Antec Scientific
Industrieweg 12
2382 NV Zoeterwoude
The Netherlands

DECADE II

Electrochemical Detector

Service manual

171.0020, Edition 4, 2010


Antec Leyden
DECADE-II LC-EC workstation
MAIN
1.78
CONFIG
DC
PULSE
SCAN
DIAG
1
2
3
4
5
Enter

CE

Declaration of conformity

Antec Leyden B.V., The Netherlands declares that the product

DECADE II™ Electrochemical Detector (p.n. 171.0035)

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

Safety (73/23/EEC)

Safety requirements for laboratory equipment	**EN61010-1:2001**
(Class I, Installation cat. II, Pollution degree 2)	

Immunity (89/336/EEC)

Electromagnetic immunity	**EN61326-1:1997 + A1:1998**
	EN61000-4-2, EN61000-4-3, ENV50204,
	EN61000-4-4, EN61000-4-5, EN61000-4-6, EN61000-4-8, EN61000-4-11

Emissions (89/336/EEC)

Electromagnetic emission	**EN61326-1:1997 + A1:1998**

EN55011 (Class B), EN61000-3-2,

EN61000-3-3

Attention

Only use manufacturer-supplied cable(s) to connect with other devices. Part numbers 250.0122 (RS232 cable), 250.0130 (I/O cable) and 250.0128 (output cable). Thoroughly connect shielding to common. Manufacturer will not accept any liability for damage, direct or indirect, caused by connecting this instrument to devices which do not meet relevant safety standards.

February 6, 2019

Symbols

The following symbol are used on the rear panel and oven compartment of the DECADE II:

Consult the manual for further safety instructions

Frame or chassis ground terminal

The following pictograms are used in the DECADE II manual:

Caution

Caution, risk of electric shock or other electrical hazard (high voltage)

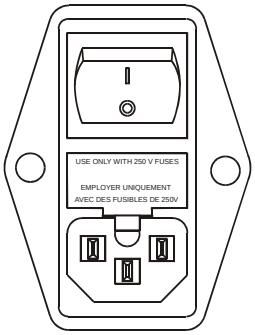
Safety practices

The following safety practices are intended to insure safe operation of the equipment.

Electrical hazards

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.

Replace blown fuses with fuses of proper type and rating as stipulated on the rear panel and specified in the installation section of this manual. 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.



Connect the detector to a grounded AC power source, line voltage 100 – 240 VAC. The instrument should be connected to a protective earth via a ground socket. The power source should exhibit minimal power transients and fluctuations. Replace faulty or frayed power cords.

Place the detector on a flat and smooth surface. Do not block the fan located at the bottom of the detector. Blocking the fan will impair the cooling capability of the power supply.

Before starting the replacement of the EPROMS please read the following safety instructions carefully:

Take precautions against electrostatic discharge during installation/removal of the eproms at all time to prevent damage of the circuit boards.

Spare parts and service availability

Manufacturer provides operational spare parts of the instrument and current accessories for a period of five years after shipment of the final production run of the instrument. Spare parts will be available after this five years period on an ‘as available’ basis.

Manufacturer provides a variety of services to support her customers after warranty expiration. Repair service can be provided on a time and material basis. Contact your local supplier for servicing. Technical support and training can be provided by qualified chemists on both contractual or as-needed basis.

Table of contents

C H A P T E R 1

Required service tools

The following tools are necessary for servicing the DECADE II:

[a] IC-puller or normal screwdriver

[b] Socket wrench 3/16”

[c] Phillips screwdriver

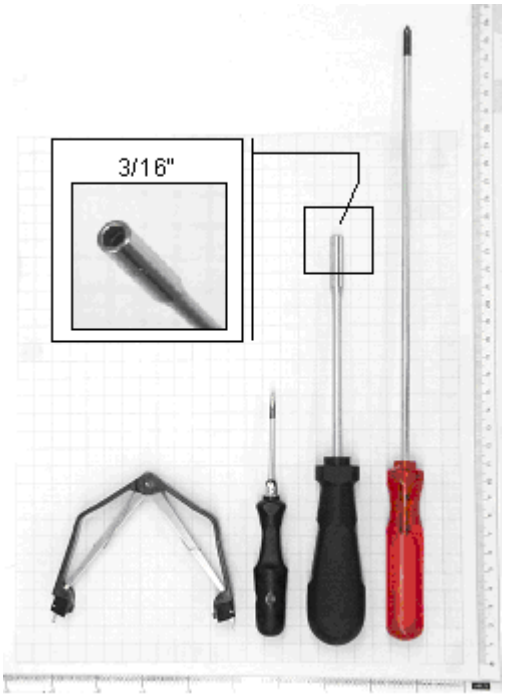


Fig. 1. IC-puller, screwdriver, socket wrench and Phillips screwdriver (from left to right).

Calibrated temperature sensor must have a tolerance at 45 °C equal or better than 0.1 °C. 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.

C H A P T E R 2

Replacement of EPROMS

Introduction

The DECADE II is equipped with two circuit boards, a sensor board and a control board. Both boards are equipped with an EPROM in which the embedded software (firmware, FW) is stored necessary for boot-up of the detector. The EPROMS used in the DECADE II are of the following type: M27C512 (size 512 kb), see Fig. 2. Both EPROMs on control board and sensor board can be identified by a label adhered on top of the EPROM with the text “control boot xxx” and “sensor boot xx”, respectively. xxx = FW revision.

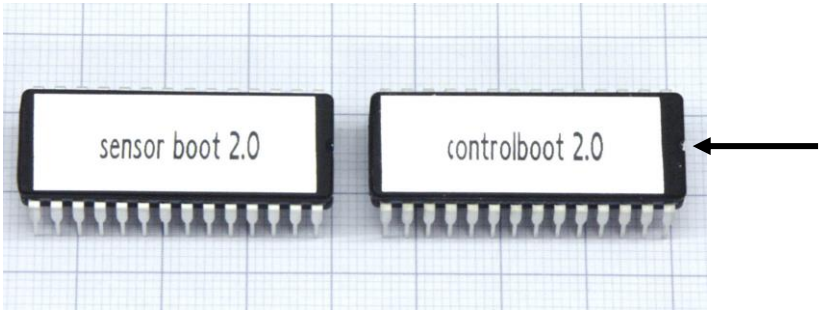


Fig. 2. Sensor board (left) and control board EPROM (right). Arrow points at indentation.

Removing the connector panel

Both circuit boards are mounted on a separate metal frame, which are fixed on the connector panel at the back of the detector. The circuit boards can be accessed by removal of the connector panel by means of the four M3 Phillips screws as depicted in Fig. 3. The screws are marked in this picture with red arrows and the letters A and B.

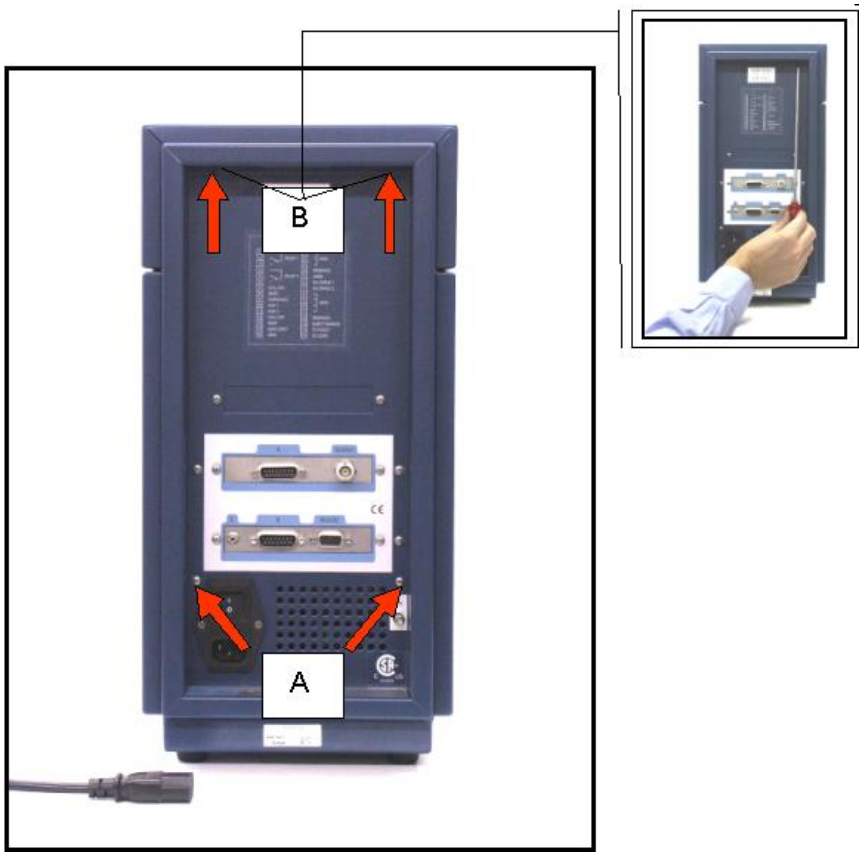


Fig. 3. Connector panel of the DECADE II

1. Remove the two screws located below (A) completely by means of a Phillips screwdriver. The screws in the top part (B) can be accessed via the two holes in the connector panel, see top-right

picture in Fig. 3. **Do not remove** the two screws in the top part completely, but just loosen them a bit (a few turns).

2. Subsequently, pull the connector panel backwards as far as depicted in Fig. 4 (constrained by the length of the connected cables). The control board can rest on the isolated casing of the power supply without any problem.

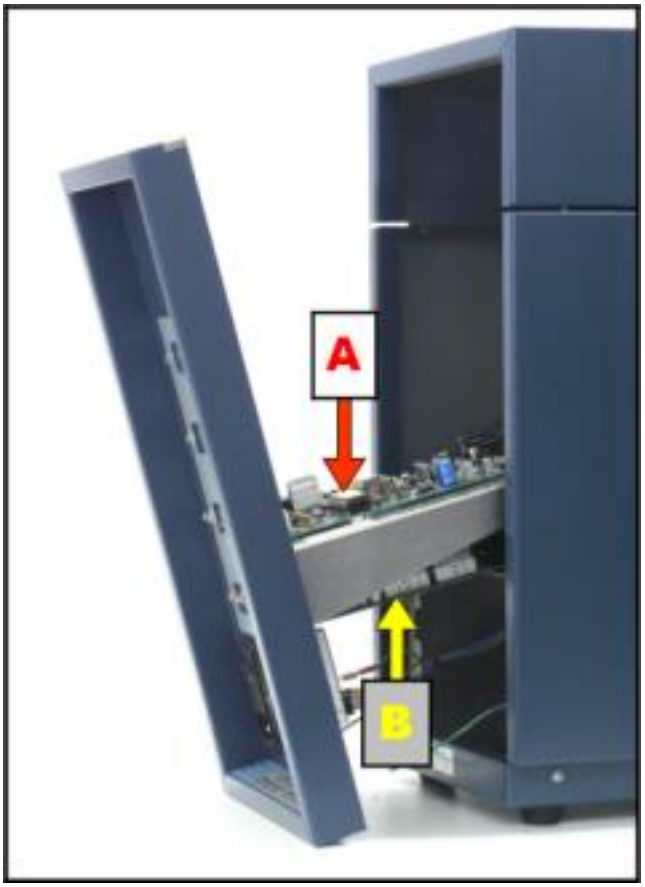


Fig. 4. Detector with connector panel pulled backwards. (A) sensor board and (B): control board.

Location of EPROM on sensor board

Arrow (A) in Fig. 5 shows the location of the EPROM on the sensor board.

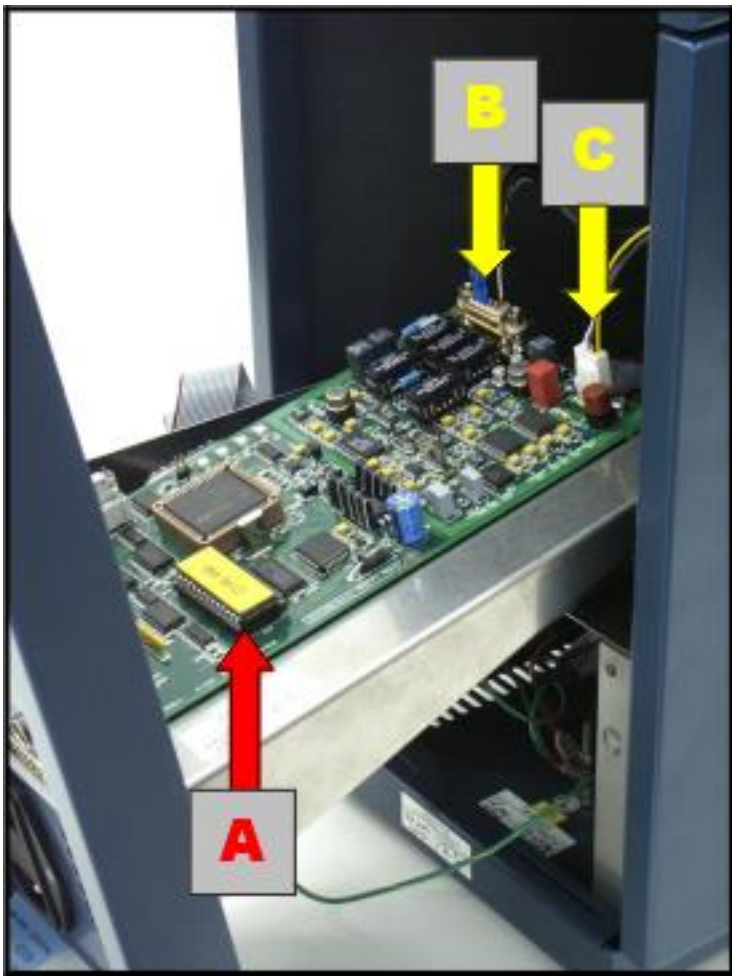


Fig. 5. Top view sensor board. (A) sensor board EPROM, (B): internal cell cable connector and (C): I^2C/power cable connector.

Location EPROM on control board

To access the EPROM on the control board it is necessary to remove the sensor board completely. This is done in the following manner:

1. Disconnect the internal cell cable depicted in Fig. 5 (B). This is a subD connector, which is fixed with two nuts. Remove the nuts with the socket wrench and pull the connector out, as depicted in figure 6A.
2. Disconnect the I^2C/power cable depicted in Fig. 5 (C). This is a Molex kk connector, which can be removed by gentle pulling in the upward direction.
3. Remove the three M3 screws which secure the sensor board on the connector panel using a Phillips screwdriver. The screws are marked in Fig. 7 with red circles.

The red arrow in Fig. 8 shows the location of the EPROM on the control board.

Fig. 6. Removal of internal cell cable connector.

Fig. 7. Removal of sensor board from the connector panel.

Fig. 8. Top view of control board. (A) control board EPROM.

Removing EPROMS

Take precautions against electrostatic discharge during installation/removal of the EPROMS at all time. Both EPROMS can be removed from the board using an IC-puller or alternatively a flat screwdriver. See Fig. 9 on the next page. An IC-puller is the recommended tool. Clip the IC-puller around the EPROM and lift it gently out of its socket. Make sure that you don't bend the legs of the EPROM. In case of a screwdriver, insert it between the EPROM and the socket and lift the EPROM gently bit-by-bit out of the socket. NOTE: avoid scratching the circuit board with the screwdriver.

Installing new EPROM

NOTE: EPROMS are board specific. Make sure that the sensor boot EPROM is installed on the sensor board and the control boot EPROM is installed on the control board.

The EPROM has a small indentation on one side of the chip this will help you to insure that the EPROM is installed correctly. The contours of the EPROMS (including the indentation) are drawn on the circuit board as a reference.

Make sure that the EPROM is installed in the right position and that all pins of the EPROM are positioned inside the corresponding holes in the IC socket before pushing the EPROM in place.

After installation of the new EPROMS reassemble the detector and upload new flash firmware as described in chapter "**Error! Reference source not found.**".

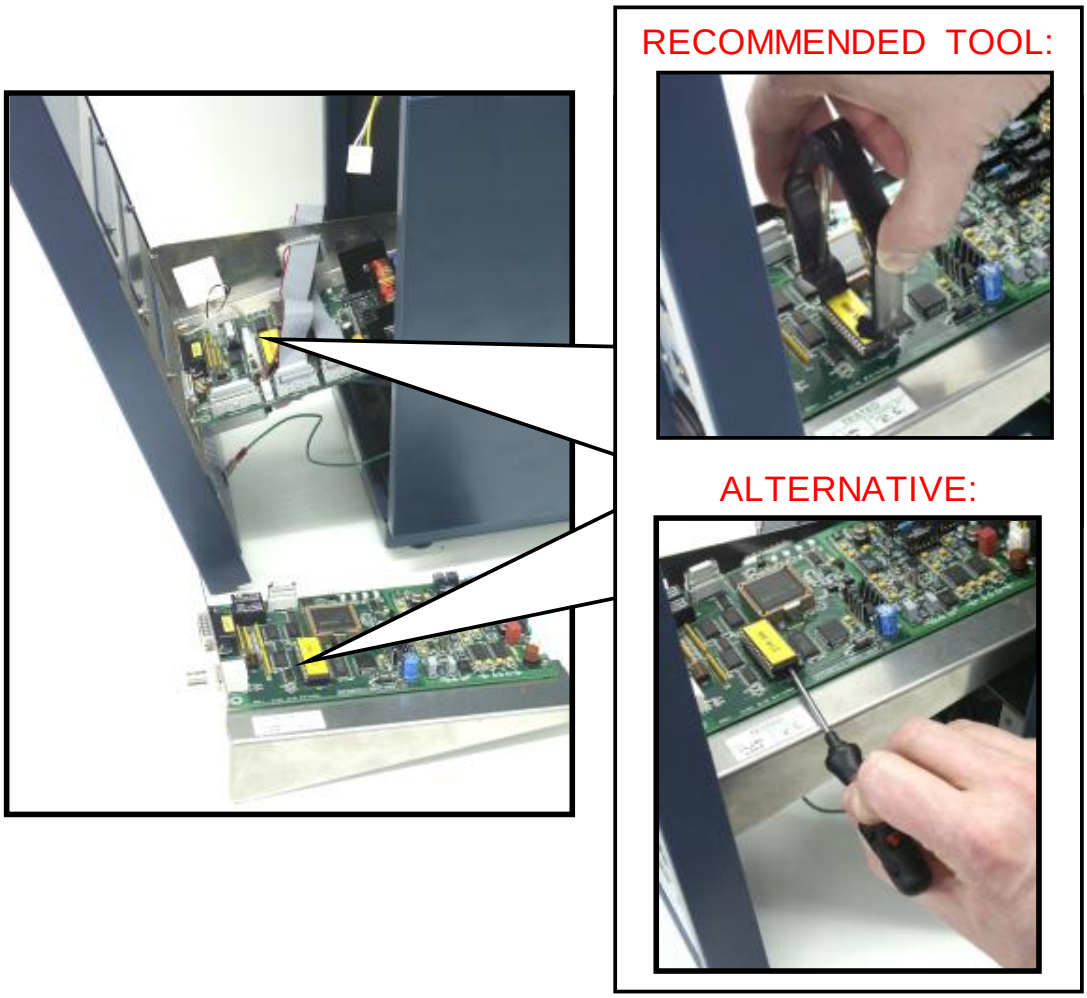


Fig. 9. Removing the EPROMS from the circuit boards.

C H A P T E R 3

Error messages

Table I. Error messages.

Error	Message	Description
01	Incompatible boot version	Boot software on control- and sensor board are not the same revision. Install FW of same revision in both boards.
02	Control board error	Boot error, control board flash file is damaged or not found. Upload new firmware using FWLoader.
03	Sensor board 1 error	Boot error, sensor board flash file is damaged or not found. Upload new firmware using FWLoader.
04	Firmware program error	Unable to write data to flash memory. Hardware error, install new board. Contact supplier.
05	Record error	Flash file error, file damaged or not of Intel's "hex standard" type. Use another flash file for FW upload.
06	Incompatible FW version	Flash executable on control- and sensor board are not of the same revision. Upload new firmware using FWLoader.
07	Incompatible FW	Flash file error, file header indicates incorrect file type. Use another flash file for FW upload.
08	Control board FW erase failed	During FW upload, unable to erase control board. Hardware error. Try uploading firmware again, if not successful install another board. Contact supplier.
09	Sensor board 1 FW	During FW upload, unable to erase sensor

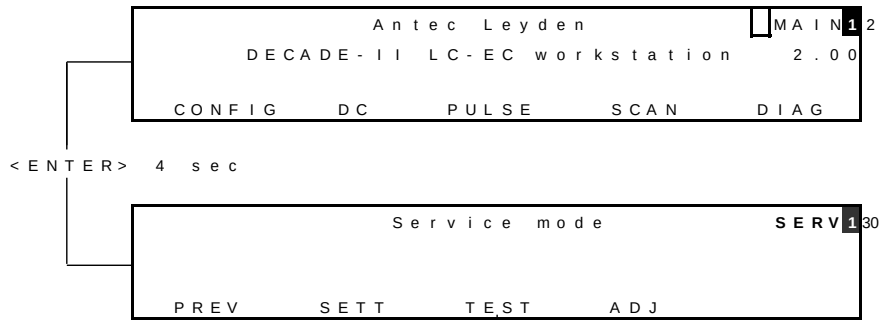
Error	Message	Description
	erase failed	board. Hardware error. Try uploading firmware again, if not successful install another board. Contact supplier.
10	Upload checksum error	Incorrect checksum. Try uploading firmware again. If not successful, use another firmware file.
11	Checksum error	Incorrect checksum. Try uploading firmware again. If not successful, use another firmware file. If not successful install another board. Contact supplier.
12	Temperature sensor 1 error	Temperature sensor in oven unit not connected or defect. Check hardware, contact supplier.
13	Disconnect flow cell 1	Cell cable still connected when entering ZER.IE sreen. Switch off cell and disconnect cell cable.
14	Control board SRAM error	SRAM read/write error during SRAM test. Try again, if not successful replace board. Contact supplier.
15	Sensor board 1 SRAM error	SRAM read/write error during SRAM test. Try again, if not successful replace board. Contact supplier.
16	Sensor board 2 SRAM error	SRAM read/write error during SRAM test. Try again, if not successful replace board. Contact supplier.
17	Sensor board 3 SRAM error	SRAM read/write error during SRAM test. Try again, if not successful replace board. Contact supplier.
18	Sensor board 4 SRAM error	SRAM read/write error during SRAM test. Try again, if not successful replace board.

Error	Message	Description
		Contact supplier.
19	Sensor board 5 SRAM error	SRAM read/write error during SRAM test. Try again, if not successful replace board. Contact supplier.
20	Sensor board 1 not connect	No communication between sensorboard 1 and control board or sensor board 1 not detected. Check: 1. If the sensor board fuse is properly inserted or not faulty. 2. if the I^2C cable is connected or faulty 3. if the dipswitch settings are correct and correspond to that of sensor board 1: [1] on [2] on [3] on [4] on. 4. if not successful contact supplier.
20	Sensor board 1 not connected ed	In case the detector has Firmware version < 3.50 the error could be induced by interaction with the control software. In that case start-up (switch off and on) the detector with the 'F5' key depressed. Its adviced to upgrade the detector to a FW version > 3.50. Please contact supplier for specific instructions with respect to upgrade of your detector.

C H A P T E R 4

Service menu

Main



SETT

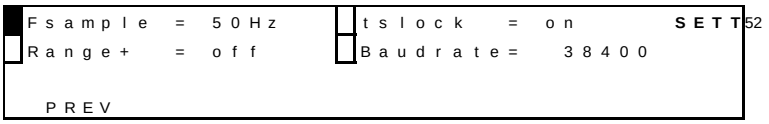


Table II. Parameters

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
tslock	SETT	Limit maximum sampling time (ts) to 100 ms in PULSE mode	C
Baudrate	SETT	RS232 baud rate. Default: 38400, changing this setting requires the same	C

Parameter	screen	Description	Type
		setting on the PC.	

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

TEST

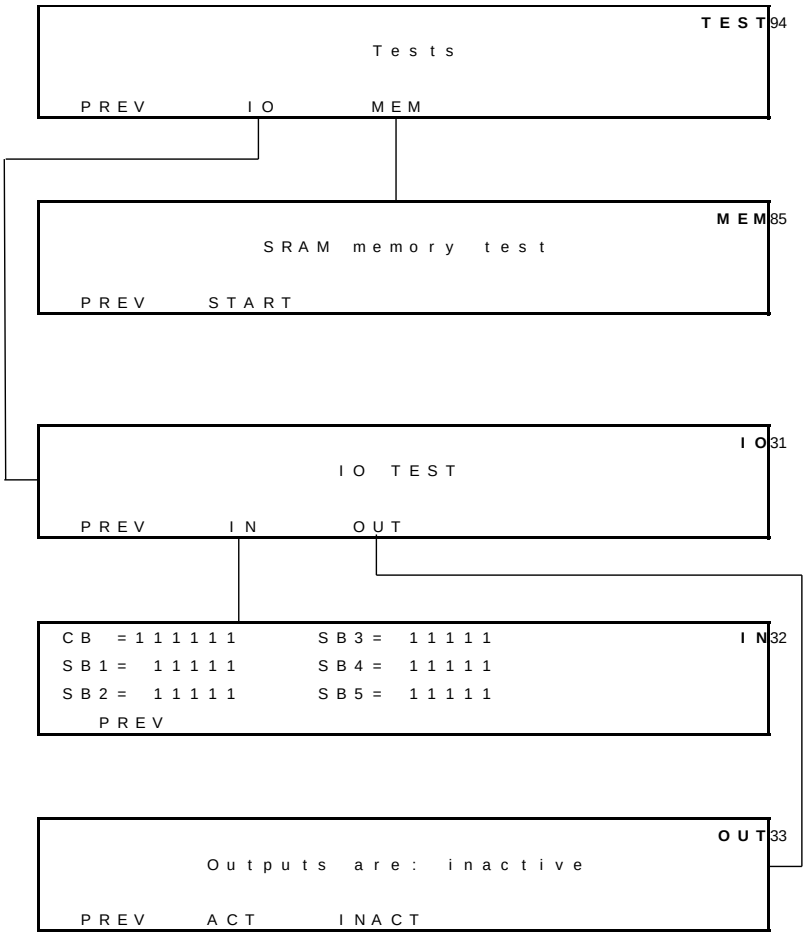


Table III. Parameters

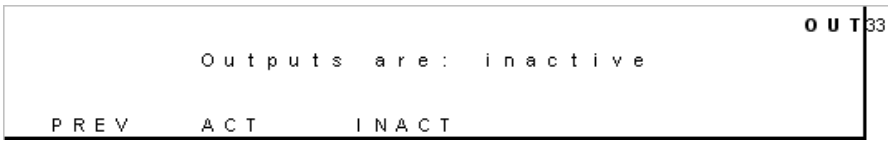
Parameter	screen	Description	Type
MEM	TEST	Enters SRAM test, performs read-write to SRAM. After testing an OK message appears for a few seconds. If not OK a warning appears.	F
RC	TEST	Test for filter parameters. Releases high frequency signal. For factory use only.	F

Parameter	screen	Description	Type
CB, SB1..6	IN	Shows status of inputs Control Board and Sensor Board(s)	S
(IN)ACT	OUT	(in)activates outputs	C

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

OUT

Outputs can be set to active (press 2) or inactive (press 3).



Testing outputs is done using the factory supplied connector cable and connecting the corresponding wire(s). Measure the output status with a calibrated voltmeter.:

A. TTL outputs: connect the minus of the voltmeter to common and the plus of the voltmeter the TTL output that needs to be tested. **In an active status the voltmeter will display > 2.5V (usually 5V), inactive <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. The situation drawn on the rear panel is the default (inactive) status.

Table IV. Control board outputs (connector B)

Pin	Description
12	Free ttl
13	Inject marker
14	To A (inject)
15	To B (load)

Default status is high (5 V).

Table V. Sensor board outputs (connector A)

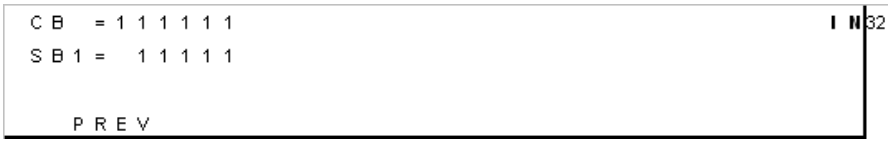
Pin	Description	TF coding

10	Aux 1	0001
11	Aux 2	0010
1 - 2	Relay 1 (default)	0000
1 - 3	Relay 1	0100
4 - 5	Relay 2 (default)	0000
4 - 6	Relay 2	1000

“TF coding” refers to “0000” output string when editing a time file.
Default status is high (5 V).

IN

Input status is reflected in display. If a short circuit with common is made the corresponding pin status will change to zero.



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

Table VI. Control board inputs (connector B, C)

Pin	Description	Coding
Connector C	Hand valve: load=1, inject=0	111110
7	Status B (load) =0	111101
6	Status A (inject) =0	111011
5	Mark	110111
4	free ttl	101111
	door open=0, closed =1	011111

Default status is high (1).

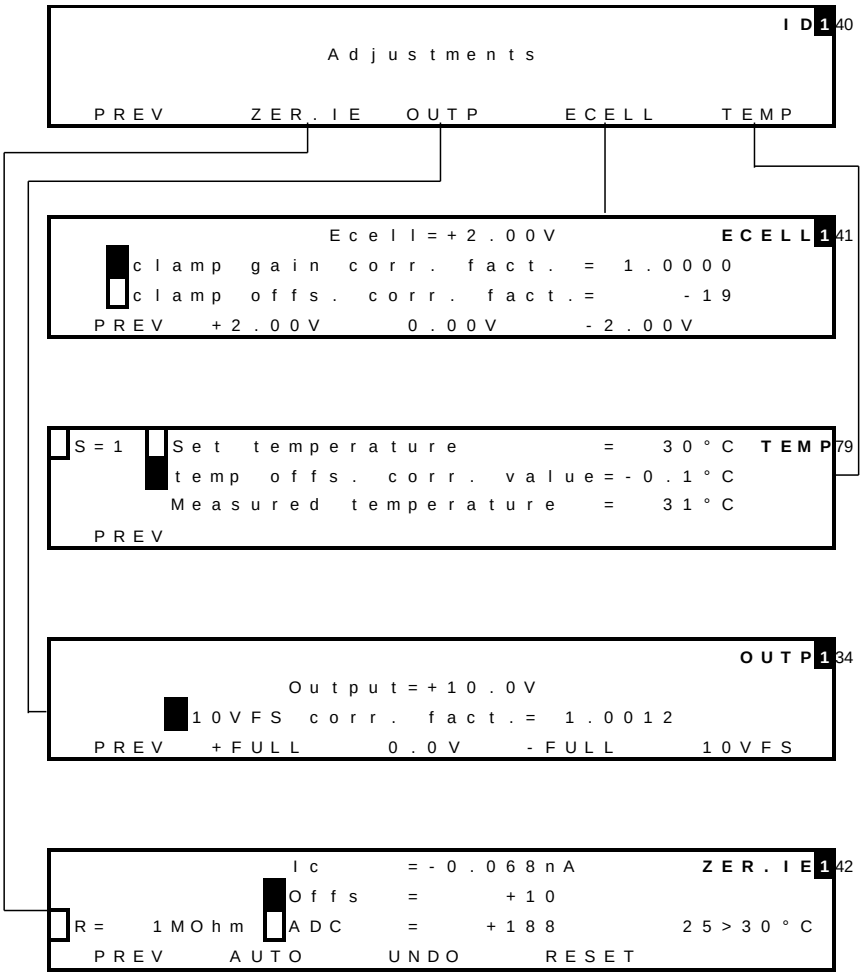
Table VII. Sensor board inputs (connector A)

Pin	Description	Coding
14	Auto zero	11110
13	start	11101

12	cell off	11011
8	reset	10111
7	cell on	01111

Default status is high (1).

ADJ

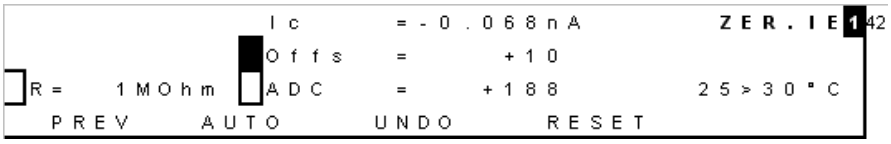


In “Adjustments“ a number of important parameters are stored:

- 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 stabilised for more than an hour with the cell off and T=35 °C. Cell cable must be disconnected all the time.



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 VIII. 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 IX. Parameters

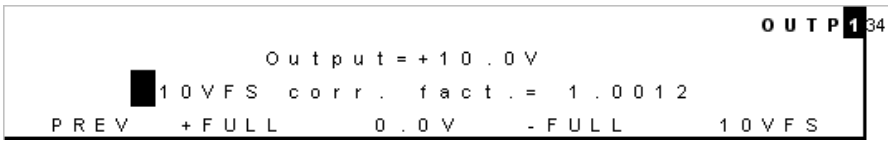
Parameter	**Screen**	**Description**	**Type**
R	ZER.IE	Select active resistor of IE converter using + or - button. Values are 100M, 10M, 1M,	C

Parameter	Screen	Description	Type
		100k, 1k Ohm	
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 stabilised 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 and 10VFS
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.
5. Press the 1 VFS / 10VFS button and check the 1VFS settings. If not in spec, return to 10VFS and repeat procedure.

Table X. Output specifications at 1 V / 10 V FS

Test	**Specified**
max. output	10000 ± 5 mV
min. Output	-10000 ± 5 mV
zero output	0 ± 5 mV

Table XI. Parameters

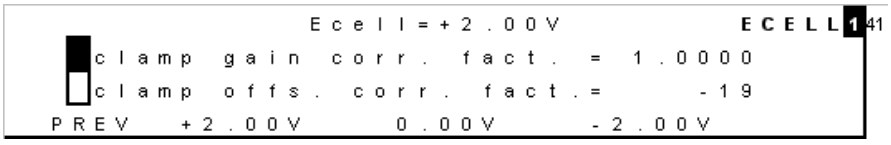
Parameter	**screen**	**Description**	**Type**

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.

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!

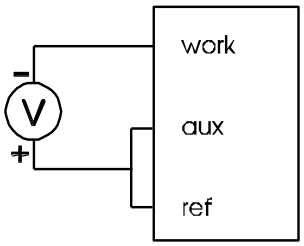


Fig. 10. Connection of the voltmeter for the ECell test. Pinning of the subD cell connector: Work=1, AUX=2, REF=3.

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 +2.00 V value
6. Adjust clamp gain correction (NOT the offset correction) until measured voltage is within specs

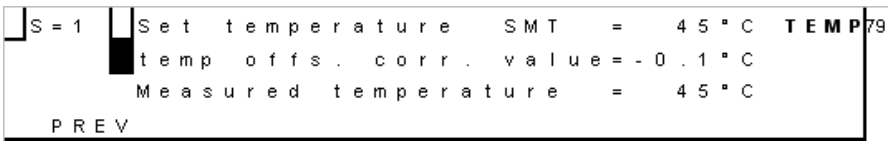
7. Press F4 and check the –2.00 V value, if not in specs adjust and repeat the 4 previous steps.

Table XII. E-cell specifications

Test	**Specified**
max. output	-2000 ± 1 mV
zero output	0 ± 1 mV
min. output	2000 ± 1 mV

TEMP Temperature calibration (FW version 2.05)

For DECADE II detectors with FW version 2.05 installed use the procedure below to perform a temperature calibration. This detectors have a SMT-160 temperature sensor for temperature control. One can recognize the type of sensor which is active in the TEMP service screen. In case of FW version 2.05, SMT is displayed. Before adjusting the temperature calibration setting make sure the system has been stabilised for more than an hour with the cell off and T=45 °C. 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. Make sure set temperature is 45 °C, if not, set temperature using +/- and wait an hour to stabilise.

Fig. 11. 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. If temperature on external sensor differs from ‘measured temperature’ in display adjust offset correction factor. Select ‘temp offs corr value’ and use +/- button to adjust until ‘measured temperature’ is exactly the external sensor temperature.

Table XIII. Temperature specifications

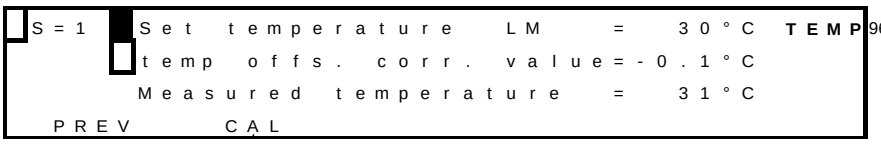
Test	**Specified**
Temperature uncompensated*	45 ± 3 °C
Temp. offs. correction factor	0 ± 3.0 °C

*uncompensated temperature is measured using an offset correction of 0 °C.

cell off and T = 45 °C. Cell cable must be disconnected all the time.

TEMP Temperature calibration (FW version 3.xx)

For DECADE II detectors with FW version 3.xx installed use the procedure below to perform a temperature calibration. This detectors have a LM-35 temperature sensor for temperature control. One can recognize the type of sensor which is active in the TEMP service screen. In case of FW version 3.xx, LM is displayed on the LCD screen.



In case of upgrading a DECADE II FW 2.05 to FW 3.xx using one of the hardware upgrade kits mentioned in the table below, please consult the relevant temperature calibration instructions in the installation guides: 171.7034 or 171.7038 supplied with the kit.

P/n	Description
171.0216	DECADE II DCC upgrade kit, s/n 92 -
171.0218	DECADE II DCC upgrade kit, s/n 72 - 91
171.0220	DECADE II DCC upgrade kit, s/n 25 - 71
171.0222	DECADE II upgrade kit v3.20

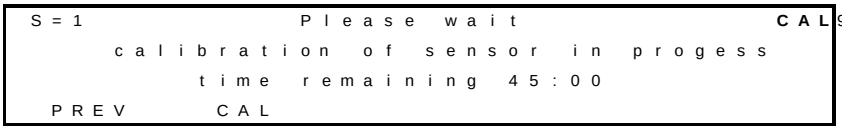
Before adjusting the temperature calibration setting make sure that no cell cable is connected during the procedure.

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 in figure 11).

2. Press “CAL” button= (F2). By pressing the “CAL” button an auto-calibration routine will start. Internally the oven temperature is set to 45 °C and the detector is allowed to stabilise for 45 minutes. During that period the detector will display a 45 minute countdown timer to indicate the progress of the calibration routine.



Leave the SERVICE mode and set the oven temperature to 45°C. Let the oven stabilise for 15 minutes and check the temperature using the external temperature probe. The measured temperature should be within specifications: 45 ± 0.5°C.

Do not open the oven compartment during the calibration procedure because this will result in an erratic calibration of the temperature sensor and subsequently in deviations in the set and actual oven temperature

A P P E N D I X 1

Key combinations

Reset to factory defaults

In CONFIG screen press Enter button for 4 seconds. A message appears “RESET TO FACTORY SETTINGS?” If yes, factory settings will be loaded.

- running time files or scans are stopped
- reset of operational parameters (Ecell, range, filter, temperature…)

Enter service mode

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

- running time files or scans are stopped

Erase time files

Switch off detector. Press F5 button and switch on detector while keeping the F5 button during the start up procedure. All time files are erased. This may be necessary when upgrading to new firmware.

- existing time files are erased.

A P P E N D I X 1

Configuration of dip switches

In order for the embedded software of the DECADE II to recognize all sensor boards properly the board address of the sensor boards should be set by means of the dip switches. The dip switches are located between the BNC connector and sub-D I/O connector at the edge of the board. The dipswitches are protected by means of a brown transparent foil. Remove this adhesive foil to free switches for programming. Program the dips switches as depicted in figure 12 and 13 for sensor board 1 and 2 respectively.

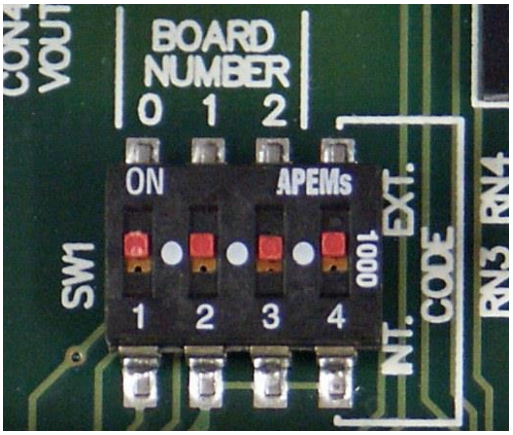


Fig. 12. Dip switch settings for sensor board 1: 1-on, 2-on, 3-on and 4-on.

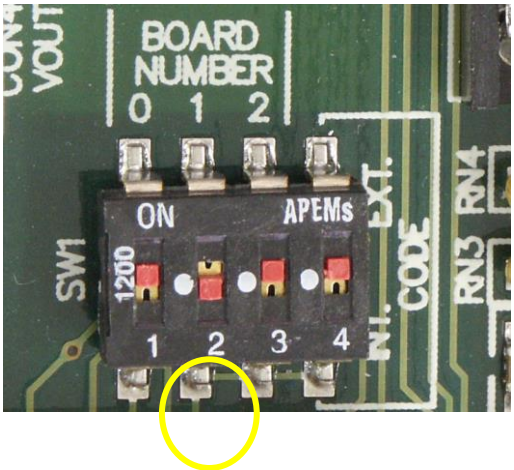


Fig. 13. Dip switch settings for sensor board 2: 1-on, 2-off, 3-on and 4-on.

Please place the transparent adhesive foil back after programming for protection.

In the table below a complete overview is given for the settings of all 5 sensor boards:

Sensor board	....1....2....3....4 (dip)
1	on on on on
2	on off on on
3	off off on on
4	on on off on
5	off on off on