Antec Scientific
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The Netherlands

DECADE Elite

Service Manual

175.0020, Edition 4, 2018

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ISO 9001 certified

CE Declaration of conformity

We Antec Leyden B.V., Zoeterwoude, The Netherlands, declare that the product:

DECADE Elite™ Electrochemical Detector	type 175 and 176

to which this declaration relates, is in conformity with the following CE directives:

Low Voltage Directive (2014/35/EU)

Safety requirements for electrical equipment for measurement, control, and laboratory use:

- Part 1: General Requirements	**IEC61010-1 3ed:2010**
- Part 2-010: Particular requirements for laboratory equipment for the heating of materials	**IEC61010-2-010 3ed:2014**

EMC Directive (2014/30/EU)

Electrical equipment for measurement, control and laboratory use - EMC requirements

- Part 1: General Requirements	**IEC61326-1 2ed: 2012**

Electromagnetic Compatibility (CISPR11: group 1, Class A)

Group 1 ISM equipment: group 1 contains all ISM equipment in which there is intentionally generated and/or used conductively coupled radio- frequency energy which is necessary for the internal functioning of the equipment itself.
Class A equipment: is equipment suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

RoHS directive (2011/65/EU) Restriction of Hazardous Substances

This device complies with the requirements of CISPR11 group 1 class A ISM equipment. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures on his own expenses. Only use manufacturer-supplied cable(s) to connect with other devices. Thoroughly connect shielding to common. Manufacturer will not accept any liability for damage, direct or indirect, caused by connecting this instrument to devices and with cables which do not meet relevant safety standards.

Zoeterwoude, The Netherlands, April 20th, 2016
Dr. N.J. Reinhoud (managing Director)

Intended use

The DECADE Elite Electrochemical Detector is used in combination with (Ultra) High Performance Liquid Chromatography for the electrochemical detection of suitable analytes in liquid samples. With this technique the amount of electroactive substances in mobile phase can be quantified. The instrument can be used for the chromatographic analysis of a wide range of electroactive analytes in the fields of for example:

- Bioanalytical analyses
- Food analyses
- Environmental analyses

For research purposes only. **While clinical applications may be shown, this instrument is not tested by the manufacturer to comply with the In Vitro Diagnostics Directive.**

Operation of an electrochemical detector can involve the use of hazardous materials including corrosive fluids and flammable liquids. The instrument should only be operated by users with the following expertise:

- Completed degree as chemical laboratory technician or comparable vocational training
- Fundamental knowledge of liquid chromatography
- Participation in an installation of the system performed by the manufacturer or a company authorized by the manufacturer and suitable training on the system and chromatography software.
- Knowledge and experience in the safe handling of toxic and corrosive chemicals and knowledge of the application of fire prevention measures prescribed for laboratories.

Information on safety practices is provided with your instrument and operation manuals. Before using your instrument or accessories, you must thoroughly read these safety practices. This manual is written for laboratory technicians who use the DECADE Elite detector for (U)HPLC analysis.

Unskilled, improper, or careless use of this instrument can create fire hazards, or other hazards which can cause death, serious injury to personnel, or severe damage to equipment and property. Observe all relevant safety practices at all times. Only use the device for applications that fall within the scope of the specified intended use. Else the protective and safety equipment of the device could fail.

WEEE directive

All equipment of Antec which are subjected to the WEEE directive shipped after August 13, 2005 are compliant with the WEEE marking requirements. Such products are labelled with the “crossed out wheelie”, depicted on the left site.

The symbol on the product indicates that the product must not be disposed as unsorted municipality waste.

Collection & recycling information
Please ship the instrument back to the manufacturer (Antec Leyden, the Netherlands) at the end-of-life time of the product. The manufacturer will take care of the proper disposal and recycling of the instrument at its facilities.

Shipping address for the end-of-life products:

Antec Leyden B.V.
Industrieweg 12
2382NV Zoeterwoude
The Netherlands

In case of questions, or if further information is required about the collection & recycling procedure, please contact your local distributor.

ROHS directive

The DECADE Elite is ROHS compliant and in conformity with Directive 2011/65/EU Restricted use of Hazardous Substances in electrical and electronic Equipment (ROHS).

Antec is an ISO 9001:2008 certified company.

Table of contents

Warning Symbols

The following symbols are used in this guide:

This sign warns about the risk of electric shock. It calls attention to a procedure or practice which, if not adhered to, could result in loss of life by electrocution. Do not proceed beyond a danger sign until the indicated conditions are fully understood and met.

The warning sign denotes a hazard. It calls attention to a procedure or practice which, if not adhered to, could result in severe injury, loss of life or damage or destruction of parts or all of the equipment. Do not proceed beyond a warning sign until the indicated conditions are fully understood and met.

The caution sign denotes a hazard. It calls attention to a procedure or practice which, if not adhered to, could result in damage or destruction of parts or all of the equipment and/or erratic results. Do not proceed beyond a cautions sign until the indicated conditions are fully understood and met.

The biohazard sign draws attention to the fact that use of biological materials, viral samples may carry a significant health risk.

The toxic hazard sign draws attention to the fact that use of toxic solvents or samples may carry a significant health risk.

The attention sign signals relevant information. Read this information.

The note sign signals additional information. It provides advice or a suggestion that may support you in using the equipment.

Safety instructions

Adhere to the following standard quality control procedures and the following equipment guidelines when using the DECADE Elite detector. The following safety practices are intended to ensure safe operation of the instrument.

Working environment & safety

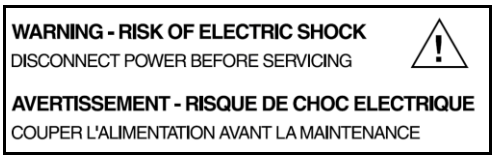
The intended use of the instrument is to detect electroactive substances in liquid samples in combination with a (U) HPLC system in a GLP-approved environment. Operators using the system should have the appropriate education an extensive understanding of GLP rules and be skilled in the art. Use this system ONLY for the intended use. Use of the system for any other purpose will cause unsafe situations.

System Operation

To assure optimal performance keep of the detector we recommend that the instrument is checked regularly and maintenance procedures are carried out. Preventive maintenance contracts are available for that Purpose. Please contact your local dealer or the nearest sales office for more information.

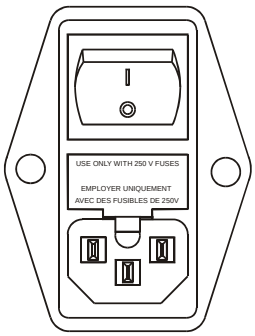
Electrical safety

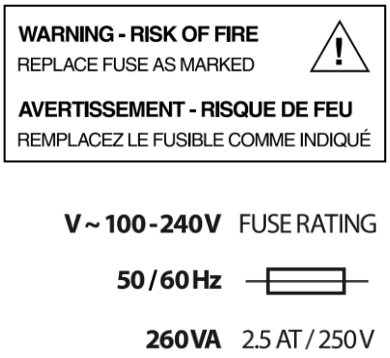
The removal of protective panels on the instrument can result in exposure to potentially dangerous voltages. Therefore, disconnect the instrument from all power sources before disassembly.



Untrained personnel should not open the instrument, **this may only be done by authorized service engineers**. Replace or repair faulty insulation on power cords immediately after discovery of the fault. Check that the actual power voltage is the same as the voltage for which the instruments are wired. Make sure power cords are connected to correct voltage sources: grounded AC power source, line voltage 100 – 240 VAC. The instrument should be connected to a protective earth via a ground socket. The DECADE Elite must only be used with appliances and power sources

with proper protective grounding to prevent damage through build-up of static electricity. The power source should exhibit minimal power transients and fluctuations. If necessary connect to a filtered mains socket.





Replace blown fuses with fuses of proper type and rating as indicated on the rear panel and as listed in the list of accessories and spares (appendix D). The fuse holder is integrated in the mains connector. Ensure that the instrument is never put in operation with fuses of a different type. This could cause fire. Only use manufacturer-supplied I/O cable(s) to connect with other devices. Thoroughly connect shielding to common. Manufacturer will not accept any liability for damage, direct or indirect, caused by connecting this instrument to devices and with cables which do not meet relevant safety standards.

Solvents

The solvents used may be flammable, toxic or corrosive. The room in which the system is installed should be well ventilated to prevent that solvent vapors cause poisoning or ignite and cause a fire. Use of open fire in the vicinity of this system must be strictly prohibited. Do not install the system in the same room with any other equipment that emits or could potentially emit sparks. Provide protective equipment near the instrument, when solvent gets into the eyes or on the skin, it must be flushed away immediately. Provide equipment, such eye wash stations and safety showers, as close to system as possible. Use proper eye and skin protection when working with solvents. Additional safety requirements or protection may be necessary depending on the chemicals used in combination with this equipment. Make sure that you understand the hazards associated with the chemicals used and take appropriate measures with regards to safety and protection.
Sample containers (vials) should be sealed to minimize any risks related to solvent vapor.

Biological Hazard

When you analyze biological fluids you need possible precautions and treat all specimens as potentially infectious. Always wear protective And gloves when handling toxic or biologically infectious samples to prevent bio hazards or hazards while working with the DECADE Elite. If necessary the instrument must be decontaminated before decommissioning or shipment of the instrument for repair to Antec or its representatives. When shipped to Antec every instrument has to be accompanied with a decontamination form which should be completely filled in and signed by the customer. Without this decontamination form the instrument will not be processed by Antec (either repaired or disposed).

Waste disposal

Perform periodic leak checks on LC tubing and connections. Do not close or block the drain in the oven compartment. Do not allow flammable and/or toxic solvents to accumulate. Follow a regulated, approved waste Disposal program. Never dispose of flammable and/ toxic solvents through the municipal sewage system.

Applications: quality control

It is recommended that you routinely run several quality control samples. Quality control samples should represent low, average and high levels of a compound. Make sure that quality control sample results are within An acceptable range, and evaluate precision from day to day and run to run. Data collected when quality control samples are out of range may not be valid. Do not report this data until you are certain that system Performance is acceptable. Apart from use of quality control samples, we Recommend that you use blanks. The blanks will help you assess whether carry-over is within an acceptable range and monitor the integrity of your data.

Using the DECADE Elite in other ways than indicated in the manual or defined by good laboratory practice may result in erratic or unsafe operation.

C H A P T E R 1

Introduction

This service manual is written for trained and qualified service engineers who service the DECADE Elite/Lite electrochemical detector.

This detector enables you to perform all (U)HPLC applications using electrochemical detection. The DECADE Elite includes a highly stable Faraday-shielded oven compartment accommodating column and flow cell. This flow cell has surprised researchers for its unsurpassed S/N ratio and therefore you now possess the best possible combination for extremely sensitive EC analyses.

The DECADE Elite has 3 operational measurement modes: DC, SCAN and PULSE mode. Furthermore, a Service, Diag(nostics) and Config(uration) mode are available. In addition, crucial parameters can be controlled by relays and TTL. The DECADE Elite can support up to 3 flow cells (optional), which makes it possible to perform 3 independent measurements with one detector.

The DECADE Elite is available in different colors. The DECADE Lite is a “light” version of the Elite, it is for single flow cell operations in DC mode only (picture, right).

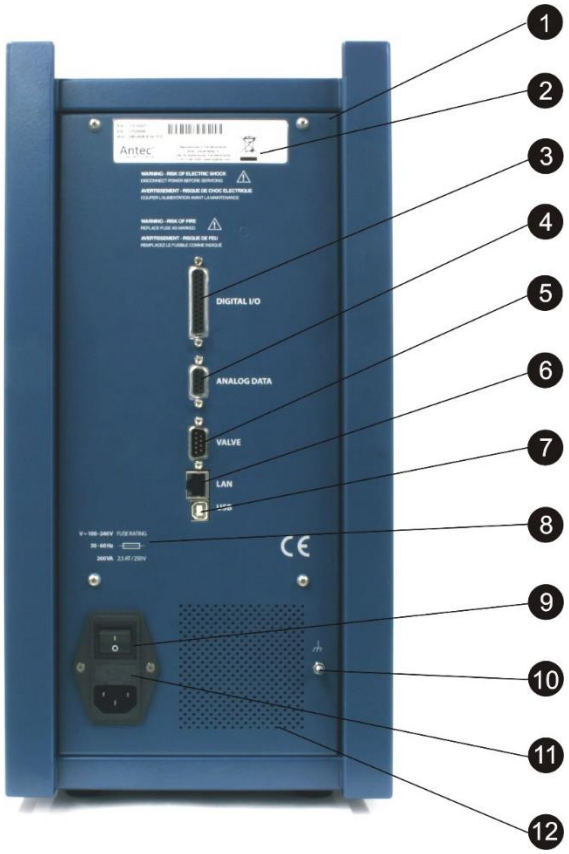
This manual covers service aspects which may be performed by field service engineers on the DECADE Elite. For details about the user operation instructions, installation, environmental conditions etc. please refer to the DECADE Elite user manual (pn 175.0010)

Instrument description

DECADE Elite – Front side

#	Description	#	Description
1	Instrument housing	7	'+' and '-' value keys
2	LC tubing inlet/outlet	8	Cursor keys
3	Instrument door panel	9	Door handle (for opening door)
4	4 x 40 Ch LCD display		
5	Function keys		
6	<Enter> key		

DECADE Elite – Back side



#	Description	#	Description
1	Instrument rear panel	7	USB connector (USB B)
2	Type label (pn, sn etc.)	8	Fuse & power rating
3	Digital I/O connector (25-pins sub-D fem)	9	Mains switch/inlet
4	Analog data (9-pins sub-D fem)	10	Grounding stud
5	Valve connector (9-pins sub-D male)	11	Fuse compartment
6	LAN connector (RJ45 jack)	12	Ventilation holes

DECADE Elite – Oven compartment

#	Description	#	Description
1	Cell cabinet	8	Column clamp
2	Cell connector (9-pins sub-D fem)	9	Mounting hole for cell clamp (M4)
3	Top fan heater (intake)	10	Bottom fan heater (exhaust)
4	Door sensor	11	Mounting hole for column clamp (M3)
5	Mounting plate (for cells & columns)	12	Drain
6	Door lock	13	Door panel, rear
7	Flow cell clamp (for SenCell)	14	Type label

C H A P T E R 2

Required service tools

The following tools are necessary for servicing the DECADE Elite/Lite:

- Screwdriver
- Socket wrench 3/16”
- Phillips screwdriver PH-1 and PH-2

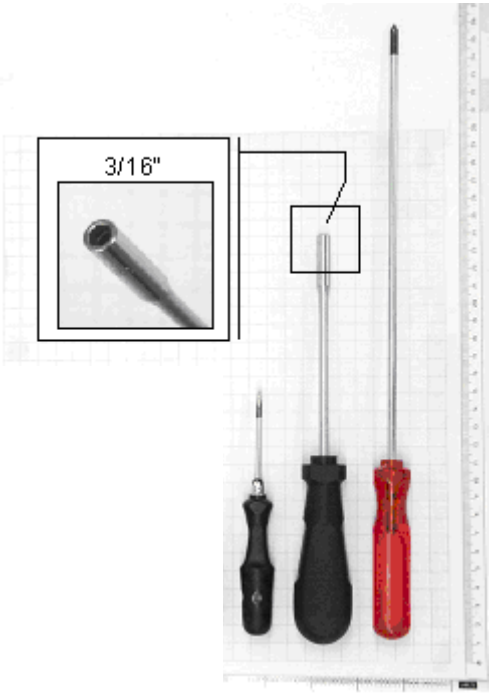


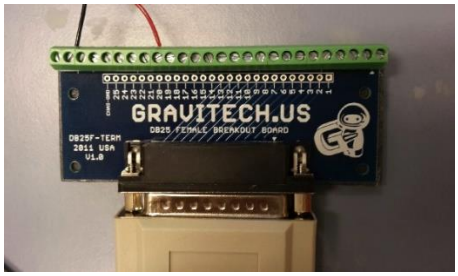
Figure 1, *Screwdriver, socket wrench and Phillips PH-1 screwdriver (from left to right).*

Calibrated temperature sensor must have a tolerance at 45ºC equal or better than 0.1ºC. Suggested model: Extech RTD 407907. Calibration certificate should not be older than 1 year.

Calibrated voltmeter must have a resolution equal or better than 0.1 mV. Suggested model: Fluke 12. Calibration certificate should not be older than 1 year.

USB cable for updates of the embedded software (Firmware) an A-B USB cable is required, this cable (pn 250.0175) is shipped with the instrument.

IO connection set Testing outputs is done using the factory supplied connector cable and screw terminal PCB: DECADE Elite I/O conn. Board (p/n 250.0131B) and DECADE Elite I/O cable 25M-25M, 1.8m (p/n 250.0131C).



Elite Dialogue software: download the latest version from our website. The free version of Elite Dialogue can be used for instrument control and firmware updates. To be able to run an OQ, PQ and automated calibration scripts an Elite Dialogue USB license key (pn 171.9012) is required. Elite Dialogue is backward compatible: ‘old’ Dialogue license dongles can be used with the new Elite Dialogue software.

Computer requirements In order to be able to run Elite Dialogue a PC with Microsoft Windows OS 7 or higher is required with 2 free USB ports and 1 free LAN port. Microsoft Excel (2003 or newer) is required for saving data to Excel and using the calibration scripts. In Windows regional settings the decimal separator should be a dot “.”, and the digit grouping symbol a comma “,”.

Dialogue Elite uses the Elite USB port only for Firmware updates, in all other cases (calibration scripts, PQ/OQ measurements) the LAN port is used.

C H A P T E R 3

Key combinations for service

Reset to factory defaults

Function to bring the instrument into a predefined state with respect to operational parameters. In CONFIG screen press Enter button for more than 4 seconds. A message appears “RESET TO FACTORY SETTINGS?” If yes, factory settings will be loaded.

- reset of operational parameters (Ecell, range, filter, temperature…)

Enter service mode

In main screen press enter for more than 4 seconds. A message appears “this mode is for qualified service personnel only, continue?” If yes, the service menu is loaded.

- data-acquisition and scanning is stopped
- operational parameters (Ecell, range, filter..) are reset to their values used for instrument calibration.

C H A P T E R 4

DECADE Elite FW upgrade

Software installation

In order to be able to run Elite Dialogue a PC with Microsoft Windows OS 7 or higher is required and 2 free USB ports (1 USB port only in case the free version is used to upload FW).

To install the software follow the procedure below:

- Download the latest version of DECADE Elite from our website.
- De-install previous versions of Dialogue before attempting an installation.
- Unzip the downloaded file and start the executable EliteDialogueSetupxxxxx.exe.
- Follow the installation instructions on the PC screen carefully. The program will by default be installed in the directory: C:\Program Files (x86)\Antec\Elite Dialogue\ After installation a new application group named “Antec” will appear in the Windows Start Menu containing a link named “Elite Dialogue”.
- In Windows regional settings the decimal separator should be a dot “.”, and the digit grouping symbol a comma “,”.

Besides the Dialogue PC software a flash file containing the latest update of the DECADE Elite/Lite embedded software is necessary. Such a flash file has the following file name: DECADE_Elite_xxxx.anl.

Always consult Antec when upgrading a DECADE Elite detector. Send an e-mail to: support@antecscientific.com to obtain upgrade information and the flash file containing the latest update of the embedded software. Please include the serial number of the DECADE Elite detector which you want to upgrade in the e-mail.

Store the obtained flash file (*.anl) in the following directory: C:\Users\xxxxx\Documents\Dialogue Elite\Templates

After installation of Elite Dialogue software connect the DECADE Elite to an available USB port on the computer using the USB (A-B) cable delivered with the detector (connect the B plug of the cable into the USB port on the rear panel of the instrument.

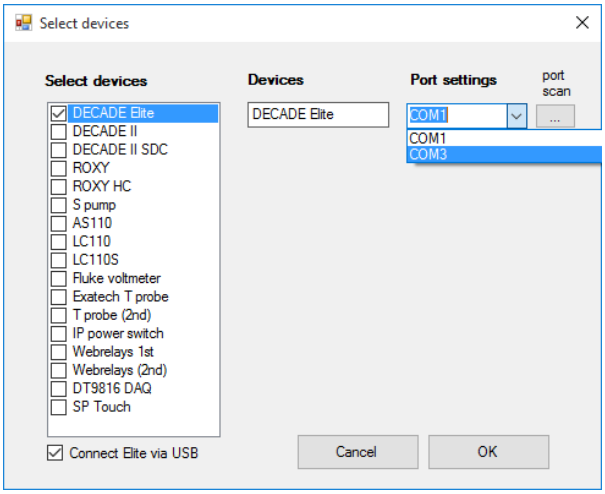
Figure 2 *Left: rear panel DECADE Elite with USB cable connected (B type connector). Right: rear panel of the PC with USB cable connected (A type connector).*

When changing the connection from LAN to USB or vice versa, always switch off and on the unit to initialize the correct communication protocol.

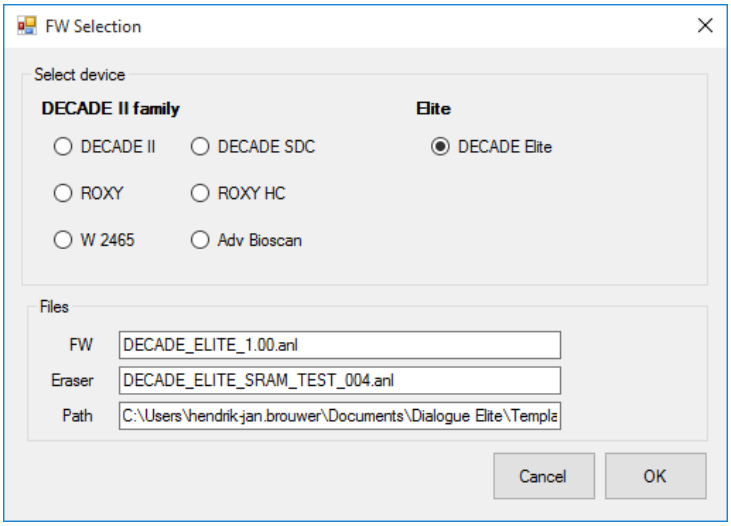
Upgrading firmware

Follow the instructions in this chapter accurately to successfully update the embedded software (FW) on your detector:

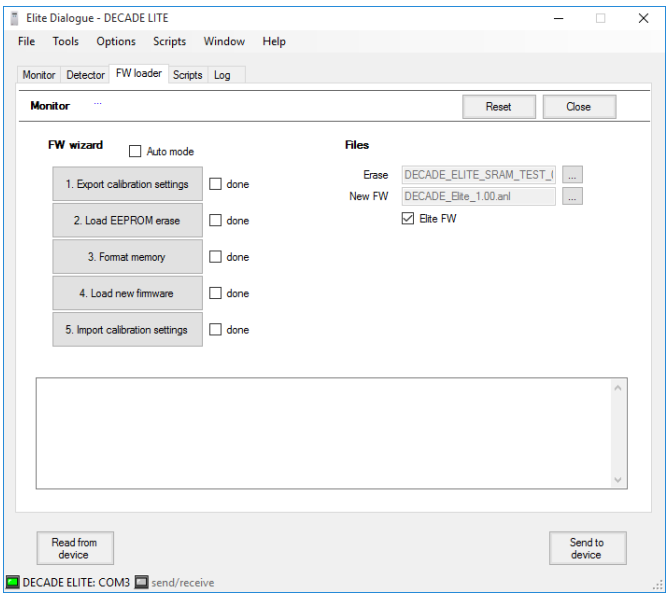
- Switch on the DECADE Elite detector and start the Elite Dialogue software on your PC. The select devices menu will pop up.



- Check the ‘DECADE Elite’ and ‘Connect Elite via USB’ check box and select the corresponding COM port from the Port settings pull-down menu. Click ‘OK’ to connect.
- Go to the "Tools" pull down menu and select the ‘FW upload’ option. The following FW selection box will open:



- The FW loader tab will open as shown below:

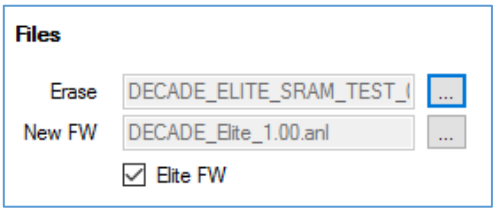


During all steps of the upload procedure instruction windows will pop-up with important information. Always read and follow these instructions carefully before clicking the OK button. At some points in the procedure the detector has to be switched off and on again to get the instrument in the FW upload state during boot-up. Make sure that the 'Auto mode' checkbox is NOT checked.

The upgrade procedure consists of 5 steps:

- Export and store the existing DECADE Elite calibration settings to the Personal Computer.
- Loading the Flash memory erase software into the DECADE Elite.
- Erasing, formatting and checking all DECADE Elite memory.
- Uploading the new FW upgrade to the DECADE Elite.
- Importing the stored calibration settings into the DECADE Elite.

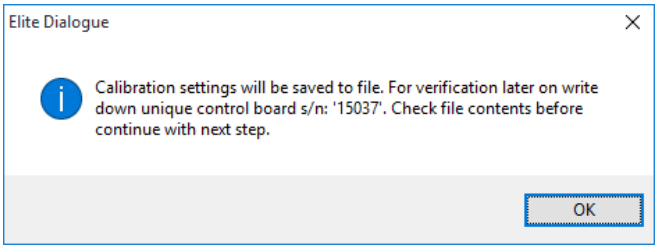
Check if the Erase and FW file in the files section are correct. If not select the valid DECADE Elite ERASE and FW files (click on the '...' button behind the file name box).



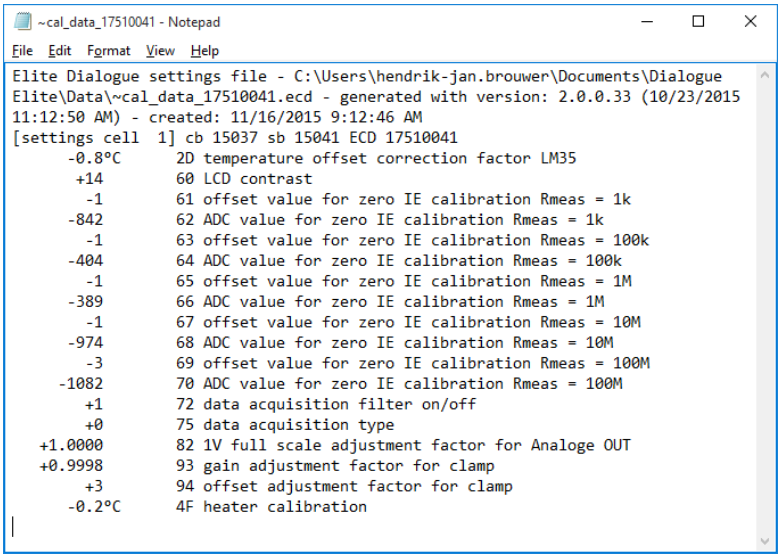
Each step will be explained in detail in the following paragraphs.

STEP 1 Export DECADE Elite calibration settings

By clicking the "Export calibration settings" button the DECADE Elite calibration settings will be saved to PC. The following instruction screen will pop-up.



The calibration data will be saved in a text file with the following file name format: " ~cal_data_175xxxxx.ecd". Where xx-xxx is the serial number of the DECADE Elite detector.



The calibration file is stored at the following location: **C:\Users\user\Documents\Dialogue Elite\Data**. After the file is stored a copy of the file will be opened automatically in Notepad and displayed on the computer screen.

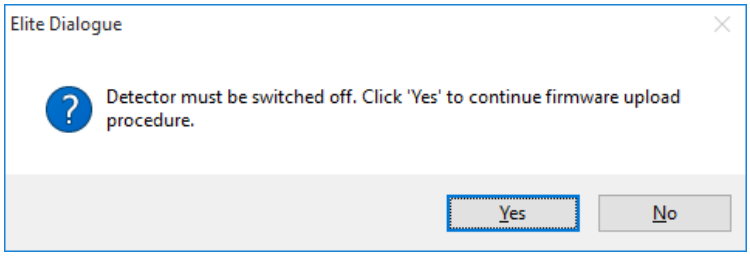
Perform the following steps:

- Write down the serial numbers of both control and sensor board (s) for verification. Serial numbers can be found in the settings file (CB xx-xxx and SB xx-xxx).
- Check file contents. Calibration data such as ADC & offset values for zero IE calibration should typically be ≠ 0. If all these values are 0 this is an indication that the sensor board was not calibrated or lost its calibration settings for some reason.

- **Always make a safety copy of the calibration file and save it at a different location using the "save as" function.**
- **Do not overwrite the first saved settings file during a second attempt to export the settings file (rename file). In the case (factory) that calibration settings are lost, please contact the supplier: support@antecscientific.com**

STEP 2 Loading the EEPROM erase software

The second step in the process is uploading the EEPROM erase software to the DECADE Elite. Start this step by pushing the button "Load EEPROM erase". The following instruction will pop-up:

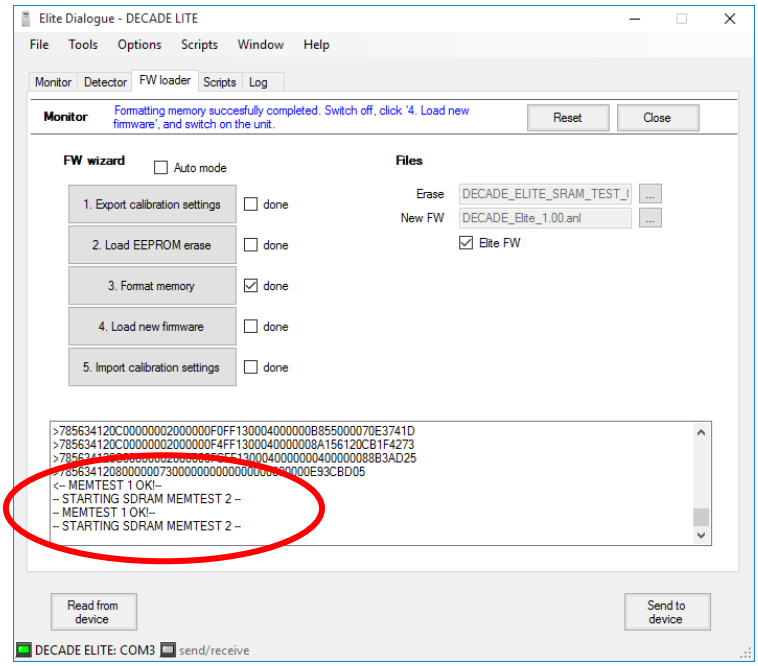


Perform the following steps:

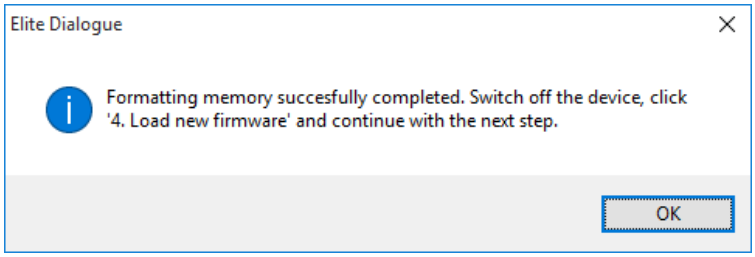
- Make sure the detector is switched off and click Yes.
- Switch on the detector and the Erase software will upload to the instrument automatically.

STEP 3 Formatting & test DECADE Elite memory

- Subsequently, the detector will reboot automatically and the erase software will start running.



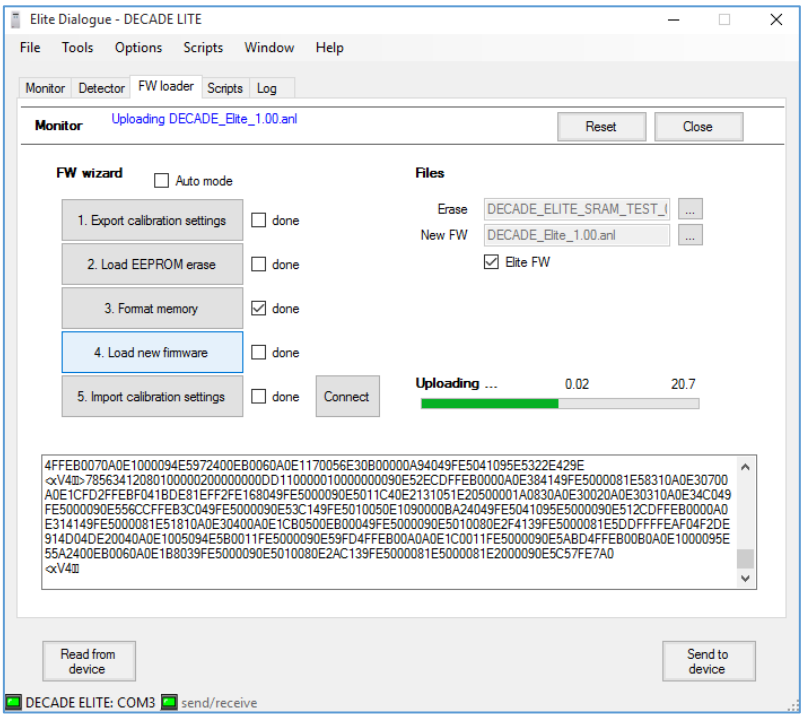
- After the formatting memory & test is completed successfully the following instruction window will pop-up.
- Switch off the detector.



STEP 4 Uploading new FW update to the DECADE Elite

The fourth step in the process is uploading the new FW update to the DECADE Elite.

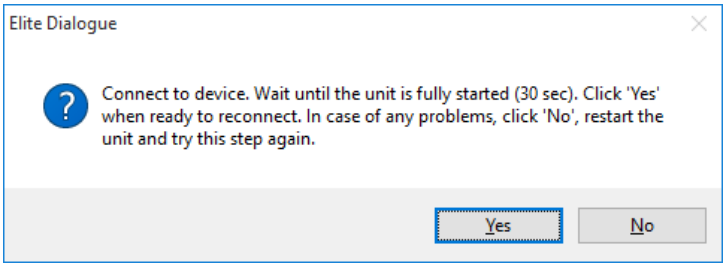
- Start this step by pushing the button "Load new firmware".
- Switch on the detector.
- The FW will automatically upload to the instrument.



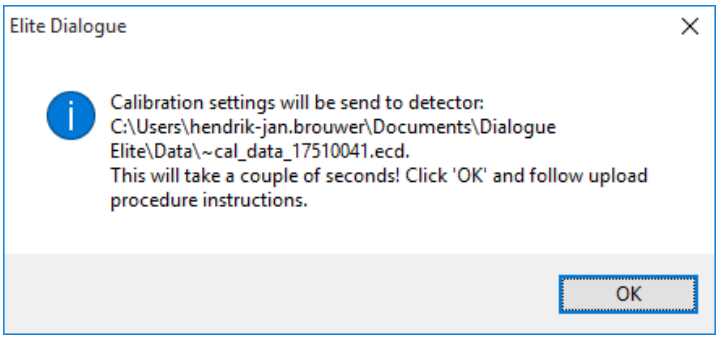
STEP 5 Import calibration settings

The fifth and last step in the process is importing the previously stored calibration settings from the PC into the DECADE Elite.

- Start this step by pushing the button "Importing calibration settings".
- Switch the detector off and on again and wait till the instrument is completely boot up into the main screen. In case of the DECADE Lite this is not so evident (no display) and it is advised to wait 30 seconds, before continuing to the next step.



- Click “Yes” when the unit is fully started, only then it will automatically re-connect. In case of any problem, click “No”, switch off and on the unit and repeat this step (click button 5).
- After clicking “Yes” the unit will automatically connect, and read the device parameters. This takes a few seconds, and is followed by opening the settings file (created in step 1.). The calibration settings will be send to the instrument after clicking “OK”.



- Close Elite Dialogue.
- Switch the detector off and on again.
- Start the Elite Dialogue software and reconnect the instrument.
- Goto ‘Options’ menu, Device settings or click the ‘F12’ button.
- Check if the serial numbers (left side of the device settings window) are filled in and correct.
- If correct the FW upload procedure was successfully completed.

Switch cables and connect the unit with a LAN cable to the PC in case an OQ, PQ or any other measurement is done using Elite Dialogue. Switch off and on the unit and reconnect using the predefined LAN port (192.168.5.1).

Trouble shooting

If during the upload procedure for any reason a power interruption occurs, please repeat the upload procedure as described in this user chapter.

In such case do not repeat step 1 Export calibration setting, because likely the detector will not contain any calibration settings anymore and the valid original calibration file might be overwritten if step 1 is repeated.

If something goes wrong during or after the firmware upgrade, the DECADE Elite will not boot up correctly and will show the error message:

In that case repeat the upload procedure as described in this chapter. If the error persists please contact your supplier.

Be careful with the calibration settings files. They are necessary to assure that the detector operates properly after the software update. Take the following precautions.

- **Do not overwrite the first saved settings file during a second attempt to export the settings file (rename file).**
- **Always make a safety copy of the calibration file and save it at a different location using the "save as" function. When (factory) calibration settings are lost, please contact the supplier: support@antecscientific.com**

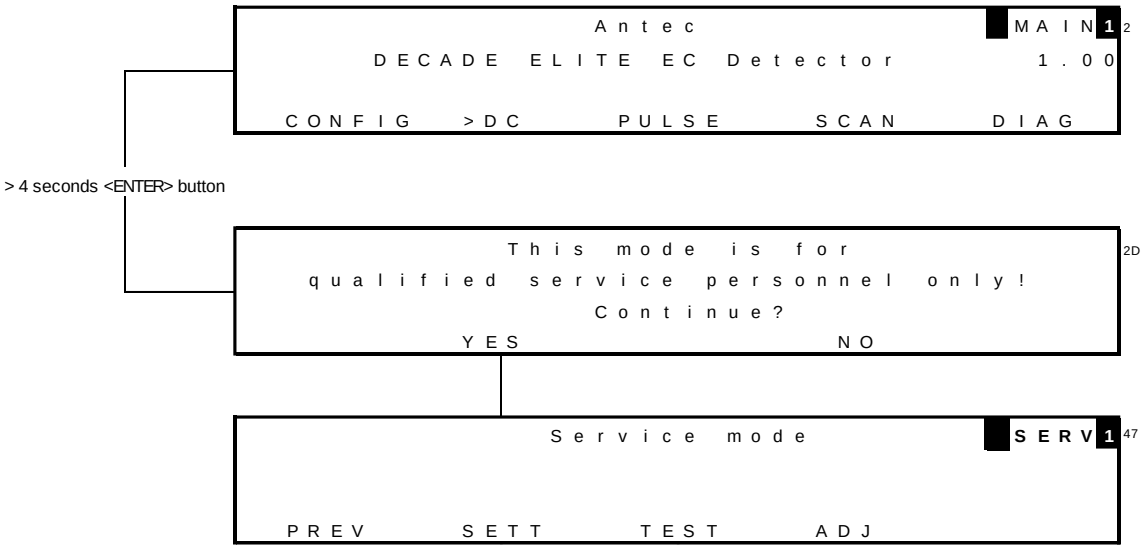
C H A P T E R 5

Service menu

This section describes the service menus accessible from keyboard/display. It is primarily used for trouble shooting in case a calibration parameter is out of spec. For full calibration of the DECADE Elite/Lite the Elite Dialogue software is required, please refer to document “171.0025 PM for DECADE and ROXY”.

The DECADE Elite service menu can be accessed by pushing the “Enter” button for more than 4 seconds, while in the main menu.

The service mode may only be accessed by authorized service engineers. Incorrect settings may results into erratic operation of the instrument.



From the service mode main menu three sub menus can be accessed which will be described in the next sections of this chapter:

- SETT(tings) menu
- TEST menu
- ADJ(ustments) menu

In the top-right corner of the service mode main menu the active sensor board is displayed **1**, to which the settings apply. The active sensor board

can be changed/selected by means of the ‘+’ and ‘-’ buttons on the keyboard.

SETT Menu

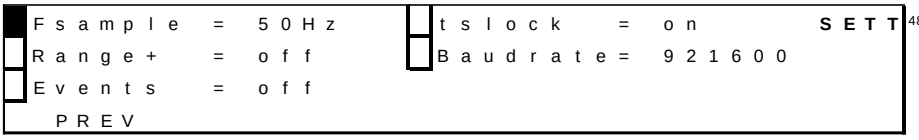
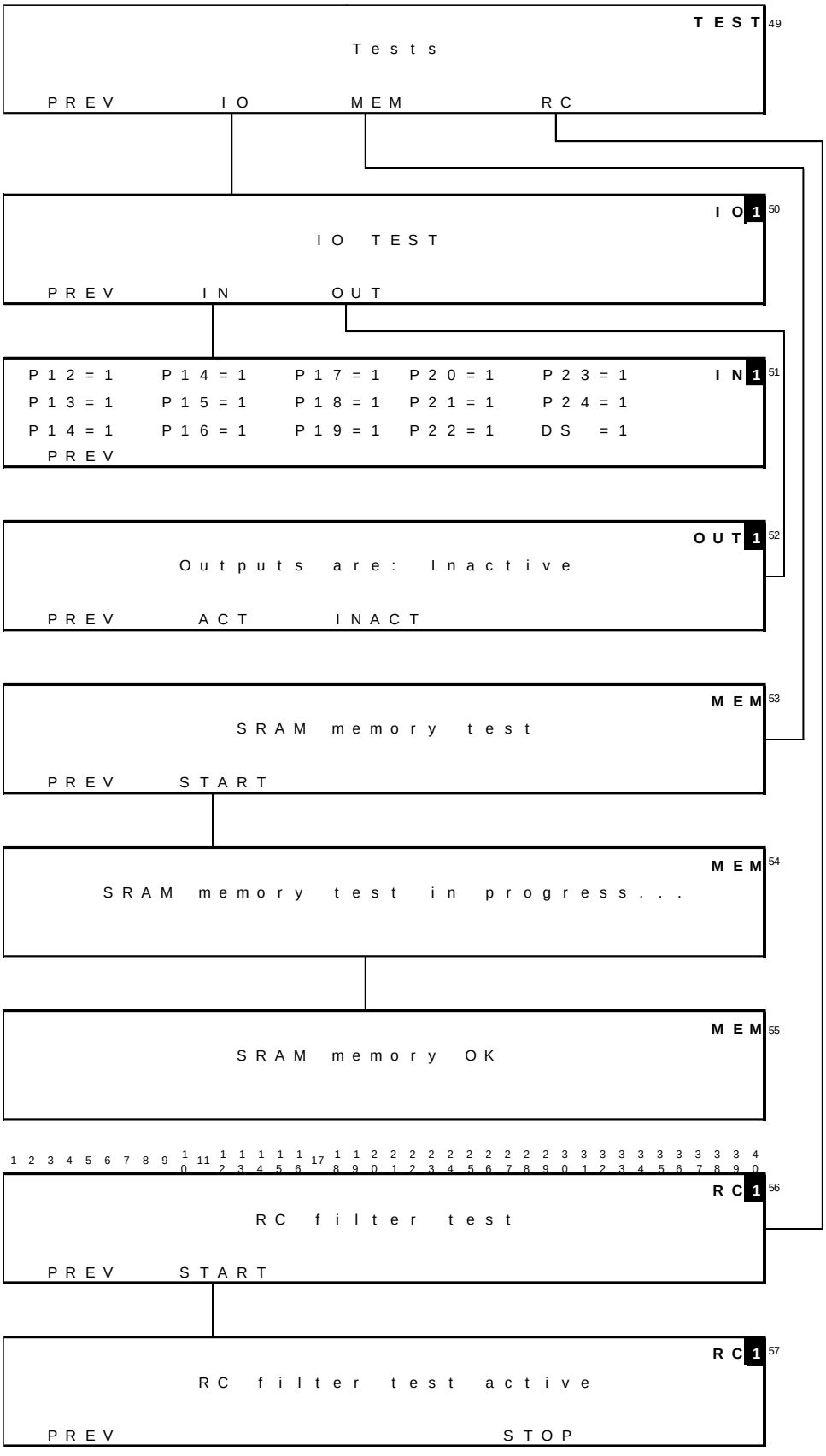


Table I. Parameters

Parameter	screen	Description	Type
Fsample	SETT	Frequency of AD converter. Set to 50 Hz by default.	C
Range+	SETT	Extended range down to 10 pA in PULSE and SCAN mode. Default: off	C
Events	SETT	This enables the time file editor and the ability to run time files. This functionality is unsupported in the DECADE Elite. Use Elite Dialogue to run timed events.	C
tslock	SETT	Limit maximum sampling time (ts) to 100 ms in PULSE mode	C
Baudrate	SETT	In the DECADE Elite the baud rate is 921600 and is a fixed. This setting cannot be changed..	S

Explanation: Type S is status, F is function and C is control.

TEST Menu


TEST 49
Tests
PREV IO MEM RC
IO 1 50
IO TEST
PREV IN OUT
P12=1 P14=1 P17=1 P20=1 P23=1
P13=1 P15=1 P18=1 P21=1 P24=1
P14=1 P16=1 P19=1 P22=1 DS =1
PREV
IN 1 51
OUT 1 52
Outputs are: Inactive
PREV ACT INACT
MEM 53
SRAM memory test
PREV START
MEM 54
SRAM memory test in progress...
MEM 55
SRAM memory OK
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
RC 1 56
RC filter test
PREV START
RC 1 57
RC filter test active
PREV STOP

OUT(put) test

Outputs can be set to active (press F2) or inactive (press F3).
Testing outputs is done using the factory supplied connector cable and screw terminal PCB:

DECADE Elite I/O conn. Board (p/n 250.0131B)
DECADE Elite I/O cable 25M-25M, 1.8m (p/n 250.0131C)

Figure 3 *I/O connection set supplied with the DECADE Elite.*

Measure the output status of all individual outputs using a calibrated voltmeter:

A. TTL outputs: connect the minus of the voltmeter to common (pin 25) and the plus of the voltmeter the TTL output that needs to be tested. **In an inactive status the voltmeter will display > 2.0V (usually about 3.3V), in an active state <0.8V (usually 0V).**
B. Switching relays: are tested with an Ohmmeter (contacts open or closed measurement). Connect the Ohmmeter to the relay pins that

need to be tested. Common: pin 3 and 6, Normally closed: 1 and 4. See schematic drawing below.

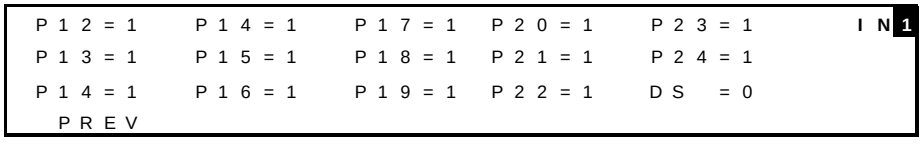
Table II. Outputs on digital IO connector

Pin	Description
1	RELAY 1 (normally closed)
2	RELAY 1 (normally open)
3	RELAY 1 (common)
4	RELAY 2 (normally closed)
5	RELAY 2 (normally open)
6	RELAY 2 (common)
7	AUX 1 (TTL)
8	AUX 2 (TTL)
9	AUX 3 (TTL)
10	AUX 4 (TTL)
11	Overload (TTL)

Default status of TTL contact is high (3.3V).

IN(put) test

The input status of all individual input pins is reflected in the LCD display. If a short circuit with common (pin 25) is made the corresponding pin status will change to zero. See for example the screen shot below which shows the LCD display after opening the detector door which activates the door sensor (DS) input..



Testing inputs is done using the factory supplied connector cable and connecting the corresponding wire(s), see previous section.

Table III. Inputs on digital IO connector

Pin	Description
12*	Cell on 1 (TTL[#])
13	Cell on 2 (TTL)
14	Cell on 3 (TTL)
15*	Cell off 1 (TTL)
16	Cell off 2 (TTL)
17	Cell off 3 (TTL)
18*	Autozero 1 (TTL)
19	Autozero 2 (TTL)
20	Autozero 3 (TTL)
21*	Start 1 (TTL)
22	Start 2 (TTL)
23	Start 3 (TTL)
24	Start 4 (TTL)

[#])Default status of TTL contact is high (3.3V).

**) Programmable Inputs (see DECADE Elite user manual for details.*

In case the output/input test fails repeatedly please consult your Antec representative.

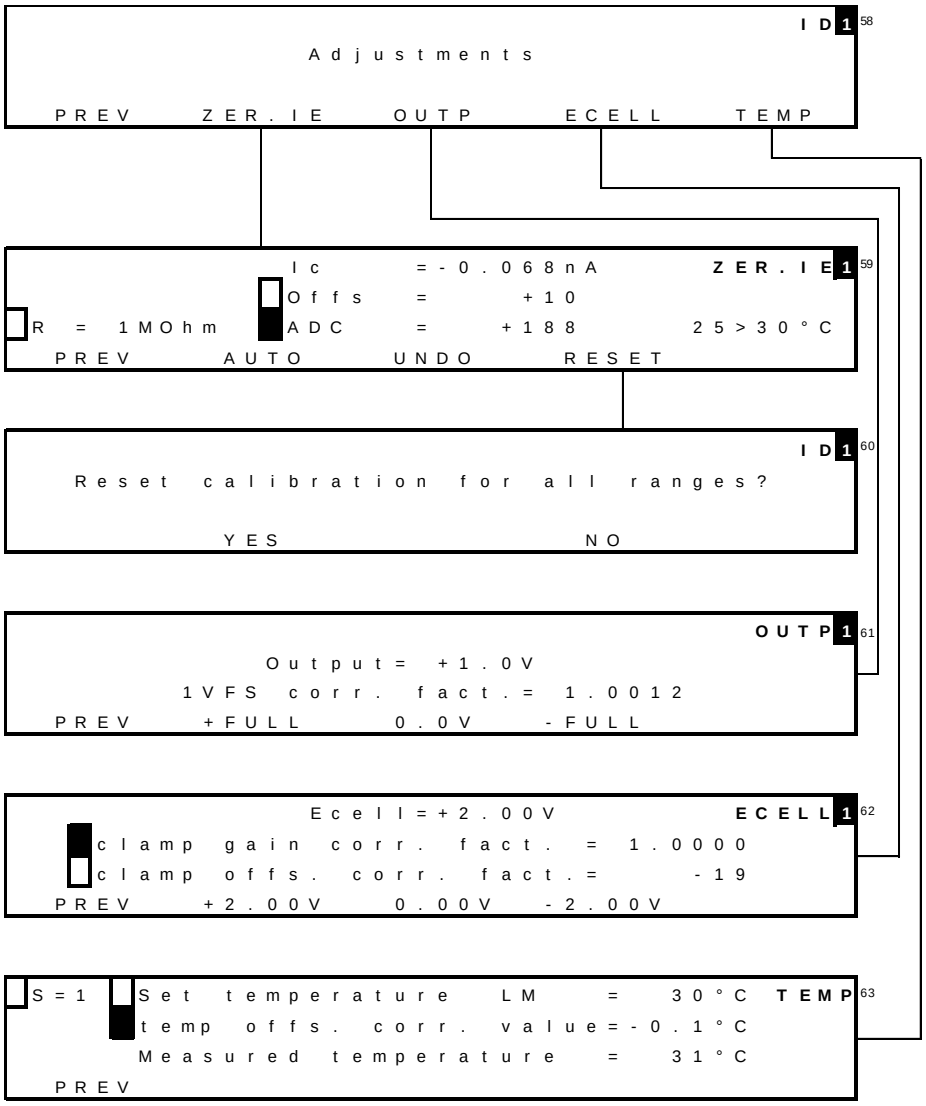
MEM(ory) test

With the memory test the SRAM memory is checked. Every memory address will be verified/tested by a WRITE/READ action. In case the test was unsuccessful please contact your Antec representative for further advise.

RC filter test

This is a test specifically for internal USE at the Antec factory only. It is not used for diagnostic purposes in the field.

ADJ(ustments) menu



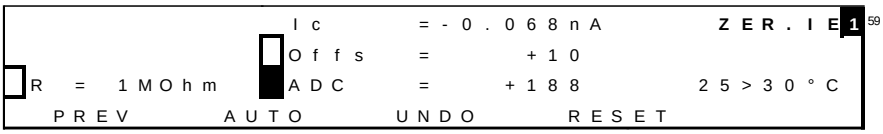
In “Adjustments“ a number of important parameters are stored:

- Compensation to zero current for IE converters (ZER.IE)
- Correction factors max and min output voltage (OUTP)
- Correction factors for cell potential (Ecell)
- Temperature calibration parameters (TEMP)

ZER.IE zero current for IE converters

Before adjusting the zero current make sure the system has been stabilized for more than an hour with the cell off and T=35ºC.

Cell cable must be disconnected all the time. If the cell cable is connected 'ERR 13 Disconnect flow cell'.



Procedure:

1. Select R using arrow and +/- buttons.
2. Set compensation to Ic = zero current using AUTO, it may be necessary to use AUTO more than once.
3. Repeat procedure for each R

Table IV. Residual current specifications

R	Specified
1k	0.0 ± 0.1 µA
100k	0.0 ± 0.1 nA
1M	0.00 ± 0.01 nA
10M	0 ± 2 pA
100M	0 ± 2 pA

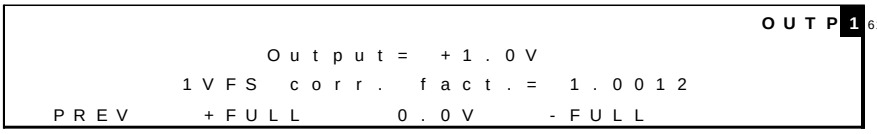
Table V. Parameters

Parameter	Screen	Description	Type
R	ZER.IE	Select active resistor of IE converter using + or - button. Values are 100M, 10M, 1M, 100k, 1k Ohm	C
Ic	ZER.IE	Residual current	C
ADC	ZER.IE	Digital offset ADC	C
Offs	ZER.IE	Analogue offset ADC	C
AUTO	ZER.IE	Automatically compensate to zero current	F
UNDO	ZER.IE	Restore previous compensation setting	F
RESET	ZER.IE	Release any zero compensation	F

Explanation: Type S is status, F is function and C is control.

OUTP Output voltage

Before adjusting the output voltage make sure the system has been stabilized for more than an hour with the cell off and T=35 °C. Cell cable must be disconnected all the time.



Procedure:

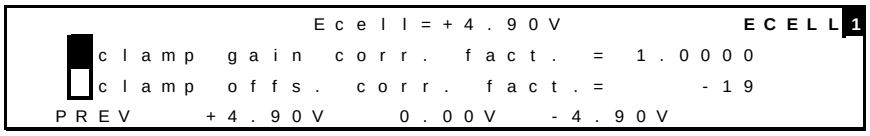
1. Connect calibrated voltmeter to Output using the factory supplied output cable.
2. Set Output Voltage to +FULL
3. Adjust correction factor until measured Output voltage is within specs. Using +/- buttons.
4. Check – FULL and 0.0 V setting, if not in specs adjust and repeat the 2 previous steps.

Table VI. Output specifications at 1V FS

Test	**Specified**
max. output	1000 ± 5 mV
min. Output	-1000 ± 5 mV
zero output	0 ± 5 mV

ECELL Cell potential

Before adjusting the cell potential make sure the system has been stabilised for more than an hour with the cell off and T=35 °C.



Procedure:

1. Connect calibrated voltmeter to AUX & REF on (+) pole and WE on the other (-) pole. Note that AUX and REF should both be connected to the same (+) voltmeter pole!

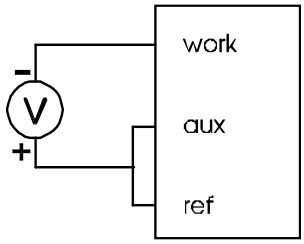


Figure 4 *Connection of the voltmeter for the ECell test. Pinning of the subD cell connector: Work=1, AUX=2, REF=3.*

2. Switch ON the flow cell
3. Press F3 and measure the 0.0 V value
4. Adjust offset correction (NOT the gain correction) until measured voltage is within specs.
5. Press F2 and measure the +4.90 V value
6. Adjust clamp gain correction (NOT the offset correction) until measured voltage is within specs
7. Press F4 and check the –4.90 V value, if not in specs adjust and repeat the 4 previous steps.

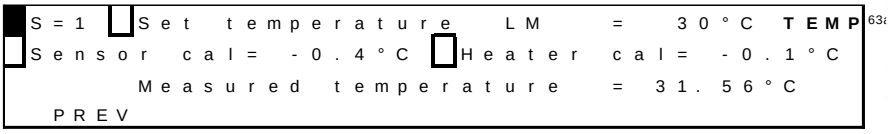
Table VII. E-cell specifications

Test	Specified
max. output	-4900 ± 1 mV
zero output	0 ± 1 mV
min. output	4900 ± 1 mV

TEMP Temperature calibration

The DECADE Elite heater is controlled by a LM-35 temperature sensor located in the heater compartment behind the cell cabinet. The temperature sensor can be calibrated using the procedure described below. The temperature is calibrated at the center of the oven compartment where the flow cell is located.

Before adjusting the temperature calibration setting make sure the system has been stabilized for more than an hour with the cell off and T=45ºC. Cell cable must be disconnected all the time.



Procedure:

1. Put a calibrated temperature sensor in the oven cabinet, on the position where the flow cell is mounted. Insert the probe via the tubing holes in the top-left or top-right side of the oven (see white arrow).
2. Set both the sensor calibration factor and heater calibration factor to 0.0°C at the start of the procedure.

Figure 5 *Take out flow cell and place temperature sensor within white circle and close the door. Insert the temperature probe via the tubing hole (arrow) and close the door.*

3. Make sure set temperature (set point) is 45ºC, if not, set temperature using +/- and wait an hour to stabilize.
4. After one hour read the temperature of the external calibrated temp sensor and the measured temperature of the internal LM-35 temp sensor from the TEMP menu
5. Calculate the Sensor calibration factor (command 2D temp offset correction factor LM35) in the following way:

   Sensor cal = T(LM35 temp sensor) – T(external temp sensor)

6. Calculate the Heater calibration factor (command 4F Heater calibration) in the following way:

   Heater cal = T(LM35 temp sensor) – T(set point)

7. Set the Sensor calibration factor and Heater calibration factors in the TEMP menu to the values calculated at point [5] and [6].
8. Let the instrument stabilize for 30 minutes and read the temperature of the external temperature sensor.
9. If temperature on external sensor differs from ‘measured temperature’ in display more than +/- 0.2°C re-adjust the calibration factor as described in the procedure above.

Table VIII. Temperature specifications

Test	Specified
Temperature uncompensated*	45 ± 3 °C
Sensor/Heater calibration factors	0 ± 3.0 °C

**uncompensated temperature is measured with both calibration factors (sensor cal and heater cal) set to 0.0ºC. cell off and T = 45ºC. Cell cable must be disconnected all the time.*

What to do if failed

In case one of the adjustment procedures failed after repeated attempts please contact Antec for advice.

PM Calibration DECADE Elite

Full calibration of all DECADE Elite parameters is done using an automated calibration script in Elite Dialogue software. This procedure is described in document 171.0025 PM for DECADE and ROXY.

Parts for PM Calibration

The following parts for device calibration are available from Antec:

Part no	Description
171.9012	Elite Dialogue OQ/PQ/CAL (distributors)
250.3051	DECADE Elite calibration kit
250.3056	Thermometer for calibration

A calibration kit is a set of connectors and cables.

C H A P T E R 6

Sensor board installation

This section describes the installation of an additional channel (sensor board) in a DECADE Elite using the DECADE Elite additional channel kit (p/n 175.0210). This kit enable you to upgrade your DECADE Elite to an instrument with two or three flow cells.

Contents of the kit

In the table below the contents of p/n 175.0210 DECADE Elite additional channel kit is listed:

P/n	Description	Qty
175.0210A	DECADE Elite mounting kit	1
175.0220	DECADE Elite/Lite internal cell cable	1
175.0604	DECADE Elite/Lite sensor board	1
250.0040	External dummy flow cell	1
250.0103K	Column clamp kit	1
171.0208	DECADE Elite/Lite cell cable	1
250.0102A	SenCell clamp kit	1

Carefully unpack the kit and inspect it for completeness and for possible damage. Contact your supplier in case of damage or if not all marked items on the checklist are included. Prior to shipment, the parts of your upgrade kit have been inspected and tested to ensure the best possible performance.

Preparation

As a precaution the following steps are taken:

1. Export the calibration settings to file using Dialogue software (File/Export settings). Name the file ~cal_data_nnn.ecd". Where nnn is any new file counter. Save a second file with all device settings named f.e. “settings_nnn.ecd”. Retrieving settings from file is only needed in case anything unexpected goes wrong.
2. Ensure that the detector has the same firmware (FW) as the new board. If not, follow the upgrade procedure (page 25) to the latest FW.

Installation procedure

The installation procedure consists of the following steps:

1. Removing/opening rear panel
2. Disconnecting internal cabling
3. Removing/opening EMC enclosure
4. Mounting of sensor board
5. Removing/opening the cell cabinet
6. Installation of internal cell cable
7. Reconnecting wiring and mounting rear panel
8. Check & calibration

This procedure may only be executed by skilled & authorized service engineers trained and certified by Antec, the Netherlands. The removal of protective panels on the instrument can result in exposure to potentially dangerous voltages. Therefore, always disconnect the instrument from all power sources before disassembly.

WARNING - RISK OF ELECTRIC SHOCK
DISCONNECT POWER BEFORE SERVICING

AVERTISSEMENT - RISQUE DE CHOC ELECTRIQUE
COUPER L'ALIMENTATION AVANT LA MAINTENANCE

In the next sections all steps are explained in detail to guide you through the installation procedure. In case of questions please contact Antec, the Netherlands for assistance.

1. Removing the rear panel

To be able to access the electronic parts in the DECADE Elite the rear panel has to be removed. All circuit boards are mounted on a separate metal frame, which is fixed on the rear panel of the detector. To access the electronic parts loosen the four M3 Phillips screws as depicted in the figure below using a Phillips PH-1 screw driver. The screws are encircled in red.

Figure 6 *Removing the rear panel of the DECADE Elite*.

The screws should be completely loosened, subsequently the rear panel can be pulled backwards to access the electronics.

Note that the top screws are M3x12mm and the lower ones M3x8mm, make sure to install the screws back on the correct position when re-assembling the instrument.

Figure 7 *Detector with rear panel pulled backwards and frame with electronic boards accessible.*

The rear panel is constrained by the length of the connected cables. The PCB frame can rest on the casing of the power supply compartment without any problem (as depicted in the figure above).

2. Disconnecting internal wiring

Remove all cables connected to the control board below the blank metal EMC casing (with white label) as depicted in the photograph on the next page. Open the white cable clamp mounted on the bottom of the PCB frame and remove the cables from the clamp.

Do <u>not</u> disconnect the primary power and grounding connections on the mains inlet and rear panel (crossed out in red in the photograph) .

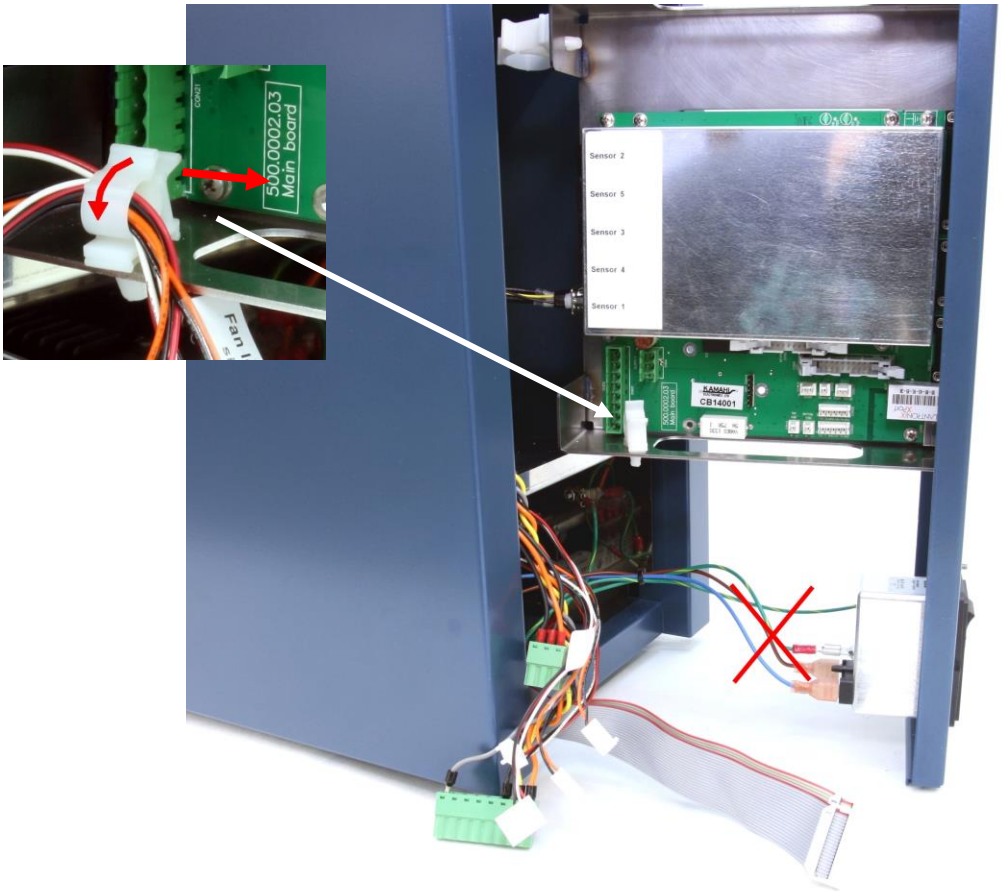


Figure 8 *Detector with all cables disconnected from the control board. Insert (top-left side): cable clamp. Red arrow depicts how to open the clamp.*

See the photographs on the next page how to disconnect the internal cell cable from the electronics:

- Move the PCB frame a bit more backwards to make the internal cell cable connection to the sensor board accessible.
- Remove the internal cell cable from the clamp located on the top side of the PCB frame
- Loosen the hex screws which fixes the cable to the sensor board 1 connector, using a 3/16” socket wrench.
- The back panel with PCB frame can now be moved out of the electronics compartment completely and can be placed on the table (with the rear of the back panel resting on the table).

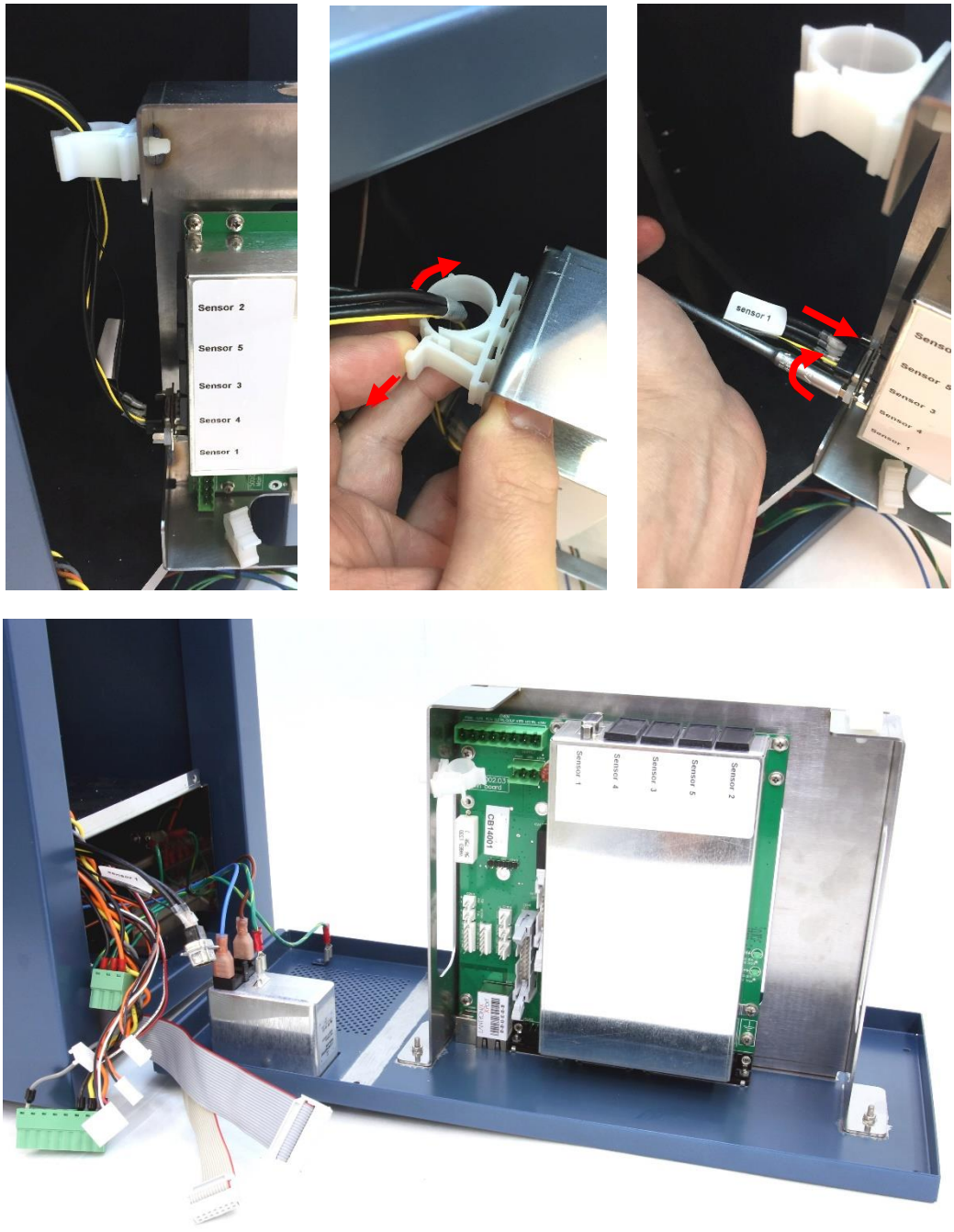


Figure 9 *Top-left: Move PCB frame backwards to access the internal cell cable connection on sensor board 1. Top-middle: remove internal cell cable from the cable clamp. Top-right: loosen the 2 hex screws fixing the internal cell cable to the sensor board connector and disconnect the cable. Bottom: The back panel with PCB frame can now be moved out of the electronics compartment completely and can be placed on the table.*

3. Removing EMC enclosure

To remove the EMC enclosure perform the following steps:

- Loosen and remove the hex screws fixing the sensor board connector to the EMC enclosure using the 3/16” socket wrench.
- Loosen the EMC enclosure by unscrewing the four M3x 5mm bolts on the outside of the cover.
- Remove the EMC enclosure from the control board.

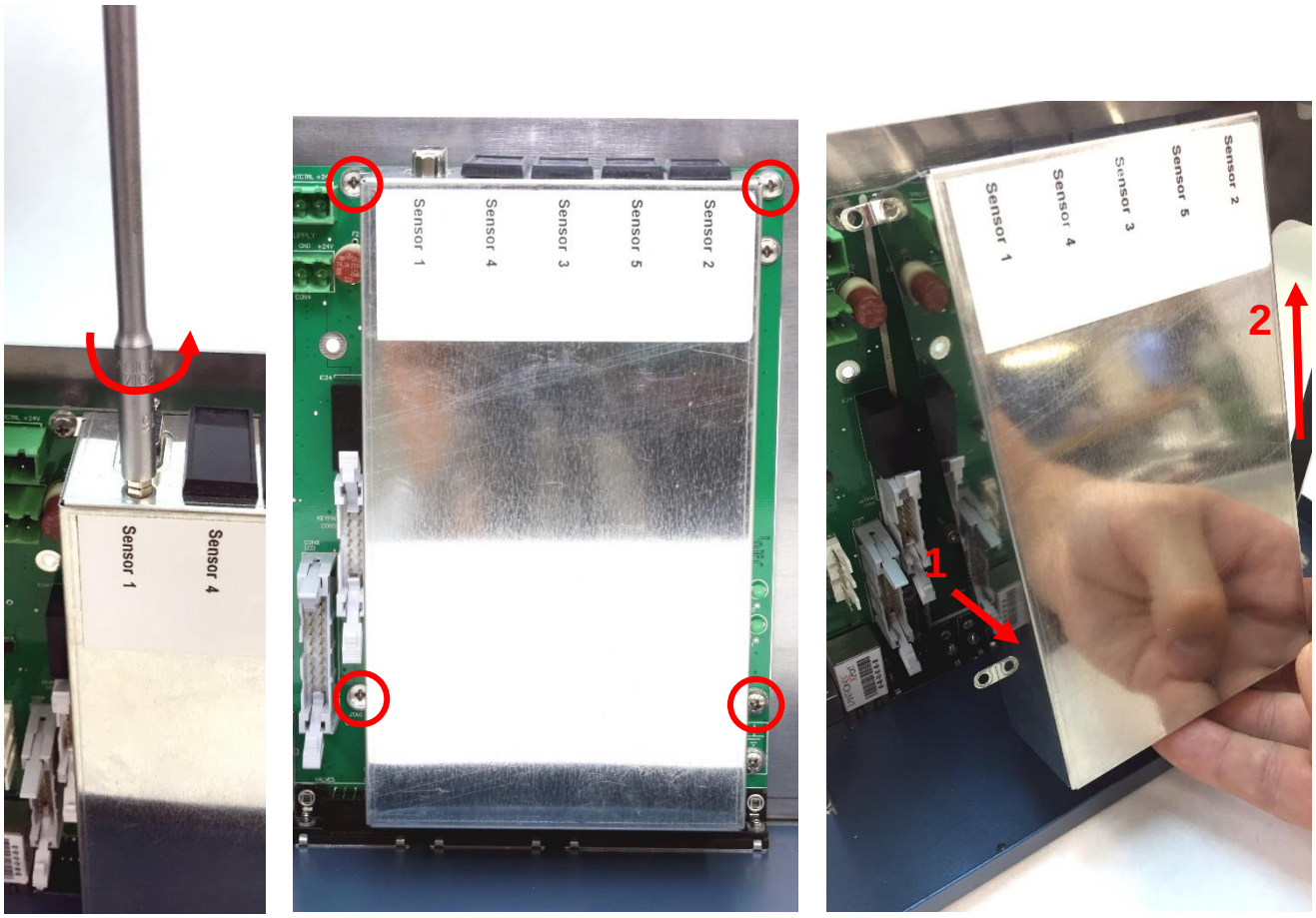
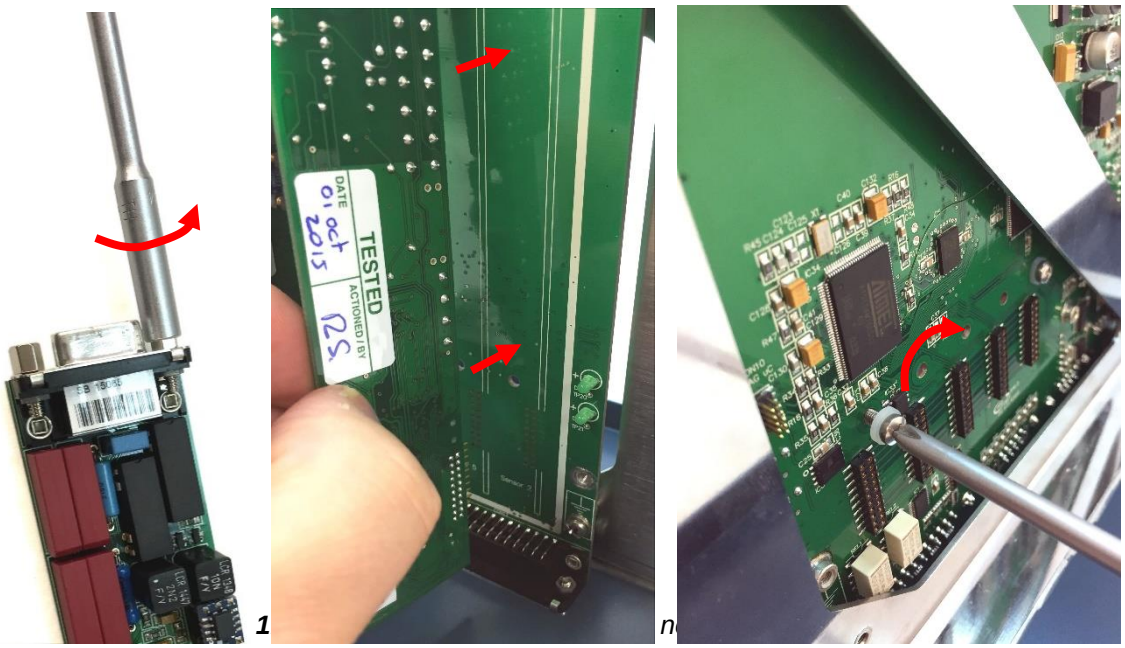


Figure 10 *<u>Left:</u> remove the hex screws fixing sensor board 1 (and from sensor board 2 if present) to the EMC enclosure. <u>Middle:</u> loosen the EMC enclosure by unscrewing the four M3x 5mm bolts on the outside of the cover (encircled in red). <u>Right:</u> remove the cover by (1) lifting the cover from the bottom side and pivot the cover over the cell connectors until the bottom side of the sensor boards are free. (2) Subsequently, move the cover upwards to free the sensor board connectors and take it off completely.*

4. Mounting additional sensor board

To mount an additional sensor board perform the following steps:

- Remove the two hex screws from the new sensor board supplied in the kit using the 3/16” socket wrench.
- Place the new sensor board in the slot ‘Sensor 2’ (in case a SCC is upgraded to a DCC) by inserting the pin header on the sensor board into the corresponding socket on the control board.
- Fix the sensor board on the back side of the control board by means of the M3 x 8mm screw with a plastic washer supplied in the mounting kit using a Phillips PH-1 screw driver.



***1** n the second sensor board in socket designated ‘Sensor 2’. <u>Right:</u> fix sensor board on the back side of the control board with M3x8mm screw.*

- Remove the plastic cover strip from the sensor board connector opening (sensor 2) on the EMC enclosure using a tweezer or other pointed metal object. Bend the metal retaining clips outwards to be able to shove them from the plastic fixing pins (see photo on next page).
- Re-install the metal EMC cover onto the sensor boards and fix it using the four M3x5mm screws.
- Fix the sensor board connectors from both board to the EMC enclosure using the four 3/16” hex screws.

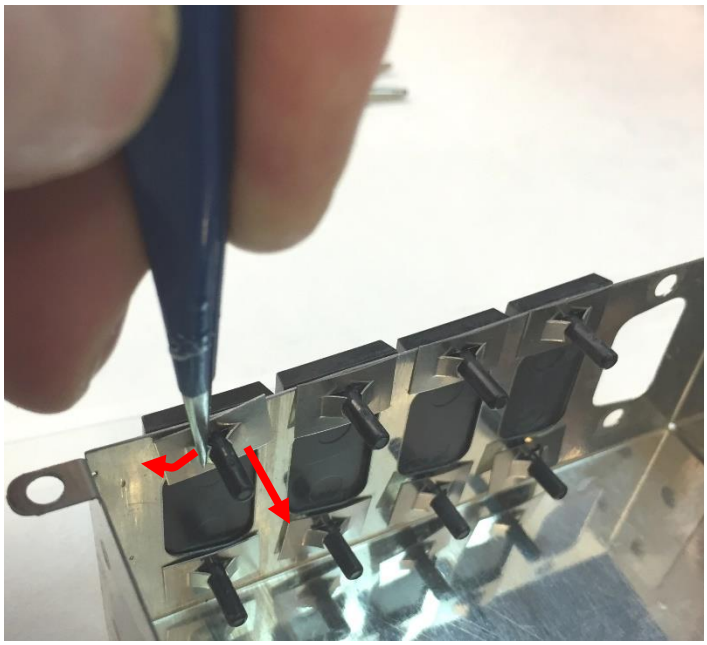


Figure 12 *Remove the black plastic connector cover strip by bending the retaining clips outwards with a tweezer or pointed metal object and shove the complete metal plate of the plastic pin.*

Figure 13 *Control board with 2 sensor boards under the EMC enclosure.*

Proceed to the next section describing the installation of an additional internal cell cable.

5. Opening the cell cabinet

To access the electronics compartment from the front side of the detector (to install an additional internal cell cable) follow the steps described below:

- Remove all cell cables, tubing, cells, columns etc. from the oven compartment.
- Remove the 4 rubber liners of the inlet/outlet (tubing) openings in the detector oven compartment (position of the liners marked by a red arrow).
- Remove the 4 M3 x 8mm screws to loosen the cell cabinet using a Phillips PH-1 screw driver (screws encircled in red).

Figure 14 *Left: removal of the rubber liners in the inlet/outlet openings in the detector oven compartment. Right: Removing the M3 screws securing the detector cell cabinet.*

- Open the detector electronics compartment from the front side by pulling the detector cell cabinet out of the housing from the top side. Pivot the bottom side of the cell cabinet until the top side of the isolated heater compartment is obstructed by the top panel of the detector.

Do not put any tension on the electronic wiring connected to the cell cabinet/heater assembly, it may lead to damage and malfunction of the detector.

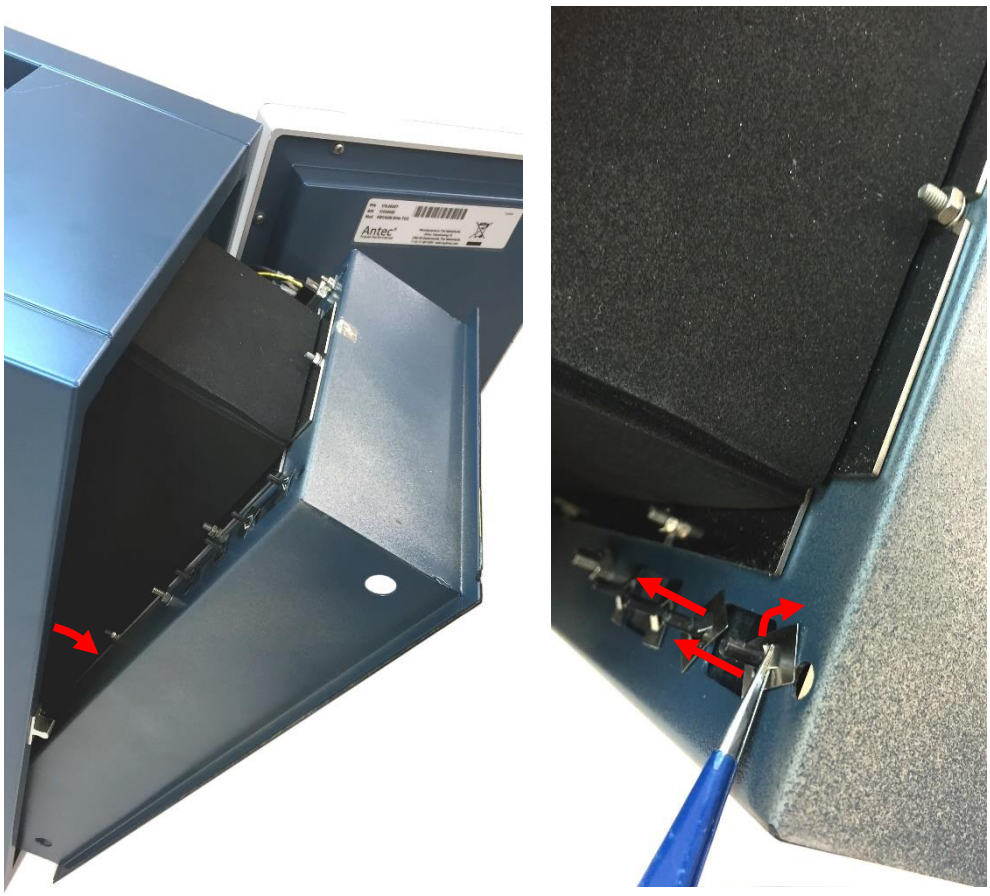


Figure 15 *Left: opening the electronics compartment from the front side Right: Removing the plastic connector cover strip.*

6. Installation of internal cell cable

- Remove the plastic cover strip from the cell connector opening (sensor 2) in the cell cabinet (top-left side) using a tweezer or other pointed metal object. Bend the metal retaining clips outwards to be able to shove them from the plastic fixing pins (see photo on the previous page).
- Apply the corresponding vinyl label ‘Sensor 2’ (upgrade SCC-> DCC) or ‘Sensor 3’ (upgrade DCC→TCC) to the new internal cell cable before installation. The label should be applied on the thin unshielded black lead close to the male connector on the cable.
- Fix the cell connector of the internal cell cable (female connector with threaded bushing) in the corresponding connector opening in the cell cabinet with the two hex screws using the 3/16” socket wrench.
- Fix the internal cell cabinet in the housing using the four M3x8mm screws.
- Insert the four rubber liners back into the inlet/outlet (tubing) openings of the oven compartment.

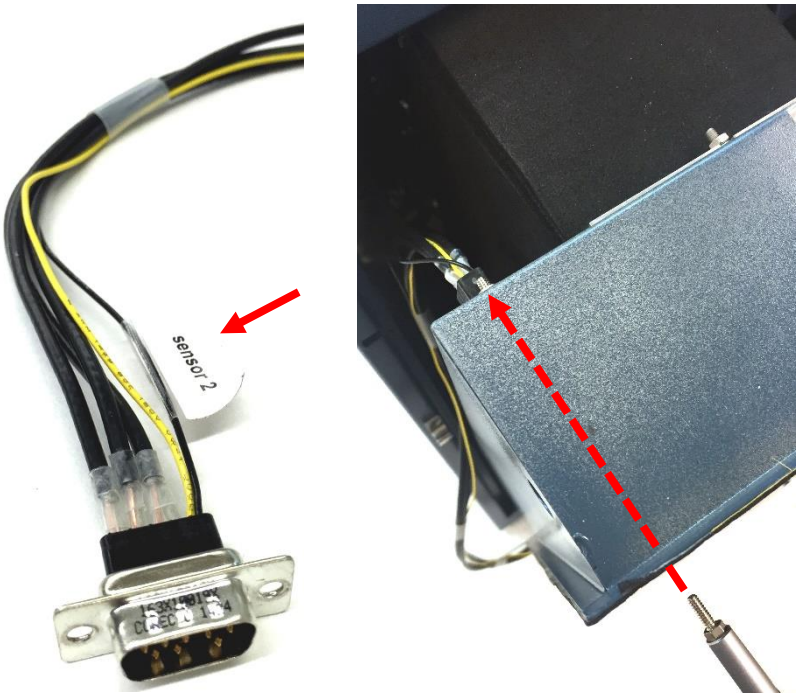


Figure 16 *Left: labelling internal cell cable Right: Fixing the cell connector in the corresponding D-sub connector opening in the cell cabinet panel.*

7. Reconnecting wiring & mounting rear panel

Follow the steps below to reassemble the instrument:

- Fix the two (or three) connectors of the internal cell cables into the corresponding sensor board connectors using hex screws with two plastic washers as depicted in the photo below.
- Insert the two (or three) internal cell cables into the white cable clamp on the top side of the PCB frame.
- Reconnect all wiring (power, heater, fans, door sensor, temp sensor, keyboard and LCD display connectors) on the control board.
- Insert the cables of the door sensor, fans and temperature sensor into the white cable clamp on the bottom side of the PCB frame.
- Place the rear panel back into the main detector enclosure and fix the panel using the two 3Mx12mm screws (top side) and the two 3Mx8mm (bottom side). Use one plastic washer per screw.

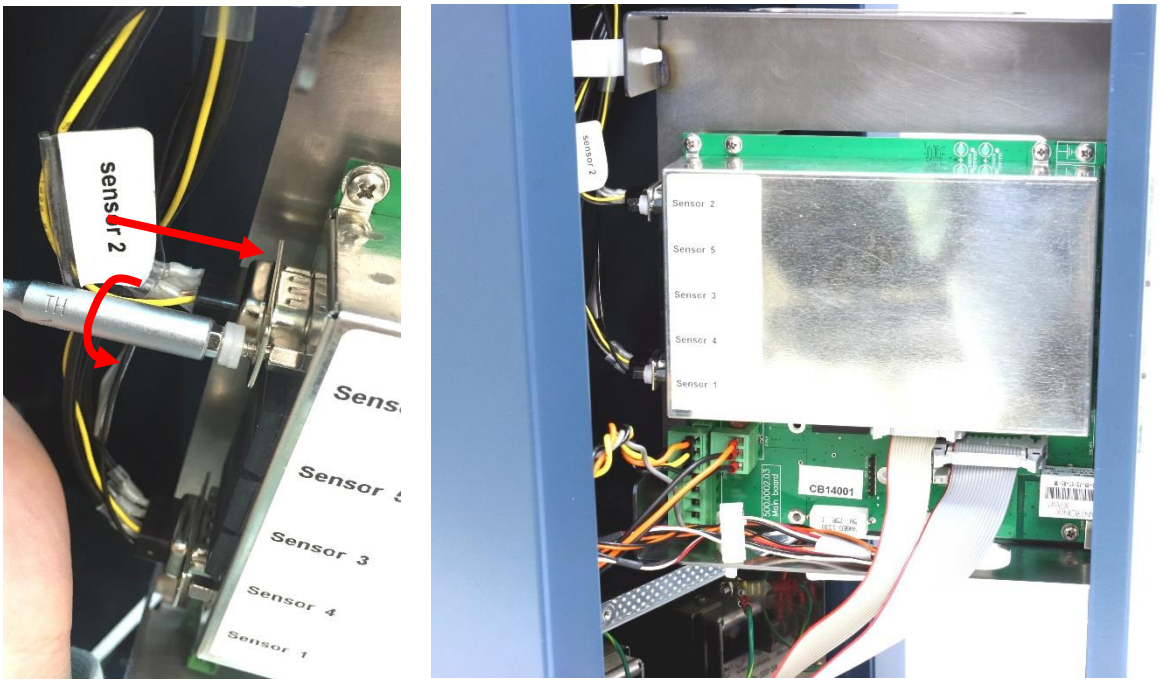


Figure 17 *Left: Fixing the internal cell cables on the sensor board connectors. Right: Reconnecting all internal wiring on the control board.*

- Mount the additional cell clamp and column clamps supplied in the kit (in case the cells are used for detection in series, it is not necessary to install the column kits).
- Update the embedded software (FW) of the instrument if necessary as described (page 25).
- Let the instrument equilibrate with the oven set to 35°C for at least half an hour.
- Check and calibrate the instrument as described in Chapter 4 (either via the SERVICE menu or using the PM procedure). Perform a dummy cell test as described in the DECADE Elite IQ/OQ/PQ manual (document 171.0023) to check if the instrument performs within specification with respect to cell current and noise.

Figure 18 *Oven compartment DECADE Elite DCC.*

C H A P T E R 7

Replacing the power supply

This section describes the replacement of the DECADE Elite power supply (PSU), p/n 175.0630. For this service action the following tools are required:

- Phillips PH-1 screw driver
- Phillips PH-2 screw driver

This procedure may only be executed by skilled & authorized service engineers trained and certified by Antec, the Netherlands. The removal of protective panels on the instrument can result in exposure to potentially dangerous voltages. Therefore, always disconnect the instrument from all power sources before disassembly.

WARNING - RISK OF ELECTRIC SHOCK
DISCONNECT POWER BEFORE SERVICING

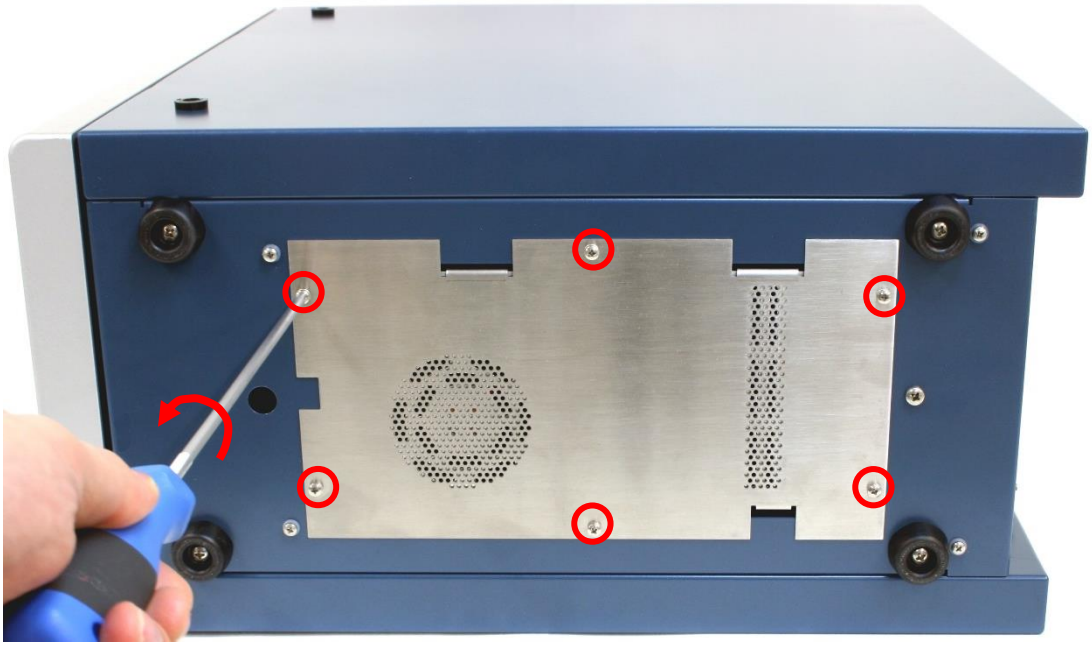
AVERTISSEMENT - RISQUE DE CHOC ELECTRIQUE
COUPER L'ALIMENTATION AVANT LA MAINTENANCE

Removing the PSU frame

To access the PSU remove the PSU frame as described below:

- Switch the instrument of by means of the power switch on the mains inlet the back of the instrument.
- Remove the power cable out of the mains inlet.
- Flip the instrument on its side panel to be able to access the PSU frame on the bottom of the instrument.
- Loosen all 4 M3X8mm screws fixing the PSU frame to the bottom panel of the instruments using a PH-1 Phillips screwdriver.
- Pull the PSU frame gently out of the detector bottom panel.

Take care, the PSU frame has reasonably sharp edges. Do not put any tension on the electronic wiring connected to the PSU, it may lead to damage and malfunction of the detector.



Disconnecting the PSU wiring

Follow the steps below to disconnect the wiring:

- Pull the PSU frame out of the bottom panel as far as possible to be able to access the screws fixing the wiring.
- Remove the transparent plastic cover strip shielding the wiring connections.
- Loosen the screws of the PSU connectors fixing the wires of the primary and secondary power circuitry, using a PH-2 Philips screw driver.

***Figure 20**. PSU frame with PSU and connected wiring of the primary and secondary power circuitry. Arrow indicates the plastic cover strip.*

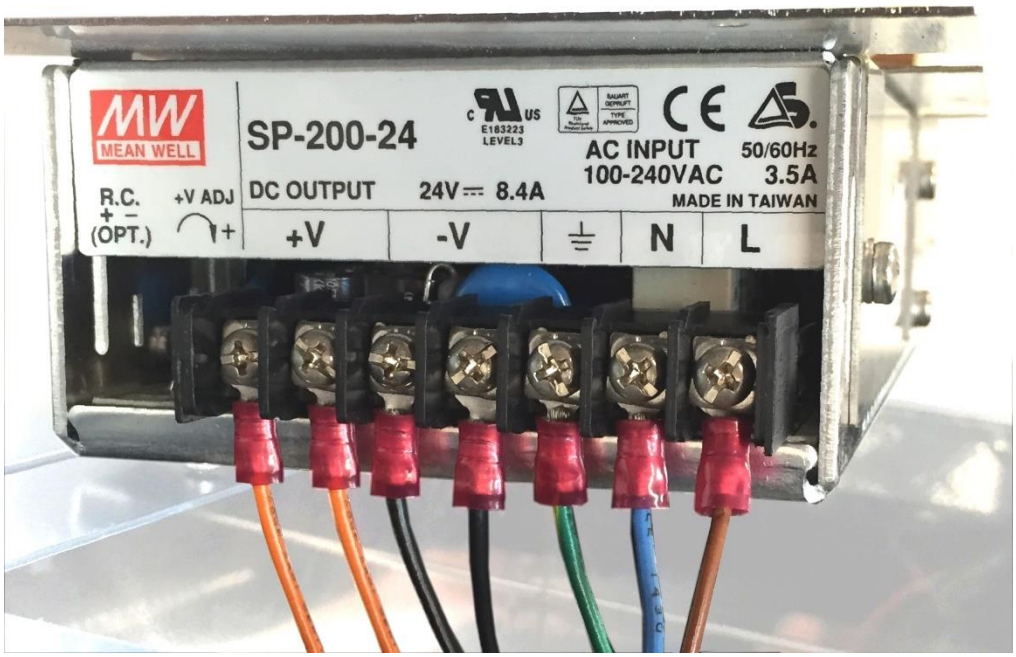


***Figure 21**. PSU wiring of the primary and secondary power circuitry.*

Table IX. Lay-out of the PSU wiring.

Symbol on PSU	Wire color	Description
L	Brown	Line
N	Blue	Neutral
⏚	Green/yel-low	Protective ground
-V	Black	0V
-V	Black	0V
+V	Orange	+ 24V (control board)
+V	Orange	+ 24V (heater)

Make sure that <u>all</u> wires are firmly connected again to the corresponding contacts on the power supply as depicted in the photograph and table above. Incorrect wiring may lead to dangerous situations (electrocution) or damage to the instrument.

Replacement of PSU

To replace the PSU on the PSU frame follow the steps below:

- Remove the PSU frame with PSU completely out of the bottom panel and lay it flat on the table.
- loosen the three M4x6mm screws fixing the PSU on the PSU frame located on the side of the PSU using a Phillips PH-2 screw driver.
- loosen the M3x5mm screws fixing the PSU on the PSU frame located on the top of the PSU using a Phillips PH-1 screw driver.
- The PSU can now be removed from the frame and replaced by a new PSU.

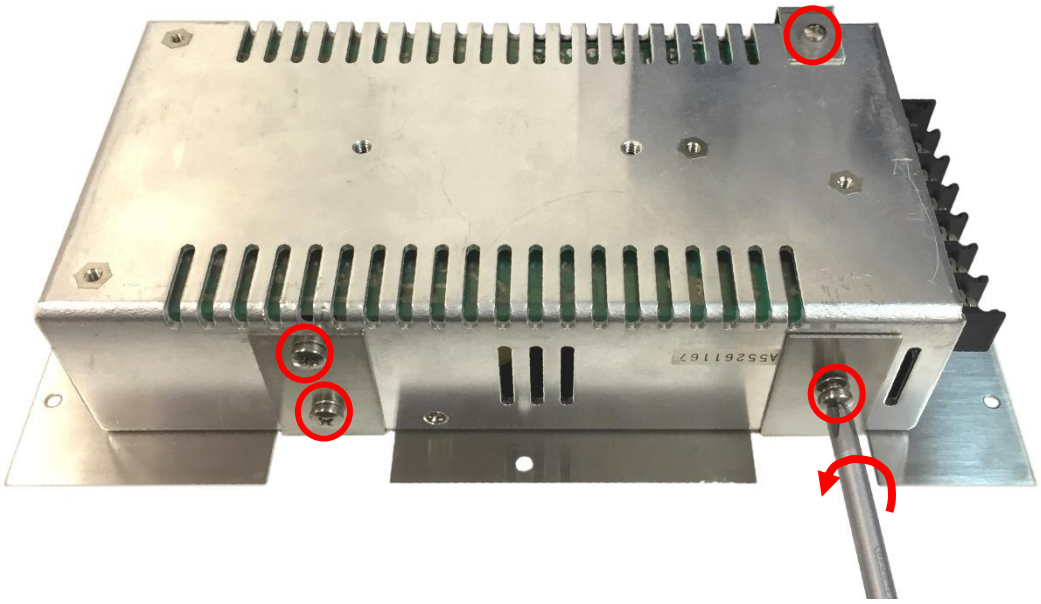


***Figure 22**. Removing PSU from the PSU frame. The four screws fixing the PSU are encircled in red.*

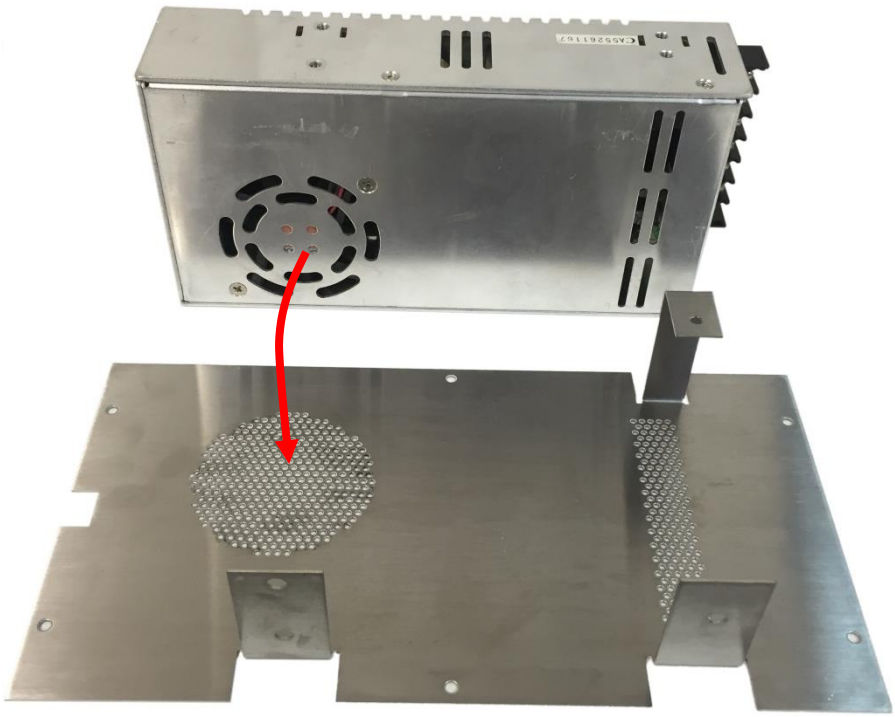


***Figure 23**. The PSU fan outlet should be facing downwards and positioned on top of the corresponding ventilation holes in the PSU frame.*

- Place the new PSU with the PSU fan outlet facing downwards on top of the corresponding ventilation holes in the PSU frame.

Do not install the PSU with the fan outlet facing upwards, this might impair the cooling capability of the power supply.

- Fix the PSU onto the frame using the 3x M4x6mm and 1x M3x5mm screws in combination with the corresponding washers.

Reinstallation of PSU frame

- Remove the transparent plastic cover strip from the new PSU.
- Fix all wiring to the PSU as shown in figure 21 and table IX described on page 62.

Make sure that <u>all</u> wires are securely connected corresponding to the wiring information on page 62. Incorrect wiring may lead to dangerous situation (electrocution) or damage to the instrument.

- Reinstall the transparent plastic cover strip onto the PSU.
- Place the PSU frame back into the PSU compartment in the bottom panel of the detector.
- Fix all 4 M3X8mm screws to secure the PSU frame.
- Flip the detector back in its original position on the lab table (standing on its instrument feet).
- Reconnect the power cable into the mains inlet on the rear panel.
- Connect an USB or LAN cable to the instrument if applicable.
- Switch the instrument on by means of the mains switch on the rear panel/
- Check if the instrument powers up correctly. In case of a DECADE Lite check if the instrument connects successfully with the Dialogue Elite or DataApex Clarity software.

In case the instrument does not start up correctly (Elite) or does not communicate over LAN/USB (Lite), check if all steps in this chapter are executed correctly. If the problem persists please contact Antec for advice.

C H A P T E R 8

Specifications DECADE Elite

Environmental, dimensions, weight & power requirements

Working temperature	10 - 40°C (indoor use only)
Storage temperature	–25 - +50°C
Humidity	20 - 80% RH
Safety and EMC	According to EC-directives; Emission Group I Class A; cMETus approved
Equipment class	1
Installation category	II
Pollution degree	2
Dimensions	43 (D) x 22 (W) x 44 (H) cm = 16.9” (D) x 8.7” (W) x 17.3” (H)
Weight	14.4 kg (32 lbs) without flow cell and column
Installation	Install upright on flat & smooth surface, keep space under the detector free (risk of blocking power supply fan).
Power requirements	110-240 VAC, 50/60 Hz, 260 VA, auto-sens-ing
Mains fuse	2.5 AT / 250V, 5x20 mm, IEC 60127-2 For safety reasons, any other internal fuse or circuit breaker is not operator accessible, and should be replaced only by Antec authorized personnel. Use only manufacturer-supplied fuses.

For optimum analytical performance it is recommended that the ambient temperature of the laboratory be between 17-25 °C and be held constant to within ± 2 °C throughout the entire working day. For optimal performance of the oven the temperature should be set at least 7 degrees above ambient.

General

Operating modes	DC, PULSE SCAN (Lite: DC mode only)
Other mode	CONFIG, DIAG and SERVICE
Sensors	Up to 3 flow cells (Lite: single cell only)
Autozero	triggered by keyboard, rear panel TTL, or remote PC control (LAN)
Max. current compensation (Autozero)	25 nA - 2.5 mA in DC and PULSE mode dependent on range setting
Offset	+50% to - 50% of max. output voltage, 5% steps
PC control	Parametric control and data-acquisition via LAN port (USB service port)
Embedded software	Flash technology, upgradeable via PC (USB)
Oven	+7°C above ambient to 60°C, accuracy 0.5°C, stability 0.1°C; accommodates column and flow cell(s)
Rear panel connectors	1x IEC inlet (Mains), 1x USB B, 1x RJ45 LAN, 1x 9-pins sub-D Male (Valve), 1x 9-pins sub-D Female (Analog output), 1x 25-pins sub-D Female (Digital I/O)
Analog output (DAC)	-1 to +1 V full scale (via 16-bit D/A converter)
Analog output (I/E)	-2.5 to +2.5 V full scale (unprocessed I/E converter signal)
Digital I/O (HW)	2x Relay, 5x TTL outputs (CMOS 3.3V logic), 13 TTL inputs (programmable), 1x GND
Programmable I/O functionality	Cell on, Cell off, Autozero, Start, Overload, Relay, Auxiliary
Valve control	VICI valco 2-pos electrically-actuated valve (E2CA, EHCA) via serial cable, Manual valve, 1x inject marker output

DC mode

Range	10 pA - 200 µA in 1, 2, 5 increments
Filter (ADF)	10 - 0.001 Hz in 1, 2, 5 increments RAW and OFF: for unprocessed data
Potential (Ec)	-2.50 V to + 2.50V with 10 mV increments
Data Rate	1 - 100 Hz in 1, 2, 5 increments, dependent on filter setting
Noise	< 2 pA with dummy cell (load of 300 MΩ/470 pF) in 1 nA range, filter off, Ec +800mV and temperature of 35 °C.

PULSE mode

Range	10 nA - 200 µA in 1, 2, 5 increments
Filter (ADF)	0.5 - 0.001 Hz in 1, 2, 5 increments OFF: for unprocessed data
Potential (Ec)	-2.50 V to + 2.50 V with 10 mV increments
Data Rate	1/(pulse duration) Hz
Waveform	Max 5 potential steps
Pulse times (t1-t5)	t1: 100 ms - 2000 ms; t2, t3, t4, t5: 0 - 2000 ms in 10 ms increments
Sampling times (ts)	20 ms – [t1 – 60] ms

SCAN mode

Range	10 nA - 200 µA in 1, 2, 5 increments
Potential (Ec)	-2.50 V to + 2.50V with 10 mV increments
Data Rate	1 Hz
Scan rate	1 - 100 mV/s in 1, 2, 5 increments
Cycle	Half, Full, Continuous