torque wrench.

Article number	Connector type	Thread (t)	Frequency range	Sensitivity (±1 dB) *	Bias (typical)
SLD 121 B	2-pin	M8	2 – 1000 Hz	1.2 mV/m/s² = 12 mV/g	6 – 9 V (8 V)
SLD 121 F	2-pin	UNF ¼"	2 – 1000 Hz	1.2 mV/m/s² = 12 mV/g	6 – 9 V (8 V)
SLD122 B	2-pin	M8	2 – 5000 Hz	4 mV/m/s² = 40 mV/g	6 – 9 V (8 V)
SLD122 F	2-pin	UNF ¼"	2 – 5000 Hz	4 mV/m/s² = 40 mV/g	6 – 9 V (8 V)
SLD144 B	2-pin	M8	2 – 10 000 Hz	10 mV/m/s² = 100 mV/g	11 – 13 V (12 V)
SLD144 F	2-pin	UNF ¼"	2 – 10 000 Hz	10 mV/m/s² = 100 mV/g	11 – 13 V (12 V)

* Individual value given on the calibration chart.

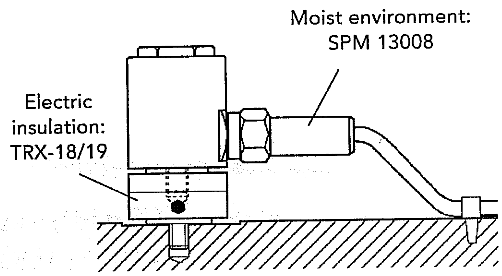


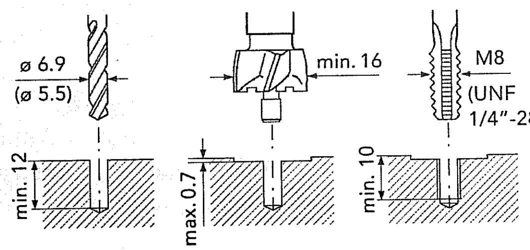
VIB Transducers, Series TRV

The vibration transducers series TRV are piezoelectric accelerometers of compression type with built-in preamplifier, designed for vibration monitoring of industrial machinery. The cable length between transducer and measuring unit is max. 50m (165 ft).

The transducer is mounted against a smooth, flat surface on the machine. TRV-18/20 has thread size M8 and TRV-19/21 has UNF 1/4"-28. The transducers are delivered with three washers for adjusting the connector angle. Each washer turns the transducer 90°. The coaxial cable (SPM 90005-L or 90267-L) with TNC connector must be secured with a clamp close to the transducer.

In moist environments, use sealing TNC cable plugs SPM 13008 to prevent cable corrosion. For electric insulation, use insulation foot TRX-18/19.





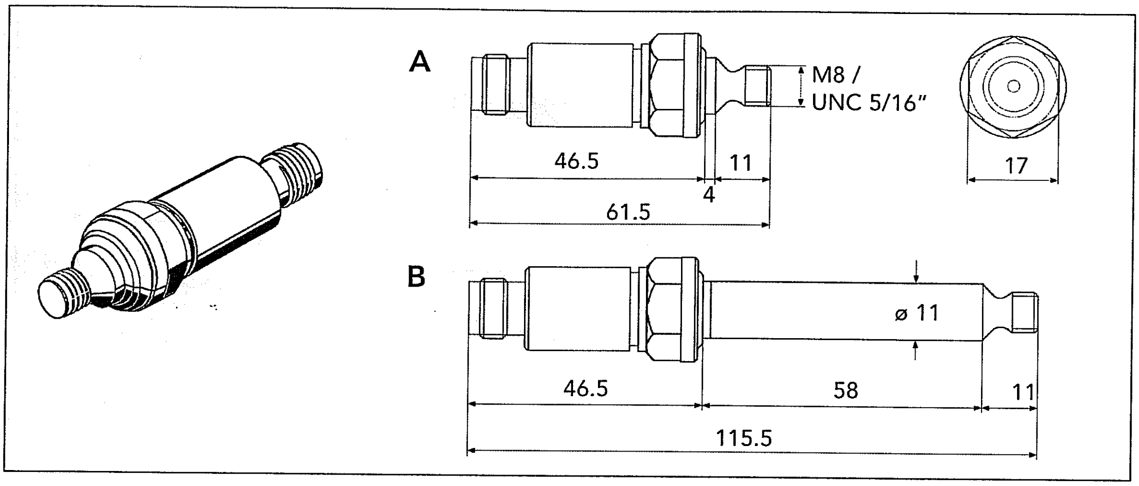
Technical data

Nom. sensitivity, main axis	
TRV-18, TRV-19:	1,2 mV/m/s² *
TRV-20, TRV-21:	4,0 mV/m/s² *
Transverse sensitivity:	max. 10%
Typical basestrain sensitivity:	0.01 m/s²/µ strain
Linear frequency range	
TRV-18, TRV-19	3 to 1000 Hz
TRV-20, TRV-21	2 to 5000 Hz
Max. peak acceleration:	600 m/s²
Temperature range:	–20 to +125 °C (-4 to +260 °F)
Typical temperature drift:	0.25%/°C
Casing:	Stainless steel, acid proof, AISI 316 (SS 2382)
Design:	Sealed
Weight:	135 grams (5 oz)
Connector type:	TNC
Torque limit:	10 Nm (7.4 lbf/ft)

* Individual value given on the calibration chart.

Tools for mounting

81027	Holder for counterbore
81057	Counterbore, diam. 20 mm
81030	Pilot for UNF 1/4"
81031	Pilot for M8



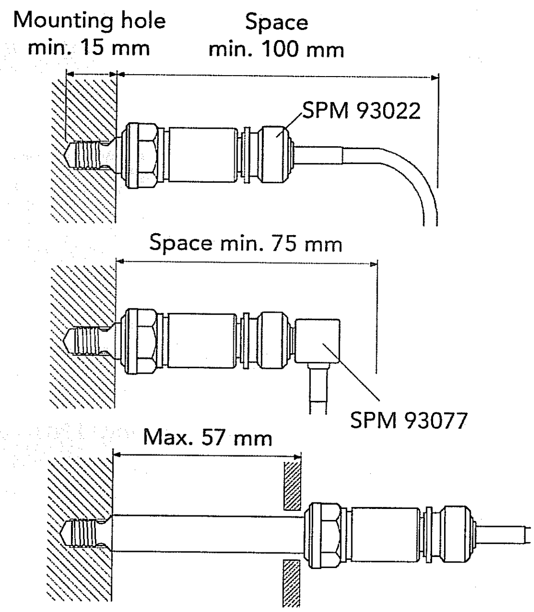
SPM transducer 40000

Standard shock pulse transducers are used in all permanent SPM installations for bearing monitoring. They are installed in countersunk mounting holes on the bearing housings.

A shock pulse transducer converts the shock pulses emitted by the bearing into electric signals. A coaxial cable connects the transducer with a measuring terminal or measuring device. Max. cable length is 4 m.

Transducer housing and base are made of stainless acid proof steel, suitable for aggressive environments. Standard thread size is M8, with UNC 5/16" as an alternative. Standard length (A) is 61.5 mm. A long transducer (B), length 115.5 mm, is used to reach bearing housings beneath protective covers.

The transducer is normally connected with a TNC plug, SPM 93022. A TNC angle plug, SPM 93077, can be used in narrow spaces. To prevent cable corrosion in moist environments, the coaxial cable must be connected with a sealing TNC plug, SPM 13008.

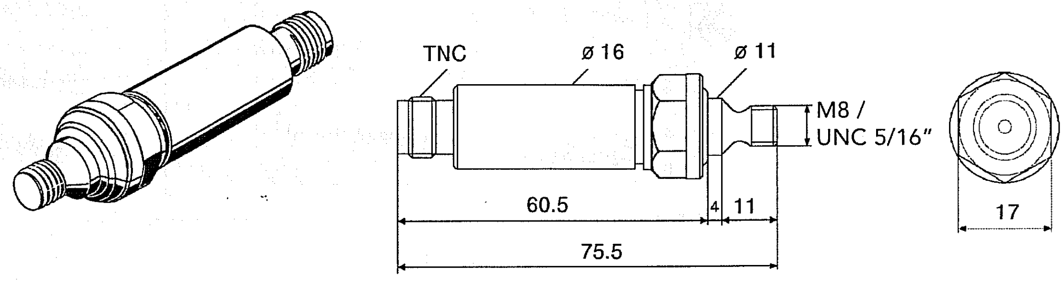


Ordering numbers

40000	Standard shock pulse transducer, M8
40100	Standard shock pulse transducer, UNC 5/16"
40001	Standard shock pulse transducer, M8, extended
40101	Standard shock pulse transducer, UNC 5/16", extended

Technical data

Measuring range:	Max. 100 dBsv
Housing, base:	Stainless steel, SS 2382
Design:	Sealed
Temperature range:	–30 to +150 °C
External overpressure:	Max. 1 MPa (10 bar)
Torque:	15 Nm, max. 20 Nm
Connector:	TNC jack



SPM transducer 42000

The shock pulse transducer with TMU is used in permanent SPM installations for bearing monitoring, in cases where the cable length between transducer and measuring unit exceeds 4 m. This allows a cable length of max. 100 m. The transducer with TMU is installed in a countersunk mounting hole on the bearing housing, in the same way as a standard transducer.

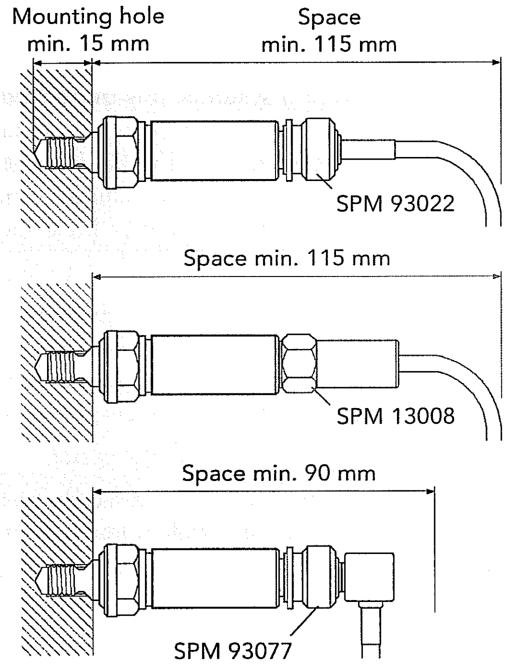
A shock pulse transducer with TMU (TMU = Transducer Matching Unit) converts the shock pulses emitted by the bearing into an electric signal, and stabilizes the signal for transmission via a long cable. A coaxial cable connects the transducer with a measuring terminal or measuring device.

Transducer housing and base are made of stainless, acid proof steel (SS 2382), suitable for aggressive environments. Thread size is M8, with UNC 5/16" as an alternative.

The transducer is normally connected with a TNC plug, SPM 93022. In moist environments, the coaxial cable must be connected with a sealing TNC plug, SPM 13008. A TNC angle plug, SPM 93077, can be used in narrow spaces.

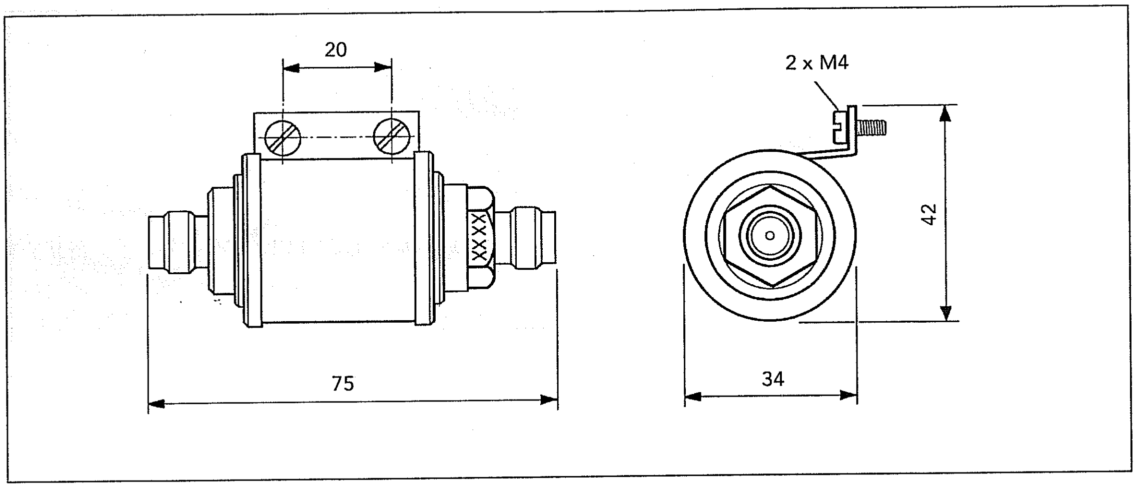
Ordering numbers

42000	Shock pulse transducer with TMU, M8
42100	Shock pulse transducer with TMU, UNC 5/16"

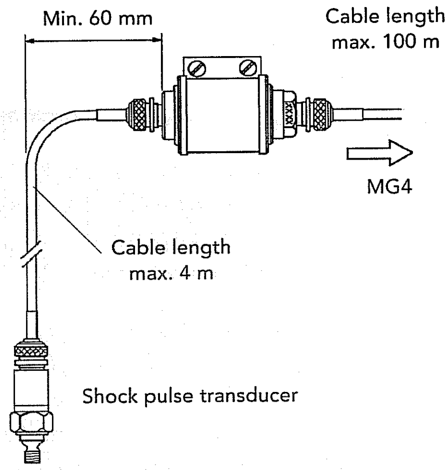


Technical data

Measuring range:	Max. 100 dBsv
Housing, base:	Stainless steel, SS 2382
Design:	Sealed
Temperature range:	–30 to +100 °C
External overpressure:	Max. 0.7 MPa (7 bar)
Torque:	15 Nm, max. 20 Nm
Connector:	TNC jack



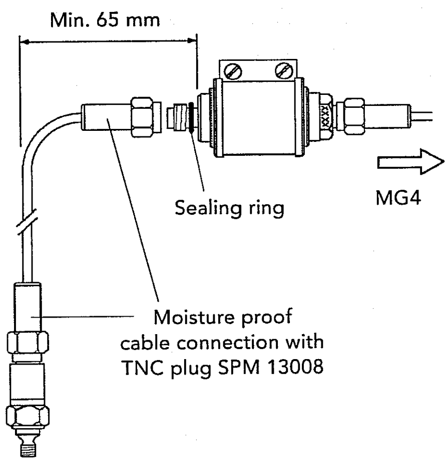
Transducer matching unit TMU-12



Transducer Matching Unit TMU-12 is an impedance converter for all permanently installed SPM bearing monitoring systems. It is placed between the shock pulse transducer and the measuring device. The bracket on the TMU is fastened with two mounting screws to the machine or machine foundation. The round connector base faces towards the transducer.

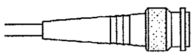
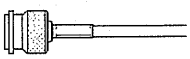
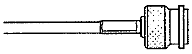
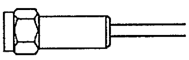
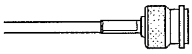
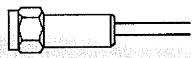
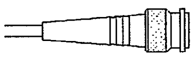
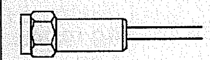
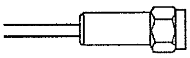
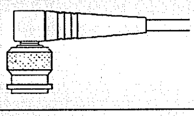
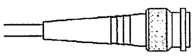
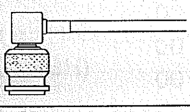
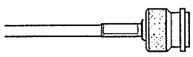
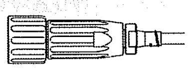
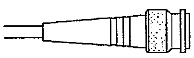
A TMU is used to extend the length of the coaxial cable between transducer and measuring device from max. 4 m to max. 100 m. The distance between the TMU and the transducer is always max. 4 m.

TMU-12 is suitable for both chemically basic and acid environments. For installations in moist environments, it is necessary to use sealing TNC cable plugs SPM 13008 to prevent cable corrosion.



Technical data

Casing	Stainless steel AISI 316, and fluor rubber
Sealing	IP 65 with TNC connector IP 67 with connector SPM 13008
Temperature range	–30 to +100 °C
Dimensions	75 x ø34 mm
Weight	140 grams
Connectors	TNC jacks
Cable length	Max. 100 m
Fastening screws	2 x M4, stainless steel

	Transducer Connector type	Coaxial cable data	TNC Connector type	
45011-L 	Straight crimp 93022 PVC sleeve 81018	PVC cable –25 to +70 °C ø 5 mm SPM 90005	Straight crimp 93022 PVC sleeve 81018	
45300-L 	Straight crimp 93022	PVF cable –55 to +150 °C ø 4 mm SPM 90267	Straight crimp 93022	
46058-L 	Sealing connector 13008	PVC cable –25 to +70 °C ø 5 mm SPM 90005	Straight crimp 93022	
46041-L 	Sealing connector 13008	PVF cable –55 to +150 °C ø 4 mm SPM 90267	Straight crimp 93022 PVC sleeve 81018	
47125-L 	Sealing connector 13008	PVF cable –55 to +150 °C ø 4 mm SPM 90267	Sealing connector 13008	
46012-L 	Angle crimp 93077 PVC sleeve 81018	PVC cable –25 to +70 °C ø 5 mm SPM 90005	Straight crimp 93022 PVC sleeve 81018	
46057-L 	Angle crimp 93077	PVF cable –55 to +150 °C ø 4 mm SPM 90267	Straight crimp 93022	
46081-L 	2-pin connector 15168	PVC cable –25 to +70 °C ø 5 mm SPM 90005	Straight crimp 93022 PVC sleeve 81018	

Standard cables for transducers

This is the range of ready made standard cables used for permanently installed vibration transducers and shock pulse transducers. When ordering, please state the desired cable length (L) in meters.

Protocol for Modbus network using RTU

In a Modbus network using RTU (Remote Terminal Unit) mode, each 8–bit byte in a message contains two 4–bit hexadecimal characters. Each message must be transmitted in a continuous stream.

Communication and hook-up

RS-485 port. Baud rate configurable 1200, 2400, 4800, 9600, 19200, 38400 and 57600 bps, default setting 9600 bps.
Bi-directional master-slave communication over a single set of screened twisted pair cables.
Max. line length per segment 1200 meters (4000 feet).
Differential transmission (balanced lines) with high resistance against noise.
Maximum 32 nodes per segment.
Parallel connected nodes, true multi-drop.

Initial settings

In a RS-485 network, all modules must have a unique address ID. Every MG4 has an initial factory setting as described below:

1. Address ID:	01
2. Baud rate:	9600 bps
3. Parity:	None
4. Checksum:	On

Byte format

The format for each byte in RTU mode is:

Coding system

8–bit binary, hexadecimal 0–9, A–F.
Two hexadecimal characters contained in each 8–bit field of the message.

Bits in a byte

1 start bit.

8 data bits, least significant bit sent first.

1 bit for even/odd parity; no bit for no parity.

1 stop bit if parity is used; 2 stop bits if no parity.

Error check field

Cyclical Redundancy Check (CRC).

Function codes supported

Function 03 (Hex): Reading data
Reads the binary contents of a data register in the MG4. Broadcast is not supported.

Query

The query message specifies the starting register and quantity of registers to be read. The registers are addressed starting at zero.
The number of registers in the MG4 is 0 – 13.

Query example :

Address	addr
Function	03H
Start address Hi	00
Start address Lo	00
Number of registers	00
Number of registers	02
crc16	
crc16	

Response

The register data in the response message are packed as two bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the second contains the low order bits.

Response example:

Address	addr
Function	03H
Number of data bytes	04
Data Hi	Register 0
Data Lo	Register 0
Data Hi	Register 1
Data Lo	Register 1
crc16Hi	
crc16Lo	

Registers

Registers in MG4-1, MG4-2, MG4-12 and MG4-22:

0 Measured value on VIB channel 1
1 Measured value on VIB channel 2
2 Measured value on SPM channel 1
3 Measured value on SPM channel 2
4 Alarm flags and system errors
5 MG4 unit type ID
6 Alarm level A1 on VIB channel 1
7 Alarm level A2 on VIB channel 1
8 Alarm level A1 on VIB channel 2
9 Alarm level A2 on VIB channel 2
10 Alarm level A1 on SPM channel 1
11 Alarm level A2 on SPM channel 1
12 Alarm level A1 on SPM channel 2
13 Alarm level A2 on SPM channel 2

VIB registers (0, 1)
VIB measurement, value range 0 – 50.0 mm/s = register value 0 –500 (0 – 01F4H).

SPM registers (2, 3)
SPM measurement, value range 0 – 99 dBsv

Data Hi register = measured value dBm/LR (0 – 63H)

Data Lo register = measured value dBc/HR (0 – 63H)

Alarm flag and system error register (4)
Data Hi register:

b0 System error VIB1
b1 System error VIB2
b2 System error SPM1
b3 System error SPM2
b4 Master system error
b5 Master alarm level 2
b6 Master alarm level 1 or 2
b7 Master alarm levels 1 or 2 or system error

Data Lo register:

b0 A1 alarm VIB 1	b4 A1 alarm SPM1
b1 A2 alarm VIB1	b5 A2 alarm SPM1
b2 A1 alarm VIB2	b6 A1 alarm SPM2
b3 A2 alarm VIB2	b7 A2 alarm SPM2

Bits: 0 = Off, 1 = On.

MG4 unit type register (5)

Data Hi register:	not defined, always zero.
Data Lo register:	1 = MG4-1 2 = MG4-2 3 = MG4-12 4 = MG4-22

VIB alarm level register (6-9)
Alarm level, value range 0 – 50.0 mm/s = register value 0 –500 (0 – 01F4H).

SPM alarm level registers (10-13)
Alarm level, range 0 – 99 dBsv

Data Hi register= Not defined
Data Lo register= Alarm level (0 – 63H).

Exception response

Except for broadcast messages, when a master device sends a query to a slave device it expects a normal response. One of four possible events can occur from the master's query:

1 If the slave device receives the query without a communication error, and can handle the query normally, it returns a normal response.

2 If the slave does not receive the query due to a communication error, no response is returned. The master program will eventually process a timeout condition for the query.

3 If the slave receives the query, but detects a communication error (parity or CRC), no response is returned. The master program will eventually process a timeout condition for the query.

4 If the slave receives the query without a communication error, but cannot handle it (for example, if the request is to read a nonexistent register), the slave will return an exception response informing the master of the nature of the error.

The exception response message has two fields that differentiate it from a normal response:

Function code field
In a normal response, the slave echoes the function code of the original query in the function code field of the response. All function codes have a most significant bit (MSB) of 0 (their values are all below 80 hexadecimal). In an exception response, the slave sets the MSB of the function code to 1. This makes the function code value in an exception response exactly 80 hexadecimal higher than the value would be for a normal response. With the function code's MSB set, the master's application program can recognize the exception response and can examine the data field for the exception code.

Data field
In a normal response, the slave may return data or statistics in the data field (any information that was requested in the query). In an exception response, the slave returns an exception code in the data field. This defines the slave condition that caused the exception.

Here is an example of a master query and MG4 exception response. The field examples are shown in hexadecimal.

Query:

Byte	Contents	Example
1	Slave address	0A
2	Function	03
3	Starting address Hi	01
4	Starting address Lo	00
5	No. of reg Hi	00
6	No. of reg Lo	01
7	CRC	
8	CRC	

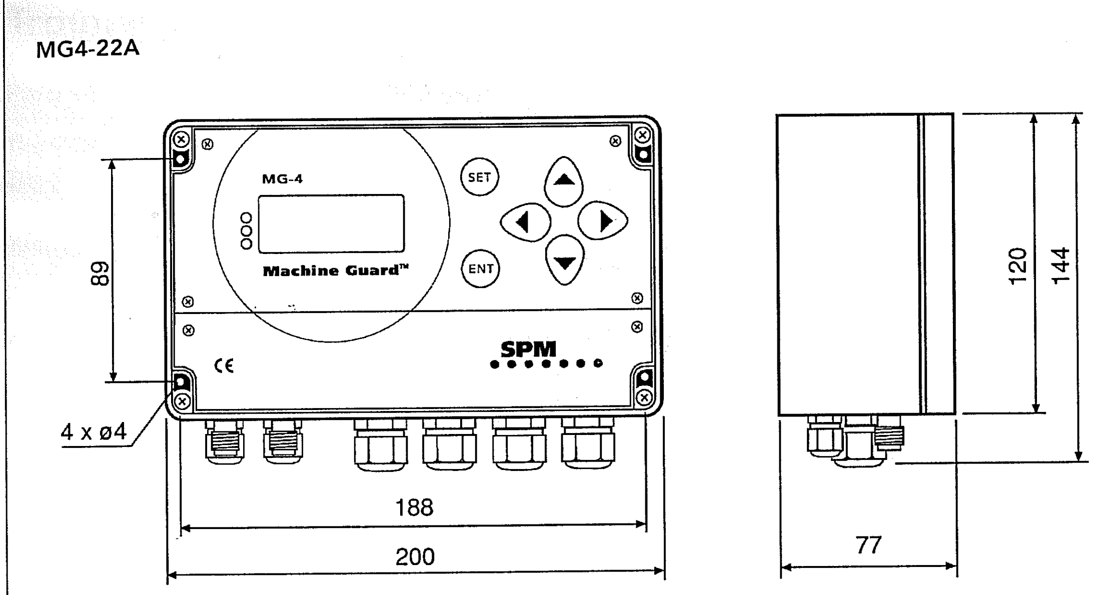
Exeption response:

Byte	Contents	Example
1	Slave address	0A
2	Function	83
3	Exception code	02
4	CRC	
5	CRC	

In this example, the master addresses a query to MG4 device 10 (0A hex). The function code (03) is for a 'Read data' register operation. It requests the status of the register at address 256 (0100 hex). Only one register is to be read, as specified by the number of register field (0001).

When the register address is non–existent in the MG4 device, the MG4 will return the exception response with the exception code shown (02). This specifies an illegal data address for the slave. The same response is made when the number of registers is not valid.

Code 02 is the only exception code in MG4.



Technical specifications

General

Vibration monitoring:	1 channel (MG4-1A/MG4-12A), 2 channels, multiplexing (MG4-2A/MG4-22A)
Bearing monitoring:	2, multiplexing (MG4-02A/MG4-12A/MG4-22A)
Data or analog outputs (4):	4 - 20 mA analog signal, selective range, no galvanic separation/ or RS-485 port for Modbus network using RTU
Main relay (1):	250 V AC, 5A, 1250 VA
Secondary relays:	2 (MG4-1A), 4 (MG4-02A, MG4-2A, MG4-12A, MG4-22A) 125 V AC, 1A, 60 VA / 150 V DC, 1A, 30 W
Power supply:	230 V AC, 115 V AC or 15 to 30 V AC/DC or 15 to 30 V AC/DC ±10%
Power consumption:	max. 6 VA
Operating temperature range:	0° to 50° C (32° to 122° F)
Relative humidity:	max. 95%
Altitude:	up to 2000 m
Casing:	polycarbonate/PVC, IP65
TNC connectors:	silver plated brass, 10 to 15 µ
Display screen:	LCD, 4 x 16 characters, back-lighted
Status display:	green, yellow, red LED
Dimensions:	200 x 144 x 77 mm
Weight:	1140 g (MG4-02A 1060 g (MG4-1A), 1070 g (MG4-2A), 1140 g (MG4-12A), 1150 g (MG4-22A)

Technical specifications

Vibration channel (VIB)

Measuring range:	0.5 to 49.9 mm/s RMS (0 to 1.9 inch/s RMS)
Resolution:	0.1 mm/s (0.01 inch/s)
Frequency range:	3-1000, 3-2000, 10-1000, 10-2000 or 100-1000 Hz, not programmable
Measuring time:	programmable 1 to 15 s
Alarm limits:	2, programmable
Alarm delay:	0 to 600 seconds, steps of 2 s
Fault indication:	transducer line test for short and open circuit
Transducer type:	IEPE (ICP®) with bias 2 to 18 V DC and sensitivity 0.9 to 12.0 $mV/m/s^2$, type SLD or TRV-18/19/20/21 with isolated installation foot TRX-18/19

Bearing channel (SPM)

SPM method:	dBm/dBc or LR/HR, evaluated
Measuring range:	0 to 99 dBsv
Resolution:	1 dB
Alarm limits:	2, programmable (dBm)
Alarm delay:	0 to 600 seconds, steps of 2 s
Fault indication:	transducer line test of measuring circuit quality
Transducer type:	SPM 40000 or 42000

Please note: The frequency range and the type of power supply are selected on ordering. They are factory set and cannot be changed by the user. Please check the unit label for data.

This product must be disposed as electronic waste and is marked with a crossed-out wheeled bin symbol in order to prevent it being discarded with household waste.

When once the life cycle of the product is over You can return it to Your local SPM representative for correct treatment, or dispose it together with your other electronic waste.

SPM Instrument AB • Box 504 • SE-645 25 Strängnäs • Sweden
Tel +46 152 225 00 • Fax +46 152 15075 • info@spminstrument.se • www.spminstrument.com

Trouble Shooting

Problem	Probable cause	Action
The MG4 can not be started. The display does not light up.	No power supply to the MG4 unit.	Check the power supply and the cable connections, see manual page 6. Check the glass tube fuse - see page 6.
No or unnormal measured values are displayed.	TLT (transducer line) fault, open or short circuit.	Check the TLT status, see page 18 (VIB transducers) and page 20 – 21 (SPM transducers). Check with a correct transducer connected directly to the MG4 input. Check that the coaxial cable and the connectors are correctly mounted and not damaged.
	Faulty transducer.	See above (TLT fault).
	Incorrectly mounted transducer.	Check the measuring point and the transducer installation, see pages 24 – 29.
	Wrong type of transducer is connected.	Check the suitable transducer type, marked on the label placed on the MG4's upper side.
	No isolation foot mounted on the vibration transducer.	Mount isolation foot on the transducer.
	The MG4 is in stand-by mode (Measuring = OFF)	Check the configuration. Select "Measuring = ON", see page 16.
	Faulty MG4 unit.	Check the MG4 with the Test Generator STG02.
The analog outputs are not working (0 mA).	The channel is not linked to the analog output.	Check the settings, see pages 19 – 20.
	TLT fault (transducer line), open or short circuit.	Check TLT status (see above) and repair if necessary. Turn off TLT test (TLT = OFF) to see if the analog outputs are working, see page 15.
The relays are not working.	The channel is not linked to the relay.	Check the settings, see manual pages 19 – 20.
	The signal is above the alarm limit.	Check the relay function by tapping on the transducer.
	Faulty relay.	Measure the resistance over the relay with a multimeter.
No alarm for TLT fault.	TLT = OFF	Check the configuration. Select "TLT= ON", see page 15. Disconnect the transducer cables for function test.
The channels can not be programmed.	The MG4 unit is locked.	Lock up with password, see page 16.

SPM Instrument AB • Box 504 • SE-645 25 Strängnäs • Sweden
Tel +46 152 225 00 • Fax +46 152 15075 • info@spminstrument.se • www.spminstrument.com

SPM

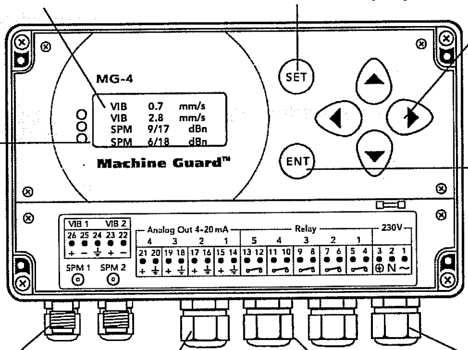
Programming guide
Machine Guard MG4

Measuring results, all connected channels

Push SET to select channel status display

Push RIGHT for VERSION menu

Status light for channel with worst condition



Push ENT to see setup for channel selected with SET

Vibration / shock pulse transducer input (max. 2 + 2 channels)

4 - 20 mA analog out (max. 4) or RS-485 port for Modbus network

Relays, 250 V (1), 125 V (max. 4)

Power supply 230 Vac, 115 Vac, 15 - 30 Vac/Vdc

Version menu

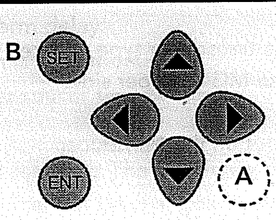
- Start
- SET Select
- ENT Open
- Change
- ENT Close/Save
- Finish

Channel programming

On the VERSION menu, set password OFF, then set 'SPM'

- SET Select channel
- ENT Start programming
- Change value
- Change position
- SET Next item
- ENT Close / Save

Default initiation



Hold down the invisible reset button (A) and press SET (B) to restore default parameters.

Copy and use to record the settings and program of your MG4 unit.

General setting

Item	Default	Choice	Setting, comment
Password	on	on / off	Set OFF to program, then set password 'SPM'
Measuring	on	on / off	OFF freezes all outputs
TLT	on	on / off	OFF blocks yellow LED (not relay), min. current 4 mA
Unit	mm	mm / inch	
Relays	NC	NC / NO	

VIB channel programming

Item	Default	Range	VIB channel 1	VIB channel 2
Name	VIB channel 1/2	16 characters		
Machine class	1	1 to 6		
Transducer sensitivity/Bias	nominal	see data card		
Measuring time	2 seconds	2 to 15 s		
TLT alarm, on relay no.	--	-- to max. 5		
Alarm limit A1	1.9 mm/s	--.- to 49.9		
Alarm A1, on relay no.	--	-- to max. 5		
Alarm limit A2	4.6 mm/s	--.- to 49.9		
Alarm A2, on relay no.	--	-- to max. 5		
Analog out, channel no.	--	-- to max. 4		
20 mA out =	50 mm/s	10 to 50 mm/s		
Alarm delay	--	-- to 600 s		

SPM Instrument AB • Box 504 • SE-645 25 Strängnäs • Sweden
Tel +46 152 225 00 • Fax +46 152 15075 • info@spminstrument.se • www.spminstrument.com

SPM channel programming, dBm/dBc technique

Item	Default	Min./max.	SPM channel 3	SPM channel 4
Name	SPM channel 3/4	16 characters		
Initial value dBi	0	–9 to 40		
Bearing speed RPM	--	max. 19999		
Shaft diameter d	--	max. 1999 mm		
Alarm limit TLT	15	5 to 25		
TLT alarm, on relay no.	--	1 to max. 5		
Alarm A1, value	dBm	dBm / dBc		
Alarm limit A1	21 dBn	-- to 99 dBn		
Alarm A1 on relay no.	--	-- to max. 5		
Alarm A2, value	dBm	dBm / dBc		
Alarm limit A2	35 dBn	-- to 99 dBn		
Alarm A2 on relay no.	--	-- to max. 5		
Analog out 1, channel no.	--	-- to max. 4		
Analog out 1, value	dBm	dBm / dBc		
Analog out 2, channel no.	--	-- to max. 4		
Analog out 2, value	dBc	dBm / dBc		
20 mA out =	90 dBsv	10 to 90 dBsv		
Alarm delay	--	-- to 600 s		

SPM channel programming, LR/HR technique

Item	Default	Min./max.	SPM channel 3	SPM channel 4
Name	SPM channel 3/4	16 characters		
NORM number	--	10 to 52		
TYPE number	1	1 to 8		
COMP number	--	–15 to 30		
Acc (accumulation)	1	1 to 9		
Bearing speed RPM	--	max. 19999		
Bearing diameter dm	--	max. 1999		
Alarm limit TLT	15	5 to 25		
TLT alarm, on relay no.	--	1 to max. 5		
Alarm A1, value	LR	LR / HR		
Alarm limit A1	-- dBsv	-- to 99 dBsv		
Alarm A1 on relay no.	--	-- to max. 5		
Alarm A2, value	LR	LR / HR		
Alarm limit A2	-- dBsv	-- to 99 dBsv		
Alarm A2 on relay no.	--	-- to max. 5		
Analog out 1, channel no.	--	-- to max. 4		
Analog out 1, value	LR	LR / HR		
Analog out 2, channel no.	--	-- to max. 4		
Analog out 2, value	HR	LR / HR		
20 mA out =	90 dBsv	10 to 90 dBsv		
Alarm delay	--	-- to 600 s		

Location ....

MG4- .... Serial no.................................. Date .... Sign...

SPM Instrument AB • Box 504 • SE-645 25 Strängnäs • Sweden
Tel +46 152 225 00 • Fax +46 152 15075 • info@spminstrument.se • www.spminstrument.com

SPM

condition monitoring solutions

We hereby declare that the product quality and number of products in this consignment are correct and in accordance with our quality standards

Emina Sypartaric

+46 (0) 152 - 225 00
lager@spminstrument.se

SPM Instrument AB | Box 504 | SE-645 25 Strängnäs | Sweden
Tel +46 152 225 00 | Fax +46 152 150 75 | info@spminstrument.se

A0014