

G3 Series Machinery Monitoring System Datasheet

GENCON Monitoring Solutions

DS.2201 Iss.1



- Absolute and Relative Vibration
- Displacement and Thrust Position
- Speed, Phase and Reverse Rotation
- Differential and Casing Expansion
- Rod Drop
- Temperature
- Shutdown Protection
- Processed Analogue Output
- Modbus Communication.
- Colour LCD display.
- Turbines, Compressors, Fans, Pumps, Motors, and Centrifuges.

Description

The G3 Machinery Monitoring System (MMS) is a high-performance signal conditioning unit, providing a universal platform for the interfacing of various sensor types in compliance with the API 670 standard. Each of the four channels can be independently programmed to provide continuous monitoring and protection functionalities across a broad range of measurements (including vibration, position, expansion, speed, etc). Utilising the latest DSP technology, once a channel is set up and running, the resulting alarm relay and analogue output are independent from the remaining monitor functionalities, resulting in a scalable high integrity configuration.

The MMS monitor is provided with an intuitive colour LCD display and drive facility to provide immediate viewing and access to the machine parameters. Several modes of display are available including bar graph, FFT and an alarm historian.

The MMS monitor provides the necessary power source for the selected transducer, providing for 2 (ICP type) or 3 – wire accelerometer variants, $\pm 24V$ proximity probe systems and a range of speed sensors.

Each transducer signal is buffered and available via the front panel analogue connection arrangement and a USB interface is provided for programming of the unit and storage of channel history and settings.

The MMS monitor is designed for mounting in standard 3U rack assemblies with a dual redundant power supply option. The MMS system offers excellent channel density with up to 24 measurement channels in a 3U format.

Each channel can provide independent analogue outputs of current and voltage for DCS connection in addition to an alarm relay. Further alarm relay expansion is possible through connection to digital outputs at the rear of the monitor.

Absolute Vibration

Measurement Parameters

Overall Level, Band limited (LPF & HPF)

Configurable Warning and Danger positive going alarms per channel.

Measurement Units

Select from Acceleration (m/s² or g), Velocity (mm/s or ips) and Displacement (µm or mil).

Select from rms, pk, pk to pk.

Filter Characteristics

Low Pass

Programmable 3dB, 100Hz to 10kHz

Setting resolution 1%

High Pass

Programmable 3dB, 1.0Hz to 100Hz

Setting resolution 1%

Measurement Range, Accuracy and Resolution

Maximum range setting

Acceleration 0 – 100.0g, ±0.2% typ, ±1.0% max

Velocity 0 – 100mm/s, ±0.2% typ, ±1.0% max

Displacement 0 – 1000µm, ±0.2% typ, ±1.0% max

Resolution of displayed readings better than 1%.

Noise Floor

Acceleration 0.001g rms typ

Velocity 0.02mm/s rms typ

Displacement 0.05µm pk typ

Transducer Configurations

Accelerometer

Sensitivity Range 10.00mV/g to 10.00V/g

Standard ICP option +24V or -24V

3/4 – wire option +24V, -24V or +12V

Velocity Transducer

Active or Passive option

Sensitivity Range 1mV/mm/s to 50mV/mm/s

Standard ICP option +24V

3/4 – wire option +24V or +12V

Transducer Integrity

Active device range -19.0V to +19.0V

Passive device O/C and S/C detection

Relative Vibration

Measurement Parameters

Overall Level, Band limited (LPF & HPF)

Configurable Warning and Danger positive going alarms per channel.

Measurement Units

Displacement (µm or mil), pk or pk to pk,

Filter Characteristics

Low Pass

Programmable 3dB, 100Hz to 10kHz

Setting resolution 1%

High Pass

Fixed 3dB at 0.8Hz

Measurement Range, Accuracy and Resolution

Displacement 0–1000µm max, ±0.2% typ, ±1.0% max

Resolution of displayed readings better than 1%.

Noise Floor

Displacement 0.05µm pk typ

Transducer Configuration

Eddy Current / Proximity Probe

Sensitivity Range 1.00mV/µm to 10.00mV/µm

Fixed Options 3.94mV/µm & 7.87mV/µm

4 – wire system -24V @ 40mA max

Integrity window -19.0V to -1.0V

Gap measurement -20.0V to -0.1V

Thrust / Differential Expansion

Measurement Parameters

Thrust position and Differential Expansion

Dual level, configurable negative and positive going alarms per channel.

Measurement Units

Displacement mm, mil, or inch

Filter Characteristics

Low Pass

Measurement Filter 400Hz, 128 sample average

Gap Filter Fixed 3dB at 0.5Hz, 16 sample average

Measurement Range, Accuracy and Resolution

Displacement 0–100mm max, ±0.2% typ, ±1.0% max

Resolution of displayed readings better than 1%.

Transducer Configuration

Eddy Current / Proximity Probe

Sensitivity Range 0.1mV/µm to 10.00mV/µm

Fixed Options 3.94mV/µm & 7.87mV/µm

4 – wire system -24V @ 40mA max

Integrity window -19.0V to -1.0V

Gap measurement -20.0V to -0.1V

Speed

Measurement Parameters

Frequency Range	0.02Hz to 20kHz
Accuracy	< ±0.1% of reading
Resolution	<±0.1% of full scale
Dynamic range	100mV pk-pk – 20V pk-pk
Measurement Range	0 – 50,000 rpm 0 – 1000 Hz

Input Settings

Teeth Setting Range	1 – 256
Threshold mode	Manual Level
Threshold detection	Transition
Manual detection setting	+19.0V to -19.0V

Zerospeed Alarm

The zerospeed alarm is raised when the shaft rotation drops below a set speed. This negative going alarm can be allocated to an appropriate relay.

Zerospeed detection period 1 – 60 seconds

Transducer Configuration

Eddy Current / Proximity Probe option

Sensitivity	3.94mV/μm & 7.87mV/μm
4 – wire system	-24V @ 50mA max
Integrity window	-19.0V to -1.0V
Gap measurement	-20.0V to -0.1V
Gap Filter	Fixed 3dB at 0.5Hz, 16 sample average

Other Probe options

Passive Magnetic Probe	2-wire 10kOhm
Active Magnetic Probe	2-wire +12V 10kOhm
Active Magnetic Probe	3-wire +12V 10kOhm

Phase Reference (1/rev)

Measurement Mode

When a DSP channel is configured in this mode a phase reference is generated for use by other channels configured in the absolute or relative vibration modes. Up to two channels per monitor can be configured as a phase reference. The phase reference is selectable from any other monitor channel connected to the rack system.

Measurement Parameters

Frequency Range	0.02Hz to 20kHz
Accuracy	< ±0.1% of reading
Resolution	<±0.1% of full scale
Dynamic range	100mV pk-pk – 20V pk-pk
Measurement Range	0 – 50,000 rpm 0 – 1000 Hz

Buffered Output TTL

Input Settings

Threshold mode	Manual
Threshold detection	Positive Edge
Manual detection setting	+19.0V to -19.0V

Transducer Configuration

Eddy Current / Proximity Probe option

Sensitivity	3.94mV/μm or 7.87mV/μm
4 – wire system	-24V @ 40mA max
Integrity window	-19.0V to -1.0V
Gap measurement	-20.0V to -0.1V
Gap Filter	Fixed 3dB at 0.5Hz, 16 sample average

Other Probe options

Passive Magnetic Probe	2-wire 10kOhm
Active Magnetic Probe	2-wire +12V 10kOhm
Active Magnetic Probe	3-wire +12V 10kOhm

Casing Expansion / Valve Position (LVDT)

Measurement Mode

Expansion or Position, $Y = mX + c$

Y is the desired calibrated measurement

X is the LVDT measured value

m is a scaling factor resulting from calibration

c is an offset factor resulting from calibration

Dual level, configurable negative and positive going alarms per channel.

Measurement Units

Displacement mm, um, mil, inch or % of stroke

Measurement Range, Accuracy and Resolution

Displacement 0–1000mm max, ±0.2% typ, ±1.0% max

Resolution of displayed readings better than 1%

Transducer Drive

AC LVDT

Amplitude Voltage	3.5Vrms typ
Frequency	3kHz ± 5%

Integrity Alarms

Invalid measurement alarm is raised if reading falls outside of calibrated stroke range. Transducer integrity alarm raised on loss of valid signal from secondary winding.

Temperature

Measurement Mode

Two channels of temperature measurement are available for each DSP channel. The DSP channel is fixed to a particular sensor type.

Measurement Units

Temperature °C or °F

Measurement Range, Accuracy and Resolution

RTD	-20 °C – 150 °C, ±0.5% typ, ±1.0% max Sensitivity 10mV / °C
K-type	-20 °C – 1000 °C, ±0.5% typ, ±1.0% max Sensitivity 41uV / °C Junction compensated

Resolution of displayed readings better than 1%

Integrity Alarm

Transducer integrity alarm raised on loss of valid signal from transducer.

Reverse Rotation

Measurement Mode

When two DSP channels are configured in this mode a phase reference is generated by each channel for detection in the module of reverse rotation against a multi-toothed target. Consult Sonsonics for details regarding the precise positioning requirement of the probes.

Measurement Parameters

Frequency Range	0.02Hz to 20kHz
Accuracy	< ±0.1% of reading
Resolution	<±0.1% of full scale
Dynamic range	100mV pk-pk – 20V pk-pk
Buffered Output	TTL

Input Settings

Threshold mode	Manual
Threshold detection	Transition
Manual detection setting	+19.0V to -19.0V

Transducer Configuration

Eddy Current / Proximity Probe option

Sensitivity	3.94mV/um or 7.84mV/um
4 – wire system	-24V @ 40mA max
Integrity window	-19.0V to -1.0V
Gap measurement	-20.0V to -0.1V
Gap Filter Fixed 3dB at 0.5Hz, 16 sample average	

Other Probe options

Passive Magnetic Probe	2-wire 10kOhm
Active Magnetic Probe	2-wire +12V 10kOhm
Active Magnetic Probe	3-wire +12V 10kOhm

Threshold mode	Auto / Manual
Threshold detection	Pulse / Gap
Manual detection setting	+19.0V to -19.0V

Forward and Reverse Alarm

Two alarms are available to provide the status of the rotating shaft. Each alarm can be allocated to an appropriate relay.

Zerospeed Alarm

The zerospeed alarm is raised when the shaft rotation drops below a set speed. This negative going alarm can be allocated to an appropriate relay.

Zerospeed detection period 1 – 60 seconds

Rod Drop

Measurement Mode

The Rod Drop measurement mode monitors the position of a piston rod synchronised to a once per revolution phase reference (configured in a separate channel). Alarm functions are available for relative change in rod position from calibration point and for rod vibration. These positive going alarms can be allocated to an appropriate relay.

Measurement Units

Displacement, mm, um, mil or inch

Measurement Range, Accuracy and Resolution

Displacement	0–4mm max, ±0.2% typ, ±1.0% max
Vibration	0–1000um max, ±0.2% typ, ±1.0% max

Resolution of displayed readings shall be < 1%

Average Rod Drop calculated when no sync pulse available.

Transducer Configuration

Eddy Current / Proximity Probe

Fixed Options	3.94mV/um & 7.84mV/um
4 – wire system	-24V @ 40mA max
Integrity window	-19.0V to -1.0

Common Alarm Features

Parameter Alarms

Two parameter alarms (A1 and A2) are available per channel, programmable within the set measurement range. Hysteresis, Latching mode and Delay are configurable.

Hysteresis	1 to 10%, resolution 1%
Delay	1 to 60s, resolution 0.1s
Mode	Latching or Fleeting

For displacement measurements (e.g. thrust, differential expansion, etc.) each parameter alarm can be configured for both positive and negative going values for window alarming.

For speed measurements each parameter alarm can be configured for either positive or negative going.

Integrity Alarms

The A3 and A4 alarms are allocated to transducer integrity and channel / gap integrity respectively. Hysteresis, Latching mode and delay are configurable.

Hysteresis	1 to 10%, resolution 1%
Delay	1 to 60s, resolution 0.1s
Mode	Latching or Fleeting

Relay Alarms

A single relay is available per channel; this can be allocated to an alarm or group of alarms as required and configured for energised or de-energised to alarm. For further relay expansion eight channels of Alarm I/O are available at the rear terminals for allocation to available alarm parameters.

Summary Alarms

A single open collector line at the rear terminals is allocated to a 'First up' Alarm for identification of the primary channel alarm in the system rack.

Channel Defeat

Individual channels can be configured to defeat parameter alarms in the event of an integrity alarm. During defeat all other channel interfaces operate as normal.

Alarm Historian

All alarm events are stored and time stamped for later access through the front panel display and drive facility. Capacity to store 100 events with a download facility.

Alarm Reset

All latched alarm events or individual channel latched alarms can be reset through the front panel display and drive facility.

Park Enable

The Park function permits the analogue outputs to be forced to a preset value in the event of a transducer alarm (user software control only).

Analogue Outputs

Current and Voltage Outputs

Two analogue outputs are available per channel, configurable for either 4 – 20mA or 0 – 10V.

Accuracy	±0.5% of range
Amplitude Linearity	± 1% of range

The analogue output is set across the measurement range as standard.

Buffered Outputs

For each channel the raw transducer signal is buffered to both the front panel and rear terminals.

Frequency Range	DC to 10kHz
Accuracy	± 1%

For speed and timing measurement modes a TTL signal only is available at the rear terminals.

Communications

USB interface for front panel user set up.

RS-485 Dual Redundant Modbus slave at rear terminals.

Front Panel Facilities

Colour LCD display	Size 43mm x 57mm
Resolution	240 x 320 pixels
	Backlight Timeout Function

Display Modes	4 Channel Bargraph 4 Channel Traffic Light Measurement + Gap Alarm Matrix
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Historian	Single Channel Trend 500,000 points per channel Downloadable to .csv format Alarm Log 500 entries
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FFT	Single Channel FFT, 512pts
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LED Indicators	OK Active Green ALM Active Red TxRx Active Green
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Communications	USB Type B Interface Windows XP compatible
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Navigation Menu Button
 Drive Button

Buffered Outputs SMB Jack 75 Ohm

Power Supply

Monitor Supply Voltage +18V to +28V
 Monitor Power Consumption 15W typ 20W max

Mechanical

Monitor Dimensions 3U x 12HP x 220mm
 Monitor Mass 0.9kg

Temperature

Operating -30 °C to +65 °C
 Storage -30 °C to +85 °C

CE Marking

EN55011 Heavy Industrial Standard conducted & radiated emissions

EN61000-3-2:1995
 EN61000-3-3:1995

EN55014 Heavy Industrial Standard Immunity

EN61000-4-2:1995,
 EN61000-4-3:1996,
 EN61000-4-4:1995,
 EN61000-4-5:1995,
 EN61000-4-6:1996,
 EN61000-4-8:1993,
 EN61000-4-11:1994

Low Voltage Directive
 EN60950:1992+A1+A2+A3+A4

The latest version of G3 Monitor is IS.4001 with variances as below.

IS.4001/1-GC 1x Channel Monitor
 IS.4001/2-GC 2x Channel Monitor
 IS.4001/3-GC 3x Channel Monitor
 IS.4001/4-GC 4x Channel Monitor
 IS.4001/8-GC up to 8x Temperature / Process Monitor

For more details of G3 Monitor, please contact to our sales and service representatives.

System Rack



To accommodate the monitors, variant 3U rack assemblies and DIN enclosure are optional.

IS.4010/xx-GC: 19" x 3U full rack format for 6x monitors
 IS.4013/xx-GC: 12" x 3U half rack format for 3x monitors
 IS.4113/1-GC: DIN43700 enclosure for 1x monitor

Common Rack Features

Trip Level Multiply or Divide: Monitor detection of this common rack facility will multiply or divide alarm levels when configured for vibration or speed channels respectively.

Calibration: Monitor detection of this common rack facility will force the analogue outputs to a preset value. Alarms can be defeated in this mode if required.

Reset: Monitor detection of this common rack facility will reset all active latched alarms.

Set Up Disable; detection of this common rack facility will disable changes via the front panel user interface and disable the USB interface.

Tacho 1 & 2: speed and phase marker channels can output tacho signal to backplane for use with other measurement channels.

For more details of System Rack, please contact to our sales and service representatives.



Optional Modules

On G3 system rack, there are also below optional modules for voting logic and data communication.

IS.4002/1-GC TCP/IP Modbus Communication Module
 IS.4003/2-GC 2 out of 3 Voting Module

For more details of above optional modules, please contact to our sales and service representatives.



Description

The DN G3 Machinery Protection Monitor is three channel DIN rail mountable and compact version of G3 Monitor. It's a high performance fully programmable signal conditioning unit capable of monitoring 2-Channels of Absolute Vibration, Shaft Vibration or Thrust Position. An additional third channel is available as standard for measuring speed or for use as a phase reference.

The sensor interface is programmable to accept IEPE type accelerometers / velocity transducers, proximity probes (API 670 std), and active / passive speed probes. All sensor signals are available via a buffered interface to offer the option for further detailed signal analysis.

Three alarm relays are available as standard (expandable to seven), one relay dedicated to indicate monitor and sensor integrity, the other two relays are fully programmable across the alarm criteria selected. All three input channels measured values are available via a 4-20mA interface.

The DN G3 monitor is provided with an intuitive LCD display for live viewing of measured values and alarm status. Both Modbus RS485 and TCP/IP interfaces are available for the transfer of data. The TCP/IP interface offers access to the internal webserver for configuration and set up of the monitor. This interface is also utilised for the uploading of the required measurement algorithm into the monitor.

Absolute Vibration

Measurement Units

Select from Acceleration (m/s^2 or g), Velocity (mm/s or ips) and Displacement (μm or mil).

Filter Characteristics

Low Pass

Programmable 3dB, 100Hz to 3kHz

High Pass

Programmable 3dB, 1.0Hz to 100Hz

Measurement Range, Accuracy and Resolution

Maximum range setting

Acceleration: 0 – 100.0g, $\pm 1.0\%$ typ, $\pm 3.0\%$ max
(1Hz to 3kHz as standard)

Velocity: 0 – 100mm/s, $\pm 1.0\%$ typ, $\pm 3.0\%$ max
(1Hz to 3kHz as standard)

Displacement: 0 – 1000 μm , $\pm 1.0\%$ typ, $\pm 3.0\%$ max
(5Hz to 1kHz Velocity transducer)
(10Hz to 300Hz Accelerometer)

Resolution of displayed readings better than 1%

Transducer Configurations

Accelerometer

Sensitivity Range: 1.00mV/g to 10.00V/g

Configuration: +18V 2/3 wire options

IEPE Current: 5.0mA nominal (2-wire)

+18V Source: 10mA maximum (3-wire)

Velocity Transducer

Active or Passive option

Sensitivity Range: 1mV/mm/s to 50mV/mm/s

Transducer Integrity

Active device range: -19.5V to +17.5V

Passive device: O/C and S/C detection

Relative Vibration

Measurement Units

Displacement (μm or mil), pk or pk to pk,

Filter Characteristics

Low Pass

Programmable 3dB, 100Hz to 3kHz

High Pass

Fixed 3dB at 0.8Hz as standard

Measurement Range, Accuracy and Resolution

Displacement 0–1000 μm max, $\pm 1.0\%$ typ, $\pm 3.0\%$ max

Resolution of displayed readings better than 1%

Transducer Configuration

Eddy Current / Proximity Probe

Sensitivity Range: 1.00mV/ μm to 10.00mV/ μm

Fixed Options: 3.94mV/ μm & 7.87mV/ μm

3 – wire system: -24V @ 40mA max

Integrity window: -19.5V to -0.5V

Speed

Measurement Parameters

Frequency Range:	0.02Hz to 20kHz
Accuracy:	<±0.1% of reading
Resolution:	<±0.1% of full scale
Dynamic range:	100mV pk-pk – 20.0V pk-pk
Decision Threshold:	Auto Ranging

Transducer Options

Proximity Probe
Passive Magnetic Probe
Active Magnetic Probe
TTL (Note:- Max 3mA load on TTL buffered output)
All above input options terminated in 10kOhm load.

Common Alarm Features

Parameter Alarms

Two parameter alarms (A1 and A2) are available per channel, programmable within the set measurement range. Hysteresis, Latching mode and Delay are configurable.

Hysteresis:	1 to 10%, resolution 1%
Delay:	1.0 to 60.0s, resolution 0.1s
Mode:	Latching or Fleeting
TLD/TLM:	Trip Level Multiply / Divide Function

Relay Configuration Options

Option 1	
Relay 1:	CHA A1 + CHB A1
Relay 2:	CHA A2 + CHB A2
Relay 3:	CHA A3 + CHB A3
Output 1	CHA A1
Output 2:	CHB A1
Output 3:	CHA A2
Output 4:	CHB A2
Option 2	
Relay 1:	CHA A1
Relay 2:	CHB A1
Relay 3:	CHA A3 + CHB A3
Output 1:	TACHO A1
Output 2:	TACHO A2
Output 3:	TACHO Window
Output 4:	TACHO Zerospeed

Integrity Alarms

The A3 and A4 alarms are allocated to transducer integrity and channel / gap integrity respectively. Hysteresis, Latching mode and delay are configurable.

Hysteresis:	Fixed to 2%
Delay:	1 to 60s, resolution 0.1s

A single relay is available to indicate the overall monitor integrity. This is configured for de-energised to alarm.

Relay Rating

Maximum Voltage Rating:	250Vac / 220Vdc
Maximum Current Rating:	1A
Contact resistance:	100mOhm
Switching time:	5ms

Buffered Outputs

For each channel the raw transducer signal is buffered to both the terminals and the front panel through BNC connectors.

Frequency Range:	DC to 10kHz (Prox) 1Hz to 10kHz (Accel)
Accuracy:	± 1%
Source Impedance:	< 50 Ohms

Current Outputs

For each of the two measurement channels and the speed channel a programmable 4-20mA current output is available.

Current Range:	0.0mA to 20.0mA
Current Accuracy:	± 0.2% of full scale
Maximum Resistance:	500 Ohms at +20.0V

CE Marking

EMC	2004/108/EC EN61326:1997 A2:2001
LVD	2006/95/EC EN61010-12003

Front Panel Facilities

Colour LCD display:	Size 43mm x 57mm
Resolution:	240 x 320 pixels
LED Indicators:	OK Active Green ALM Active Red TxRx Active Green

User Set up:	Ethernet TCP/IP Internal Webserver
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Navigation:	Front panel push buttons for display configuration
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Alarm Reset:	Navigation / Wired contacts
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Buffered Outputs:	BNC, 50 Ohm
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Communications

TCP/IP & RS-485 Modbus slave

Power Supply

Module Supply DC Voltage:	+20Vdc to +28Vdc
Module Supply AC Voltage:	90Vac to 264Vac 50Hz/60Hz
Module Power Consumption:	6W typ 8W max

Mechanical

Module Dimensions (W x H x D)	108.5 x 127.2 x 88.4mm (Including DIN Rail and BNC connectors)
Weight:	512 grams

Temperature

Operating: -20 °C to +50 °C
Storage: -30 °C to +85 °C

The latest version of DN G3 Monitor is IS.4130 with variances as below.

IS.4130/1-GC:	+24Vdc Power Input
IS.4130/2-GC:	Mains Power Input
IS.4131/1-GC	Tacho only, Mains Power Input
IS.4131/2-GC	Tacho only, Main Power Input 0-5V analogue output
IS.4131/3-GC	Tacho only, +24Vdc supply

For more details of DN G3 Monitor, please contact to our sales and service representatives.



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