October 27, 2014

Tech Note 2016: G450 Multi-gas Detector Performance Requirements

1. Physical Characteristics	
Size	Instrument shall not exceed 2.5" x 4.3" x 2.0" in total size.
Weight	Less than 10 oz. (280 g) with O_2/LEL/CO/H_2S sensors
Handling	Unit shall be easily held in one gloved hand.
Case material	Impact proof, rubberized housing.
Environmental protection	Rated to IP-67 protection levels for dust and water ingress (dust and water tight).
Display location	Display shall be top-mounted.
Protective housing	Instrument shall be provided with impact proof, rubberized housing.
Carrying attachments	Unit shall be provided with belt clip and lanyard ring.
Carrying case	An optional protective leather carrying case with shoulder strap shall be available.
RFI / EMI resistance	Complies with EMC Directive 89/336/EEC
Electromagnetic compatibility	Complies with DIN EN 50270

2. User Interface	
Display type	Illuminated full graphic liquid crystal display (LCD) with automatic size adjustment for optimal read out, display of battery capacity, gas concentration, peak readings, STEL, TWA, pump status and explanatory messages . LCD screen shall change colors from green to amber to red according to alarm status.
Display orientation	Display may be inverted 180° by user at any time during normal operation.
Gas readings	Gas readings for all sensors must be displayed simultaneously.
Display legibility	Readings and messages easily legible both in both dim light and bright light conditions.
Display "Zoom" function	User shall be able to increase the size ("zoom") readings at any time in normal operation.
Backlight	Instrument shall include an LCD backlight which is automatically activated in the event of an alarm condition. Backlight may be manually activated from the push of any button, and shall remain illuminated for ten seconds when any button is pressed. User can enable backlight to be continuously activated for use in dim light conditions.
Keypad buttons	Instrument must have no more than three switches or pushbuttons to operate. There shall be no requirements to access hidden or internal switches for any instrument operations.
Data access	Current gas readings, session peaks, STEL, TWA, instrument settings, user and location and other information shall be accessible directly through the instrument LCD. Access to logged gas measurement data shall be via data logging cable. Data may be downloaded either by means of the "smart charging cap", GfG Docking Station or via the drop-in cradle charger.

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3. Monitoring Capability

Number / types of gases	Instrument shall be capable of simultaneously measuring up to 4 gases (depending on the sensors installed).
Sensors	Gas sensors shall be interchangeable, user replaceable plug-in "smart" sensors capable of being automatically recognized by the instrument. It shall not be necessary to manually reconfigure the instrument for use with a new type of sensor.
Sensor warranty	Basic O_2, LEL, CO, H_2S, COSH, and CO with low H_2 interference (CO-H) shall be warranted for three full years. Sensors replaced under warranty shall be provided free-of-charge to the instrument owner. Manufacturer shall offer option for extended 6-year warranty coverage for all supported sensors including O_2, LEL, CO, H_2S, and CO with low H_2 interference (CO-H).
Combustible gas display	The instrument shall be capable of displaying the combustible gas as % Lower Explosive Limit (LEL) or % volume – selectable by user.

4. Basic Operational Features

Instrument turn-on	The button used to turn the instrument on must be clearly marked and differentiated by feel from the other buttons.
Inadvertent shutoff	The instrument must be designed to protect against accidental shut off. Once activated, a three second button hold is needed to turn the instrument off.
Zero adjustments	It shall be possible for the user to initiate a fresh air zero adjustment at any time from normal operation
Zero adjustment safety lockout	The instrument shall prevent users from zeroing out hazardous readings.
Audible "Instrument On" indicator	The instrument shall be provided with a periodic user enabled audible signal (confidence beep) indicating the instrument is in operation. Instrument will incorporate user programmable confidence beep of intervals 15 to 90 seconds.
Time / date	Instrument must be able to display time and date with or without the optional data logging package. User must be able to reset the time and date without tools. Instrument must include a board mounted battery capable of powering the clock for a minimum of 6 years.

5. Classifications and Certifications

Intrinsic safety	The detector and motorized pump must have the following certifications and approvals: • ATEX Intrinsically Safe II 2G EEX ia d IIC T4/T3 • c-CSA-us Certified as Intrinsically Safe for use in Class 1, Division I, Groups A, B, C and D T3 (t_a -20°C to +50°C) and Class I, Zone 0 AEx ia IIC T3 (t_a -20°C to +50°C) Hazardous Locations • CE Marked (Conformite Europeeane)

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6. Available Sensor Types and Ranges

The Instrument shall be available with the following gas sensing sensors and ranges:

	Gas type	Sensor Type	Range	Resolution
Sensor Types	Combustible gases	Catalytic	0 to 100% LEL / 0 to 5% vol	.5% LEL / .05% vol
	Oxygen	Fuel Cell	0 to 25% Volume	0.1% vol
	Carbon Monoxide	Electrochemical	0 to 500 ppm or 0 – 1,000 ppm	1.0 ppm
	Hydrogen sulfide	Electrochemical	0 to 100 ppm or 0 – 500 ppm	0.1 ppm
Minimum alarm setting for H_2S	It must be possible to set the instrument instantaneous low alarm (A1), instantaneous high alarm (A2), TWA and or STEL alarms for H_2S as low as 1.0 ppm.			
Minimum alarm setting for LEL	It must be possible to set the instrument LEL low alarm as low as 4.0 LEL while the instrument is calibrated to a pentane level of sensitivity.			

7. Instrument Alarms

Visual alarms	Visual alarms shall consist of bright top-mounted LEDs, a 360º wraparound LED light bar, heterochromatic backlit display that changes color from green to amber to red, numeric readings, and explanatory messages. The display must provide a positive indication as to which gas sensor is in alarm, and the alarm type. Alarms must be visible in all lighting conditions and from a distance of 5 feet.
Over-range alarms	Upwards or downwards pointing arrow icons will be used to indicate sensor readings above or below the over-range limit for the affected sensor.
Audible alarms	The audible alarms shall register at least 103 db at 1 foot. The sound pattern for the low (A1) alarm shall be differentiated from the sound pattern of the high (A2) alarm.
Alarm latch feature	A user settable latching alarm choice must be available for all gas measurement channels. When the alarm latch choice is selected, gas alarms continue to sound until manually cleared.
Oxygen alarms	The oxygen channel shall have alarms for both oxygen deficiency (falling) and oxygen enrichment (rising).
Combustible gas alarms	The combustible (LEL) channel shall have three user adjustable alarms A1 (low), A2 (high) and A3 (approaching LEL). A protective latching over-range alarm shall be activated should the LEL concentration be exceeded.
Toxic gas and PID alarms	Each toxic channel shall have 4 user adjustable alarms, A1 (low), A2 (high), TWA and STEL.
Power alarms	The instrument shall provide audible and visual alarms and messages indicating low battery power and / or impending shut-down. Low battery alarms shall be operable in all environmental conditions.
Vibrating Alarm	Instrument shall include a vibrator alarm.

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8. Advanced Display and Software Options

Industrial hygiene displays	The gas detector must have the capability of displaying session PEAK, STEL and TWA, as well as current gas level readings.
Peak reading mode	It shall be possible to use a single button to activate the "Peak reading mode" and set the instrument LCD to retain the most significant readings for each sensor since the last time the instrument "Peak reading" was reset. Pressing "Reset" restores the displayed readings to the current values. Use of the "Peak reading mode" will not cause the session time history calculations (PEAK, STEL and TWA) to be lost or reset.
Password protection	Instrument will have password protected service and alarm adjustment program.

9. Environmental

Temperature	-4 to +122°F (-20 to +50 °C): Up to 24 hours continuous operation per charge.
	-4 to -20°F (-20 to -30°C): Up to 12 hours continuous operation per charge.
	-20 to -31°F (-30 to -35°C): Up to 8 hours continuous operation per charge
	-31 to -40°F (-35 to -40°C): Up to 1.5 hours continuous operation per charge
Humidity	0 to 95% RH (non-condensing)
Pressure	700 to 1,300 kPa

10. Datalogging (Instrument Data Storage)

Datalogging	Instrument shall include datalogging on a standard basis.
Datalogger capacity	The instrument shall be capable of recording and storing data for the most recent 55 hours of monitoring (at 2 minute intervals) without overwriting existing information in normal use. It shall be possible to store up to 10 users and 100 locations in the datalogging memory.
Gas record content	Datalog entries shall contain as a minimum the date, time, and a record of the readings (instantaneous, average or peak values) for each gas sensor for each logged monitoring interval.
Record intervals	The time between data records shall be user selectable (from 1 second to 60 minutes).
Data retention	Monitoring data, as well as programmable instrument settings and choices shall be stored in non-volatile memory, and shall not be lost or corrupted in the event of sudden instrument power loss or removal of the battery pack. A backup battery shall provide a minimum of 6 years of power for the instrument clock.
Activity record content	The instrument shall log significant instrument events including: • Gas readings • Gas, pump and battery alarms • Instrument turned on / turned off • Fresh air adjustments and calibrations

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11. Instrument Power

Battery pack options	The instrument shall be powered by interchangeable NiMH and alkaline battery packs. NiMH and alkaline packs will be interchangeable without any setup from user.
Battery life indication	The LCD shall include a gauge depicting estimated remaining battery life. Gauge must be visible when the instrument is on.
Run time	The instrument shall run up to 20 hours on a single charge or one set of alkaline batteries.
Charger	The drop-in cradle charger shall be capable of charging a depleted rechargeable battery pack within 6 hours. The cradle charger shall include LEDs that indicate when charging is underway and when complete.
Deep discharge cycle	The instrument shall allow the user to pre-schedule or manually initiate an automatic deep discharge / recharge cycle to exercise the rechargeable battery pack.
Charger for motorized pump equipped instruments	An optional drop-in cradle charger shall be available for motorized pump equipped instruments such that both the rechargeable battery pack in the instrument and the battery pack in the motorized pump can be recharged at the same time.
Charger input voltages	Chargers must be usable for 110 – 240 VAC, and with optional 12VDC power source.
Flash light battery pack option	The instrument shall be capable of being equipped with an optional rechargeable battery pack with "flash light" LEDs. The flash light LEDs shall be activated by pressing a button on the instrument display. The LEDs shall illuminate in a downward direction to facilitate use during confined space and other activities in which the instrument is operated in the dark.
Cross compatible chargers	The G450 shall use the same chargers as the G460 and G450/G460 motorized pumps.
Multi-unit chargers	A five instrument gang charger will be optionally available. The five charging modules will be mounted to a common back-plate. A single 110 – 240 VAC power source will be used to provide power to the complete five unit array.

12. Calibration

Calibration tools	Standard accessories for the instrument shall include a calibration adapter used to introduce calibration gas to the instrument. The calibration adapter shall include a "read switch" that automatically tells the instrument when the adapter has been installed, and the instrument is ready to begin calibration.
Automatic calibration	The instrument shall be capable of automatic fresh air and span calibration adjustment.
Calibration history	Instrument must identify all sensors at start-up and indicate their calibration history and pre-set alarm levels appropriate to sensors installed. The instrument must retain and display the last three calibration dates for each installed sensor.
Calibration, bump test and inspection due dates	Instrument shall include programmable bump test, calibration, and inspection due dates. Instrument shall display an explanatory alarm message when any due date is exceeded. It shall be possible for the user to acknowledge the alarm and use the instrument, but the alarm will continue to be displayed each time the instrument is until the necessary procedure is completed turned on.
Docking station	The manufacturer shall offer a fully automatic docking station for bump testing, calibrating and downloading testing and gas monitoring results from the instrument, and transferring the downloaded information to a computer. The docking station shall be able to complete a bump test in 20 seconds. The docking station will include an SD card capable of storing up to 10,000 test records. The docking station shall allow the user to program the types and concentrations of gas used in the calibration procedure. Docking stations shall be available in single calibration gas inlet, and four calibration gas inlet versions.
Test station	The manufacturer shall offer an automatic test station for bump testing and downloading test results from the instrument, and transferring the downloaded information to a computer. The test station shall be able to complete a bump test in 20 seconds. The test station will include an SD card capable of storing up to 10,000 test records.

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13. Sampling Systems

Sampling modes	Instrument may be operated in diffusion mode, with optional attachable motorized pump or with a hand-aspirator (squeeze bulb) type sample draw kit.
Motorized pump	The attachable motorized pump shall include a built-in slide-shutter switch that permits operation in either diffusion or sample draw mode while the pump is attached.
Pump power source	Motorized pump shall include its own separate power supply. The motorized pump shall not be powered by means of the instrument battery pack.
Motorized pump battery pack options	The motorized pump shall be powered by the interchangeable NiMH and alkaline battery packs. The same battery packs must be interchangeably usable in either the instrument or the motorized pump.
Sampling accessories	A polycarbonate sampling wand (probe) with integral, replaceable hydrophobic barrier and particulate filters will be included standard with the motorized pump. Two meter and three meter telescoping stainless-steel probes will be optionally available.
Sampling system filters	The motorized pump must contain user replaceable filters to prevent the ingress of dust into the instrument. The filter must be readily accessible without disassembling the instrument or motorized pump.
Sample line attachment	Sample lines must be attached using an adaptor for secure attachment.
Allowable sample line length	The motorized pump must be capable of drawing a sample from at least 200 feet (65 m) away.
Fluid ingress protection	A sample probe assembly with an inline filter that has provision to prevent water and debris from entering the sample line must be available.

14. Maintenance, Warranties

Sensor Replacement	Sensors shall be easily accessed and replaced in the field. The only tool necessary shall be a
Warranty	The instrument electronics and mechanical components shall be provided with a lifetime warranty for defect in manufacture.
Warranty, sensors	- O_2, H_2S, CO, CO-H, and %LEL combustible gas sensors shall be warranted for three full years. An optional extended 6-year warranty plan shall be available for these sensors.
Warranty, consumables	Battery packs and other components consumed or degraded in normal operation (such as filters and pumps) shall have a one-year warranty.

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