Barometers

User manual

Revisions list

Issue	*Date*	*Description of changes*
Origin	11/08/2020	
1	03/11/2023	Modified DQA251 sensor power supply; made minor changes
2	28/10/2024	Added information in case of changing of measuring range/output of the sensor

About this manual

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LSI LASTEM reserves the right to carry out changes to this product without timely updating of this document.

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Summary

1   Introduction
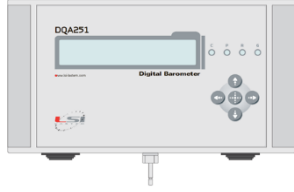
The LSI LASTEM barometer are sensors designed for accurate measurement of barometric pressure.

DQA240.1 is more suitable for LSI-LASTEM data acquisition systems (0÷1 Vdc output).

DQA801 is also suitable for integration with third-party systems (0/4÷20 mA output), its measurement range is locally selectable via dip-switch.

DQA251 is a high precision instrument for absolute pressure, QNH, QFE, QFF. Long-term stability and a web interface make it the perfect tool for professional acquisition, meteorology, and aviation systems. The robust IP67 housing allows easy installation even in difficult environmental conditions. This sensor is built according to WMO and ICAO standards.

2   Versions

PN	DQA240.1	DQA801	DQA251
Output	0÷1 V	0/4÷20 mA	Modbus on RS485; Modbus on TCP-IP, Lan-Ethernet; autosending on RS232, socket TCP, FTP (SDI12 Optional)
Measure	Absolute pressure		Absolute pressure QNH, QFE, QFF according to CIMO/ET-Standard-1/Doc.10 (20.XI.2012) WMO -2012
Memory	NO		128 Mb (about 3 years of measures)
Data display	NO		- With built-in 2x24 LCD display - Via Web browser on a connected PC (graphs and numerical values)
Data download	NO		Measurements of the last 30 days in Excel and ASCII files via Ethernet port

2.1 Technical features

PN	DQA240.1	DQA801	DQA251
Power supply	10÷14 Vdc	10÷30 Vdc/ac	10.8÷15 Vdc
Power consumption	0.25 W	0.5 W	<0.6 W (˜45 mA @ 12 Vdc)
Accuracy	0.5 hPa		±0.15 hPa (@20 °C) ±0.20 hPa (-40÷60 °C)
Thermal drift	Compensated into the range: 10÷60°C. Drift in the range -20÷10 °C: -0.025 hPa/°C		Compensated in the range: -40÷60°C
Range	800÷1100 hPa	Default: 800÷1100 hPa (selectable: 600÷1100 hPa, 700÷1100 hPa)	500÷1200 hPa
Linearity	NA	NA	±0.1 hPa / <0.05 hPa
Resolution	0.1 hPa		0.01 hPa
Constant time	2 s		2 s
Response time	0.5 s		0.1 s
Long term stability	<±0.5 hPa/year		<±0.1 hPa/year
Calibration	Using DL setup	Through trimmer	Via internal software
Calibration certificate	Not included	Not included	Included
Maximum pressure limit	2000 hPa	2000 hPa	3000 hPa
Principle	Piezoresistive		
Protection	IP43	IP66	IP66
Weight	200 g	300 g	1 kg
Installation	Within ELF protection	DYA078 on arm	On DIN rail
Operative temperature	-40÷85 °C		-30÷80 °C
Operative UR%	0÷100 % non-condensing		
Compatibilità con data logger	M-Log (ELO008) R-Log (ELR515) E-Log Alpha-Log		Alpha-Log using RS232->485 converter: M-Log (ELO008) R-Log (ELR515) E-Log

3   Installation

For the installation of the barometer choose a site whose conditions are representative of the environment examined.

Barometers must be assembled in dry places (indoor possibly) where there aren't considerable and unexpected fluctuations of temperature. If an outdoor application is required, the sensor should be located inside a protected case or below a sun/rain shelter.

3.1   General safety rules

Please read the following general safety rules in order to avoid injuries to people and prevent damages to the product or to possible other products connected with it. In order to avoid any damages, use this product exclusively according to the instructions herein contained.

The installation and maintenance procedures must be carried-out only by authorized and skilled service personnel.

Power the instrument in a suitable manner. Pay attention and observe the power supplies like indicated for the model in your possession.

Carry-out all connections in a suitable manner. Pay strict attention to the connection diagrams supplied with the instrument.

Do not use the product in case of suspected malfunctions. In case of suspected malfunction, do not power the instrument and contact authorized technical support immediately.

Before you carry-out any operation on electrical connections, power supply system, sensors and communication apparatus:

- Disconnect the power supply.
- Discharge the accumulated electrostatic discharges touching an earthed conductor or apparatus.

For more information about safety regulations, please refer to manual INSTUM_05290.

3.2   Mechanical installation and connection

3.2.1   DQA240.1 sensor

1. Fix the barometer on the plate inside the ELFXXX enclosure, together with data logger using the screws provided.
2. Connect the sensor to an analogue input of the terminal board of the LSI LASTEM data logger following the drawing in APPENDIX A.


Fixing holes
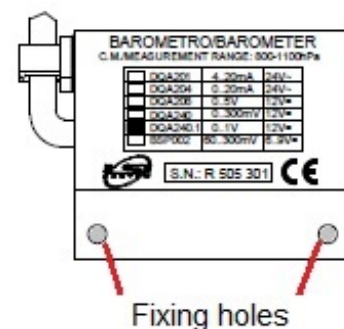
3.2.2   DQA801 sensor

Referring to the drawing in APPENDIX B, proceed as follows:

1. Open the sensor cover by unscrewing the four screws.
2. Set the output (0÷20 mA or 4÷20 mA) and the measurement range (800÷1100 hPa, 700÷1100 hPa, 600÷1100 hPa) using the internal switches. Check these parameters when configuring the data logger (§3.3).
3. Fix the barometer to the chosen position (usually on a pole, using the DYA078 shelter, or to a wall, or inside ELFxxx enclosure) using four screws which are inserted through the holes found on the base of the instrument.
4. Close the sensor cover.
5. Connect the DWA5xx cable to the connector
6. Connect the sensor to an analogue input of the data acquisition system and to the power supply system, following the schematic in APPENDIX B.

Warning! Check the power supply version before to switch-on the sensor.
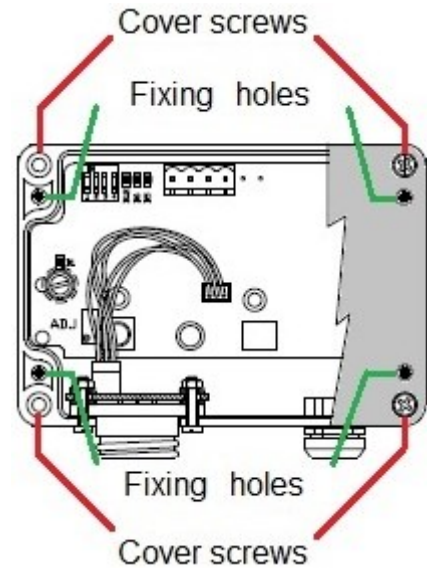
3.2.3   DQA251 sensor

The barometer can be mounted on a DIN bar inside the box or fixed to the wall.

For wall mounting:

1. Remove the side straps by pushing them outwards.
2. Fix the DQA251 using the appropriate holes.
3. Re-apply the straps after installation.

Connect the sensor to an RS485 input of the LSI LASTEM data logger following the drawing in APPENDIX C.

For more information on the use of DQA251, refer to I*NSTUM_03479 – Digital barometer – User manual.*
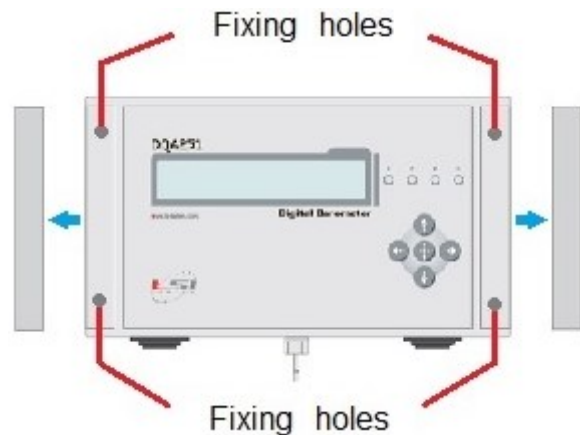
3.3   LSI LASTEM data logger configuration

If the sensor is used with an LSI LASTEM data logger, proceed with the configuration of the data logger using the 3DOM software:

➢ Open the data logger configuration.
➢ Add the sensor by selecting its code (eg DQA240.1) from the *3DOM Sensor Library*.
➢ Check the acquisition parameters (input, rate, etc.).
➢ Verify that the physical input type and measuring range (scale) parameters match those of the sensor.

➢ Save the configuration and send it to the data logger.

For more information about the configuration, refer to the manual of the data logger in use.

To obtain the pressure value at sea level, refer to chap. 3.4.

3.4 Adjustment of pressure at sea level

Find out the exact value for the atmospheric pressure at sea level, from the nearest airport or any reference instrument. In a day of meteo-climate stable condition, the atmospheric pressure will be about 1013 hPa; remember that the atmospheric pressure takes lower values with the increase of the altitude. The gradient of decrease is about 1 hPa every 10 m of altitude.

Then, compare the reference value with the output of barometer (related opportunely to the same altitude). If the difference between these values is considerable, set the adjustment:

For DQA240.1 sensor:

1. Remove the sensor.
2. Unscrew the screws that secure the board to the sensor body.
3. Using a screwdriver, act on the P1 trimmer until the value read is the same as the reference value. If the reading takes place through a data logger, wait for the acquisition of the measurement that typically takes place at the end of each minute; if this is done using a multimeter, connect the test leads to the sensor output and apply the following formula:
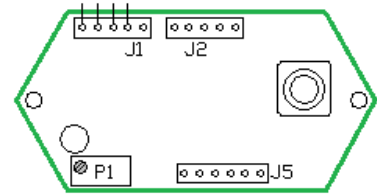
*Output value (V) = Reference value – Start scale (V) * (Full scale (V) – Start scale (V))/300*

4. Install the sensor.

For DQA801 sensor:

1. Open the sensor cover.
2. Use a screwdriver to adjust the ADJ trimmer (§ APPENDIX B) so that the value read is the same as the reference value. If the reading takes place through a data logger, wait for the acquisition of the measurement that typically takes place at the end of each minute; if it takes place by means of a multimeter, connect the test leads to the sensor output and apply the following formula:

*Output value (mA) = Reference value – Start scale (mA) * (Full scale (mA) – Start scale (mA))/300*

3. Close the cover once the operation is completed.

3.5   Pressure measurement at sea level with Pluvi-ONE and Alpha-Log data loggers

Pluvi-ONE and Alpha-Log data loggers implement function to calculate the pressure at sea level, according to different types of calculation. They are:

➢ *QNH-WMO Table:* calculate the QNH using the WMO Table 3.10 (ref. "International Meteorological Tables – WMO No. 188 TP. 94 – 1966".

➢ *QNH-ISA:* calculate the QNH using the ISA Equation N. 7 (ref. "CIMO/ET-Stand-1/Doc. 10 - 20.XI.2012).

➢ *QNH-ICAO:* calculate the QNH using the ICAO Equations N. 28/29 (ref. "CIMO/ET-Stand-1/Doc. 10 - 20.XI.2012; ICAO documents 7488/9837).

Using the 3DOM software, add a calculated measurement, selecting the desired type of calculation, the pressure measurement generated by the sensor, and other parameters, such as altitude, depending on the type of calculation chosen.

For more information about the configuration, refer to the manual of the data logger in use.

4   Operation check

To check the sensor output it is necessary to have the accompanying drawing (DISACC) of the sensor and a multimeter.

Identify the sensor output (§2). For sensors with analog output (current or voltage), proceed as follows:
- Current output (0/4÷20 mA):
    1. Set the multimeter to measure signals in direct current (DC) and 20 mA scale.
    2. Disconnect the wire corresponding to the negative signal (- Sig) and connect it to the red test lead (+) of the multimeter. The black test lead (-) fix it in place of the disconnected wire.
    3. Read the value displayed on the multimeter and apply the formula shown in the chapter 4.1.
- Voltage output (V):
    1. Set the multimeter to measure voltage signals and scale in V.
    2. Connect the red test lead (+) of the multimeter to the wire corresponding to the positive signal (+ Sig) and the black test lead (-) to the negative signal wire (- Sig) of the sensor (it is not necessary to disconnect the sensor from the data logger.)
    3. Read the value displayed on the multimeter and apply the formula shown in the chapter 4.1.

Verification of the digital output (RS485) can be done using a PC, equipped with an RS232 serial port and in which the third-party program *modpoll* (https://www.modbusdriver.com/modpoll.html) is installed.

1. Connect the sensor serial cable to the PC serial port.
2. Open a DOS Prompt window and type the following command (it is assumed that the transmission parameters are set as follows: *Baudrate: 9600 bps*, *Parity: None* and that the PC serial port used is COM1):

    modpoll -a 1 -r 1 -c 24 -t 4:float -p none -b 9600 com1   [Enter]

    For the list of available commands, type the command *modpoll /help*.
3. The program displays the values for the following quantities:
    Pressure, Sensor Temperature, Sensor Voltage, QFE Pressure, QNH Pressure, QFF Pressure, Altitude, External Temperature, Latitude, Longitude, Battery Voltage, Power Supply Voltage.

For more information about the DQA251 sensor, refer to *INSTUM_03479 – Digital barometer - User manual*.

4.1 Calculation of the barometric pressure from the analog output of the sensor

To calculate the barometric pressure starting from the current or voltage value, apply the formula:

FORMULA:

$$P = P_{low} + \frac{P_{range}}{U_{range}} \cdot (U_{out} - U_{low})$$

where:
P_{low} = lower pressure limit (hPa)
P_{range} = pressure range (hPa)
U_{range} = output measurement range (V or mA)
U_{out} = measured output (V or mA)
U_{low} = lower output limit (V o mA)

EXAMPLE:

$$P = 800\,hPa + \frac{(1100\text{-}800)\ hPa}{(20\text{-}4)\ mA} (12\text{-}4)\ mA = 950\ hPa$$

With sensor with the following features:
- Pressure range: 800÷1100 hPa
- Output measurement range: 4÷20 mA
- Measured output: 12 mA

It is also possible to obtain the value following the correspondence shown in the table:

Reading on multimeter for each hPa	Sensor output	Sensor range
0.066 mA	0÷20 mA	
0.053 mA	4÷20 mA	800÷1100 hPa
3.0 mV	0÷1 V	
0.05 mA	0÷20 mA	
0.04 mA	4÷20 mA	700÷1100 hPa
2.5 mV	0÷1 V	
0.04 mA	0÷20 mA	
0.032 mA	4÷20 mA	600÷1100 hPa
2.0 mV	0÷1 V	

5 Maintenance

No maintenance is required for barometers; a functional check with annual periodicity is however recommended. It is possible verify the accuracy of barometric output by the comparison between values reported to the same altitude. For more information about the adjusting of the sensors, refer to chap. 3.4.

LSI LASTEM suggests to check the instrument calibration at least every 2 years.

6 Spare parts

Code	Description
DWA505	Cable L = 5 m for DQA801
DWA510	Cable L = 10 m for DQA801
DWA525	Cable L = 25 m for DQA801
DWA526	Cable L = 50 m for DQA801
DWA527	Cable L = 100 m for DQA801
MG2251	7 pin free female connector
DYA078	Support for DQA801 with radiant shield (requires DYA049 collar)

DYA049	Mast mounting device for Ø 45÷65 mm pipe

7 Disposal

This product is a device with high electronic content. In accordance with the standards of environmental protection and collection, LSI LASTEM recommends handling the product as waste of electrical and electronic equipment (RAEE). For this reason, at the end of its life, the instrument must be kept apart from other wastes.

LSI LASTEM is liable for the compliance of the production, sales and disposal lines of this product, safeguarding the rights of the consumer. Unauthorized disposal of this product will be punished by the law.

Recycle or dispose of the packaging material according to local regulations.

8 How to contact LSI LASTEM

In case of problem contact the technical support of LSI LASTEM sending an e-mail to support@lsi-lastem.com, or compiling the technical support request module at www.lsi-lastem.com.

For further information refer to addresses and numbers below:

- Phone number   +39 02 95.414.1 (switchboard)
- Address: Via ex S.P. 161 – Dosso n. 9 - 20049 Settala Premenugo, Milano
- Web site: www.lsi-lastem.com
- Commercial service: info@lsi-lastem.com
- After-sales service: support@lsi-lastem.com, Repairs: riparazioni@lsi-lastem.com

9 CE Conformity Declaration

LSI - Laboratori di Strumentazione Industriale S.p.A.
Via Ex S.P. 161 Dosso, n.9 - 20090 Settala Premenugo (MI) - Italia

Tel.: (+39) 02 95 41 41   **WEB:** http://www.lsi-lastem.it
Fax: (+39) 02 95 77 05 94   **CF./P. Iva:** (VAT) IT-00847150158
e-mail: info@lsi-lastem.it   **REA:** 834042 **Reg.Imprese:** 00847150158

Ref. CE017/12 Date : 18-Oct-2013

CE CONFORMITY DECLARATION

Producer declaration about the warranty that the series production is up to the Certified sample

Producer declaration about the conformity to the EMC European rules

Name of the producer: LSI SpA

We hereby declare that all the products of the following series:

Product name: Radiometers, codes:

DPA516, DPA518 DPA521, DPA523 DPA511, DPA513	DPA501, DPA503 DPA506, DPA508 DPA554, DPA559 DPA553, DPA558	DPA560, DPA568 DPA 855, DPA 854, DPA 860, DPA 863

produced by our company are produced in the same way as the exemplar tested.
The products satisfy the requirements imposed by the European rule

EMC DIRECTIVE 89/336 EEC (included EEC 93/68)

Compliance with this directive implies conformity to the following European Norms (in brackets are the equivalent international standards)
- EN 50082 – 1
- EN 55011
- EN 55022 (CISPR 22) – Electromagnetic Interference
- EN 55024 (IEC61000-4-2,3,4,5,6,8,11) – Electromagnetic Immunity
- EN 61000-3-2 (IEC610000-3-2) – Power Line Harmonics
- EN 61000-3-3 (IEC610000) – Power Line Flicker
- EN 60950 (IEC60950) – Product Safety

In accordance to the aforesaid rules, products are marked CE.
The present declaration covers all the options derived by the specified product.

Dr. Giulio Certo
General Manager and Representative

Appendix A

Overall dimensions and connections for DQA240.1 version.

Appendix B

Overall dimensions and connections for DQA801 version.
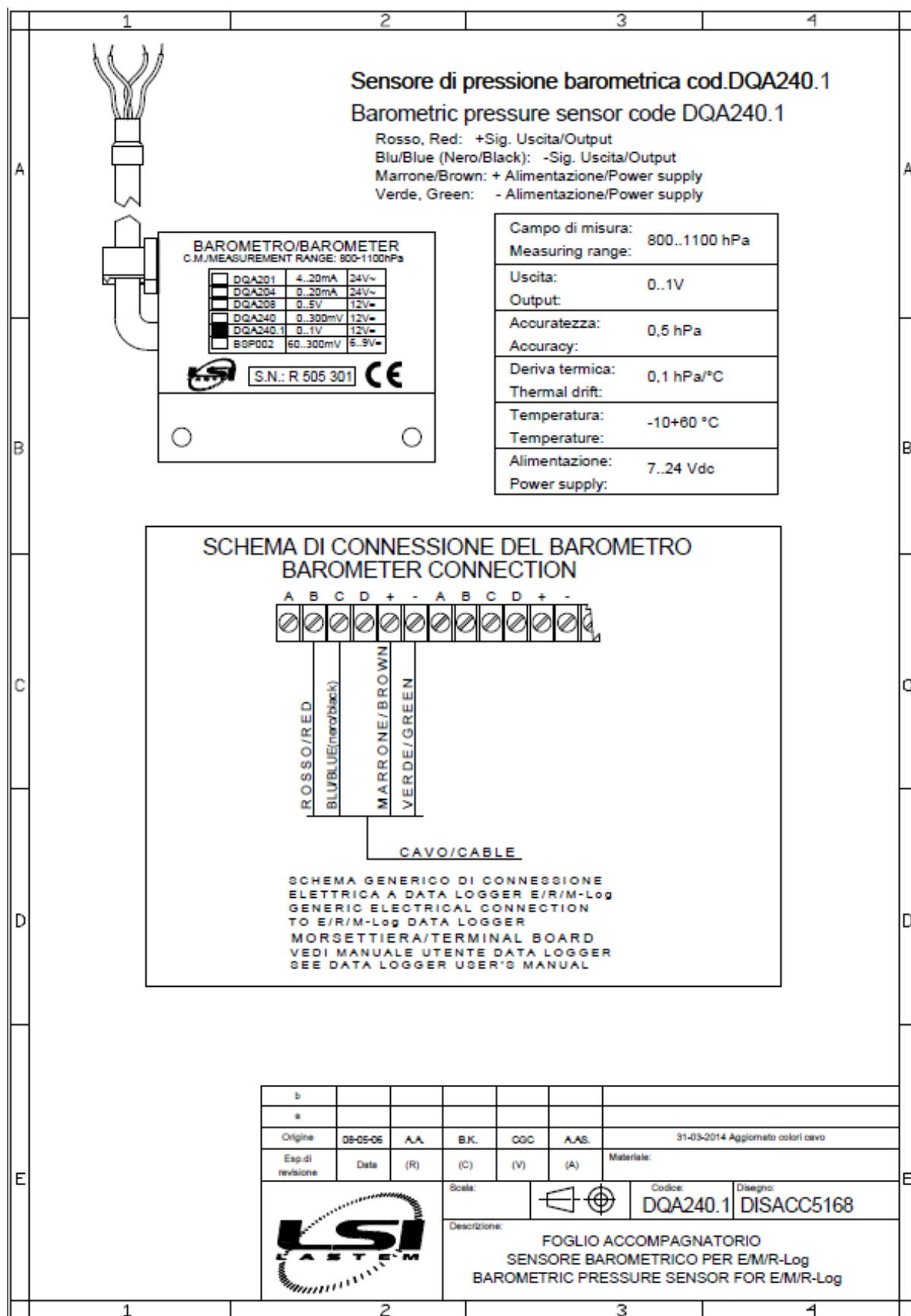
Appendix C

Overall dimensions and connections for DQA251 version.