



Environmental monitoring solutions



DEA421

Signal Transducer Box

User manual

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1 Introduction

Signal Transducer Box (code DEA421, herein called *STB*) is an electronic device produced by LSI LASTEM that allows the easy and fast connection of environmental sensors obtaining electrical standard signals with scale $0/4 \div 20$ mA. The device can be interfaced to different types of sensors.

The *sampling rate* (reading cycle of the input signals) has been set at 1 second. The instrument uses the *instantaneous* data, sampled within a programmable period (*processing rate*) and fixed in advance in order to supply a set of statistical processing; both instantaneous data and statistical processing can be transferred to the output signals.

1.1 Notes about this manual

The information contained in this manual may be changed without prior notification. No part of this manual may be reproduced, neither electronically or mechanically, under any circumstance, without the prior written permission of LSI LASTEM.

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

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2 Product installation

2.1 General safety rules

Please read the following general safety rules to avoid injuries to people and prevent damages to the product or to possible other products connected with it. 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.
- Install the instrument in a clean, dry and safe place. Humidity, dust and extreme temperatures can deteriorate or damage the instrument. In such environments we recommend the installation inside suitable containers.
- 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.
- Do not set working the product in presence of water or condensing humidity.
- Do not set working the product in an explosive atmosphere.

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 safety regulations please refer to manual INSTUM_05290.

2.2 Mechanical fastening

The installation of the apparatus can be carried-out on the wall by means of 4 plugs, *Fischer* type, and 6 mm screws, using the holes placed on the back panel.

STB is a precision measurement apparatus, but it is subject to thermal creep (even though minimum); for this reason, we recommend to place the apparatus in a shady area and safe from atmospheric agents (even if it is not expressly necessary).

2.3 Electrical connection

Power the instrument according to the technical specifications. Particularly you will get the correct operation using the suitable earthing of the power lines and communication lines.

Under the cover of the box, you can find the diagram that shows the electrical wiring of the power in line, sensors and output signals; it is summed up through the following table:

Clamp	Name	Meaning
1	Power In +	STB Power, positive
2	Power In -	STB Power, negative
3	Gnd	Earth
4	Out Sig. 1 +	Analog output 1, positive
5	Out Sig. 2 +	Analog output 2, positive
6	Out Sig. Common -	Analog outputs, common negative
7	Out Sig. 3 +	Analog output 3, positive
8	Out Sig. 4 +	Analog output 4, positive
9	Out Sig. Common -	Analog outputs, common negative
10	Voltage 1 In +	Voltage input 0...1000 mV, positive
11	N.C.	Not connected
12	Voltage 1 In -	Voltage input 0...1000 mV, negative
13	Voltage 2 In +	Voltage input 0...1000 mV, positive
14	N.C.	Not connected
15	Voltage 2 In -	Voltage input 0...1000 mV, negative
16	Dig. +Out	Digital input, anemometer photodiode power feed
17	Dig. +In	Digital input, anemometer phototransistor power/A contact
18	Dig. Common	Digital input, common/B contact
19	Gnd	Earth
20	Rad. / Voltage 3 In +	Radiometer input / voltage 0...30 mV, positive
21	Rad. / Voltage 3 In -	Radiometer input / voltage 0...30 mV, negative

Aux. power clamp (*)	Name	Meaning
P1	Gnd/Shield	Earth
P2	Power Out -	Sensor power output, negative
P3	Power Out +	Sensor power output, positive
P4	Mains Power In Phase	Mains AC power in, phase
P5	Mains Power In Neutral	Mains AC power in, neutral

(*) Refer to the §9 drawing sheet.

At first perform the connection of the sensors and signal outputs running the cables inside the holes of cable-guides; the unused cable-guides must be closed, using, for example, one piece of cable. Tighten the cable-guides appropriately to avoid the seepage of dust, humidity or animals inside the container.

At the end connect the power supply cables. Closing the main switch causes the lighting of the green led on the STB board that confirms the presence of electrical current (see §5.2).

In principle we recommend dividing the power supply lines from the measurement lines used for the connection of the sensors with STB, in order to reduce the possible electromagnetic disturbances to a minimum; so avoid the use of the same raceways for these different types of wiring.

2.3.1 Serial line

The connection to the serial communication line is carried-out through female 9 pin connector available inside the instrument. Connect STB to PC using a standard DTE/DCE cable (not inverting). STB uses Rx/Tx signals only, so the 9 pin D-Sub connector cabling can be reduced to only use poles 2, 3 and 5.

The serial line usage is limited only to the configuration and diagnostic operations, so the connection can be done only temporarily, so it is not required to use the cable holes for that.

3 System programming and management

STB is equipped with several functions that can be programmed easily through a terminal emulation program (for example *Windows HyperTerminal* or any other commercial or free program that can be downloaded from Internet).

The programming of the apparatus takes place by connecting the PC serial line (through USB/RS232 adapter or native) to the serial line of STB. The terminal program has to be programmed as follow:

- Bit rate: default 9600 bps;
- Terminal Mode: ANSI;
- Echo: disabled.

STB supplies the access to its functions through an easy menu interface. You can access to the main menu pressing ESC until the terminal program will show the following instructions:

```
Main Menu:
1: About this device...
2: Communication parameters
3: Sampling
4: Data Tx
5: Output signals
6: Save configuration
7: Restart system
8: Statistics
```

The main menu is made up of several items. You can access to the different functions pressing, on terminal, the numeric keypad corresponding to the desired item. The next function may be a new menu or the request to change the selected parameter; in this case it is shown the current value of parameter and the system waits for the input of a new value; press *Enter* to confirm the new inputted value or press *Esc* to return to previous menu without changing the selected parameter; the *Esc* key also performs the move to previous menu.

Note: when you need to express decimal values use the dot as decimal separator for numbers input.

3.1 Functions available from menu

The programming menu of STB offers following functions:

3.1.1 About this device...

This menu displays the registry data of the instrument: mark, serial number and version of the program.

3.1.2 Communication parameters

This menu allows to program some parameters useful for communication between STB and the external apparatus (PC, PLC, etc.), particularly:

- *Bit rate* and *Stop bits*: it allows to modify the serial communication speed and stop bit number, as required by the external host.

- *Network address*: the network address of the instrument. It is especially necessary for CISS protocol, in order to find (in univocal way) the instrument respect to the others connected on the same communication line.

3.1.3 Sampling

Sampling includes the parameters that adjust the sampling and the processing of detected signals from the inputs, particularly:

- *Radiometer sensitivity*: corresponds to the sensitivity of the sensor, expressed in $\mu\text{V}/\text{W}/\text{m}^2$ or $\text{mV}/\text{W}/\text{m}^2$; this value is shown in the calibration certificate of the sensor.
- *Anemometer parameters*: it allows to program the linearization factors relative to the anemometer connected to frequency input. STB supplies the right parameters for the management of LSI LASTEM mod. DNA202 and DNA30x anemometer families; possible other anemometers can be linearized introducing up to 3 factors of the polynomial function that represents the response curve of the sensor. For example, if there is an anemometer with linear response of 10 Hz/m/s frequency, the polynomial will have to be programmed with following values: $X0$: 0.0; $X1$: 0.2; $X3$: 0.0. If instead we have available a table that supplies the values of non-linear response curve, it is recommended the use of a spreadsheet and the calculation of tendency line of Y-X scatter diagram that represents the data of the table; displaying the polynomial equation (up to third degree) of tendency line, we can obtain the X_n values to be inputted in STB. Otherwise, in order to obtain the direct value of the frequency, set: $X0$: 0.0; $X1$: 1.0; $X3$: 0.0.
- *Elaboration rate*: it is the processing time used for the supplying of statistical data (mean, minimum, maximum, totalization values); statistical values can be used to update the signal outputs according to the time expressed by this parameter.

3.1.4 Data Tx

Data Tx menu allows the execution of a fast diagnostic check of the sampled data and processed by STB; directly from the terminal emulation program, it is possible evaluate the right signals acquired by the instrument:

- *Tx rate*: it shows the transmission rate of data to terminal.
- *Start Tx*: it starts the transmission according to the specified rate; they are proposed the measures sampled by means of STB (the display sequence is from measure 1 to measure 5), updating the display automatically; press *Esc* to stop the transmission of data to terminal. The measurement display order follows the instrument model type:

Voltage 1, Voltage 2, Anemometer, Pyranometer/ Voltage 3

3.1.5 Output signals

This menu allows the programming of the parameters that produce the signal outputs update; the sub-menu offers the followings commands:

- *Output channel x*: choose one output from the available channels ($x = 1 \div 4$), from which its parameters can be accessed:
 - *Config*: it allows to set the parameters:

- *Measure*: selected measure to be coupled to the electric output previously chosen; choose one from the measures list available from the inputs of STB.
- *Value scale start*: it is the start scale value of the probe sampled from the instrument input, which corresponds the start scale of the signal present on the STB output; i.e., if $4 \div 20$ mA output signal is to be equivalent to a sampled temperature using a scale from 10 to 30 °C, this parameter must be set to 10.
- *Value scale end*: it is the end scale value of the probe sampled from the instrument input, which corresponds the end scale of the signal present on the STB output.
- *Live zero*: set *true* to request STB to use an output signal current starting from 4 mA in correspondence of the start scale of the measured probe; if set to *false* the output signal starts from 0 mA.
- *Elab. item*: it is the statistical elaboration item used to calculate the value of the output signal; factory default set this value to the instantaneous measure value (updated every second); anyway, it is possible to modify this parameter to obtain a different electric signal, i.e., to the average of a measure; in this way the output signal update time is equivalent to the parameter *Sampling – Elaboration rate*. It is also allowed to use more than one signal outputs coupled with the same measure but with its different statistical values (i.e. the minimum value of *Temperature 1* to the output 1 and its maximum value to the output 2).
- *Test*: it allows to perform tests on the output channel by manually setting the following values:
 - *Specific % value*: it sets the output to the specified value.
 - *Start scale*: it sets the output to zero scale value (0%).
 - *Middle scale*: it sets the output to half scale value (50%).
 - *End scale*: it sets the output to full scale value (100%).
- *Show outputs configuration*: this useful function takes a fast look to the entire signal outputs configuration, printing a table of all parameters of interest.

3.1.6 Save configuration

Save configuration, after request to confirm the operation, it runs the final storage of all changes to parameters previous modified; please note that STB changes its operation immediately from the first variation of each parameter (excepted the serial bit rates, that need the instrument re-start necessarily), in order to allow the immediate evaluation of the executed modification; re-starting the instrument without the execution of final storage of the parameters, it is produced the operation of STB corresponding to the situation preceding the modification of parameters.

3.1.7 Restart system

Restart system, after request to confirm the operation, it runs the restart of the system; warning: this operation cancels the variation of any parameters that have been modified but not definitively stored.

3.1.8 Statistics

This menu allows the display of some statistic data relative to the operation of the instrument, particularly:

- *Show*: it shows the time from last start or re-start of the instrument, the time from last reset of statistical data, the statistical counts relevant to the communications executed on two serial communication lines (number of received and transferred byte, number of total received messages, wrong messages and transferred messages). For further information about these data read §5.1.
- *Reset*: it resets the statistical counts.

3.2 Minimal configuration

In order to let STB to operate correctly, you usually have at least to set as follow:

- *Sampling*: set the parameters of this menu according to the typical data of the used sensors (radiometer sensitivity, anemometer type).
- *Output signals*: set the output parameters against the requirements of the connected devices; factory default set each output to the widest measure input scale (see §4) and it requires the using of its instantaneous value. Parameters of unused outputs can be left to default values. Default configuration output is representing by following table:

Output	Measure	Elab. item
1	Voltage 1	Instantaneous value
2	Voltage 2	Instantaneous value
3	Frequency / Anemometer	Instantaneous value
4	Pyranometer / Voltage 3	Instantaneous value

After modification of the parameters remember to store them definitively through *Save configuration* command and re-start the system in order to make them active (reset button, switch off/switch on or *Restart system* command). It is possible to check if the instrument works in the right way using the *Data Tx* function, available on the configuration menu.

3.3 Restart of the instrument

STB can be restarted through menu (see §3.1) or acting on reset key placed under the connector of serial line 2. In both cases, the changes to configuration, made through menu and not saved, will be cancelled completely.

4 Specifications

DEA421		
Inputs	Available inputs	4
	Type	Voltage
	Measurement range	0 ÷ 1000 mV
	Resolution	< 0.3 mV
Input 1, 2	Accuracy	< ±0.7 mV
	Type	Frequency
	Measurement range	0 ÷ 10 kHz
	Level of input signal	0 ÷ 3 V (supported 0 ÷ 5 V)
Input 3	Signal for power of anemometer photodiode	3.3 V, 6 mA
	Signal for power of anemometer phototransistor	3.3 V, 0.7 mA
	Resolution	1 Hz
	Accuracy	±0.5 % measured value
	Linearization/scale adaptation	Through polynomial function of third degree (default values for LSI LASTEM anemometers, or programmable for different types of sensors)
	Type	Voltage
	Measurement range	-1.5 ÷ 30 mV
Input 4	Resolution	< 8 µV
	Accuracy	< ±20 µV
	Thermal drift	1 W/m ² (radiation unit) / 10 °C
Outputs	Available outputs	4
	Type	Current 0 ÷ 20 mA or 4 ÷ 20 mA (selectable independently of the output); default: 4 ÷ 20 mA
	Maximum output load	300 Ω @ 12 V
	Resolution	< 6 µA
	Accuracy	±15 µA
Communication line	Type	RS-232
	Connector	9 poles Sub-D female, DCE, only Tx/Rx/Gnd signals are used
	Serial parameters	No parity, 8 data bit, 1 or 2 stop bit programmable (default: 1), bit rate programmable from 1200 to 115200 bps (default: 9600 bps)
	Configuration software	Terminal emulation program

Power supply	Voltage	85 ÷ 264 Vca
	Consumption	< 0.4 W
Electrical protections	Type	Against electrostatic discharge, on all sensors inputs, on power line
	Maximum power dissipation	600 W (10/1000 µs)
Environmental limits	Operative temperature	-20 ÷ 60 °C
	Temperature of warehousing/transport	-40 ÷ 85 °C
	Protection level	IP66
Sampling	Sampling rate	Programmable, for all inputs, from 1 to 3600 s (default: 1 s)
	Potenza massima dissipabile	600 W (10/1000 µs)
Measurement processing	All processed measures with common rate programmable from 1 to 3600 s	
	Application on all measurements of calculations of mean, minimum, maximum and total	

5 Diagnostic

5.1 Statistical information

STB collects some statistics data that can be useful for diagnostics of possible operation problems. The statistics data can be obtained through menu for programming and management of the system (see §3.1) and through the proper menu entry.

The activation of display of statistics data produces the following result:

```
Power on time: 0000 00:01:00
Statistical info since: 0000 00:01:00

Com Rx bytes Tx bytes Rx msg Rx err msg Tx msg
1 0 1 0 0 0
```

Here below you can read the meaning of displayed information:

- *Power on time*: power-up time of the apparatus or from last reset [dddd hh:mm:ss].
- *Statistical info since*: time from last reset of statistics [dddd hh:mm:ss].
- *Com*: number of serial port of the device.
- *Rx bytes*: number of bytes received from serial port.
- *Tx bytes*: number of bytes transferred from serial port.
- *Rx msg*: total number of messages received from serial port (TTY/CISS protocol).
- *Rx err msg*: number of wrong messages received from serial port.
- *Tx msg*: number of messages transferred from serial port.

5.2 Diagnostic LEDs

Through the lighting of led mounted on electronic board, the instrument shows the following information:

- Green led (Power): it lights to signal the presence of power supply;
- Yellow led (Ok) / Red led (Err): they light to signal the operating status of the instrument as specified in the following table:

Flashing type	Meaning
Yellow led: single fast flashing with pause of three seconds	Standard operation, no errors
Yellow led: single flashing lasting one second with pause of three seconds	Found not-critical problem that does not compromise the operation of the instrument
Red led: triple flashing lasting 1/3 of a second and then pause of three seconds	Found critical problem, STB must be checked

Possible errors pointed out by STB are shown by means of a proper message displayed in the menu of statistics that is proposed during the access to the functions of the instrument through terminal (see §3.1); the access in the statistic menu produces the reset of the error signaling (also through led), till next error detection. For further information about the errors managed by the instrument look it up in §5.3.

5.3 Trouble shooting

The table below shows the causes of some problems detected by the system and the pertinent remedies that it can be adopted. In case of errors detection by the system, it is recommended to check the statistical data too (see §5.1) in order to have a complete picture of the situation.

Error	Cause	Remedy
The red or yellow led shows an error condition	STB has detected an error during its operation	Use the terminal, connected to serial line 2 of STB and display the statistical data; according to the reported code make reference to other instructions of this table
The statistical reports the error 1 or an error message has been reported during the final storage of the modifications of configuration parameters	It has been found a storage error of configuration parameters after their modification	The memory (store) of the instrument has a heavy malfunction that probably cannot be recovered; enter again the storage command; in case of persistence of the error contact LSI LASTEM after-sale service. In this situation the calibration parameters of STB can have been compromised; be sure that the measurements carried out by the apparatus are correct (indicatively); for example using reference signals instead of sensors, before you consider the problems like solved
The statistical reports the error 2	The instrument has restarted and the configuration memory is damaged	Try to restart the instrument checking if the signalling of non-valid configuration persists; in case of persistence of the error contact LSI LASTEM after-sale service
The statistical reports an error higher than 2	It is a non-serious error caused by the survey of a condition of internal invalid operation	Try to restart the instrument; if, within some hours of operation in standard operating conditions (sensors acquisition and signal-generating correct), you'll find again the problem check the power supply and the signals generated by the sensors; check the grounding quality

6 Maintenance

STB is a precision measurement apparatus. In order to maintain the specified measurement precision over the time, LSI LASTEM recommends to check and re-calibrate the instrument every two years.

7 Disposal

STB is a device with high electronic content. In accordance with the standards of environmental protection and collection, LSI LASTEM recommends to handle this 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 STB, safeguarding the rights of the consumer. Unauthorized disposal of this product will be punished by the law.



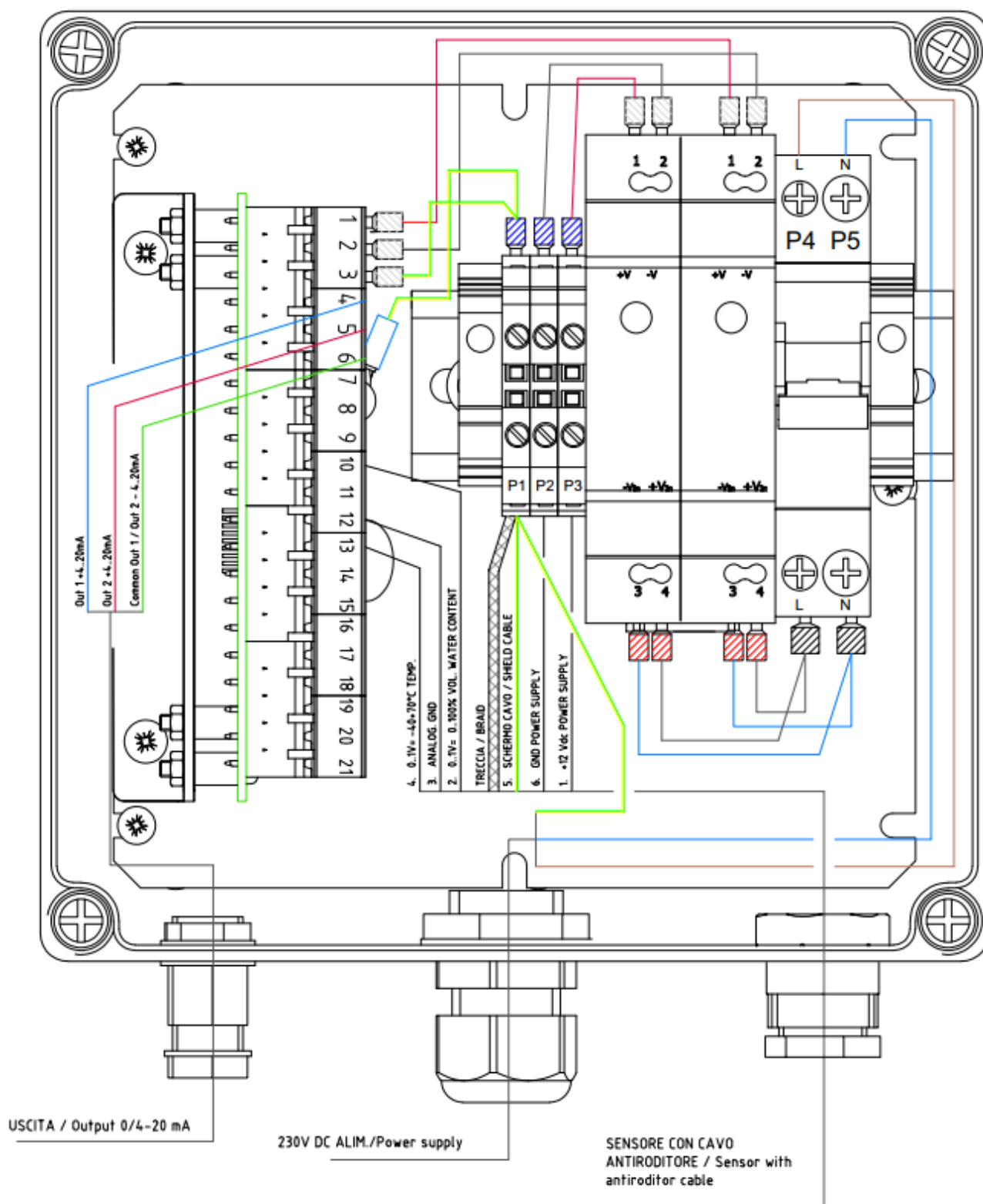
8 How to contact LSI LASTEM

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 make reference to addresses and numbers below:

- Phone number: +39 02 95.414.1 (exchange)
- 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, riparazioni@lsi-lastem.com (repairs)

9 Connection drawing



10 CE conformity declaration

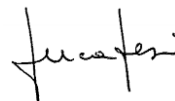
Product description: Signal Transducer Box

Models: DEA421

Issuer: LSI LASTEM Srl

LSI Lastem Srl declare under sole responsibility the above products are made under European directives 2004/108/EC and, specifically to the electromagnetic conformity, with the relevant provision of the following harmonized standards:

- EN 61000-4-2 (1995) + A1 (1998) + A2 (2001): Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test.
- EN 61000-4-3 (2002): Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test.
- EN 61000-4-4 (2004): Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test.
- EN 61000-4-5 (1995) + A1 (2001): Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test.
- EN 61000-4-6 (2003): Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields.
- EN 61000-4-8 (1993) + A1 (2001): Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test.
- EN 61000-4-11 (2004): Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests.



Settala, 29 October 2013

Luca Lesi