

FUNCTIONAL SPECIFICATION

NEDAP VOTING SYSTEM ESI2

POWERVOTE

NEDAP SPECIALS

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CONTENTS

1. NEDAP VOTING SYSTEM.....	4
1.1. INTRODUCTION	4
1.2. VERSIONS.....	4
1.3. THE VOTING MACHINE (VM).....	5
1.3.1. <i>The Control Unit (CU)</i>	6
1.3.2. <i>The voting machine screen</i>	7
1.3.3. <i>The voters screen buttons – Acoustic feedback</i>	8
1.4. THE PROGRAMMING/READING UNIT (PRU).....	8
1.5. BALLOT MODULES	9
1.5.1. <i>Storing votes in the primary ballot module</i>	9
1.5.2. <i>Storing of the votes in the back up module</i>	9
1.6. THE MECHANICAL PROTECTION FOR BALLOT MODULE AND PROCESS.....	9
1.6.1. <i>Other security features</i>	10
1.7. IDENTIFICATION NUMBERS	10
1.8. TECHNICAL DATA.....	11
1.8.1. <i>Data</i>	11
2. OPERATION MODE	12
2.1. OVERVIEW OF OPERATING FUNCTIONS.....	12
2.2. DIFFERENT OPERATING PHASES OF THE VM ESI2	12
2.2.1. <i>Opening of Poll</i>	12
2.2.2. <i>Voting</i>	13
2.2.3. <i>Close of Poll</i>	14
2.3. SERVICE MEASUREMENTS	14
3. PRE-VOTING MODE.....	15
3.1. STARTING UP THE VM	15
3.2. SELF-TESTING COMPLETE.....	16
4. VOTING MODE.....	19
4.1. A POLL	19
4.1.1. <i>Examples of an election</i>	20
4.1.1.1. <i>Voter’s panel</i>	20
4.1.1.2. <i>Control Unit display</i>	24
4.2. A REFERENDUM	26
4.2.1. <i>Examples of a referendum</i>	26
4.2.1.1. <i>Voters panel</i>	26
4.2.1.2. <i>Control Unit display</i>	28
4.3. VOTING NOT POSSIBLE	29
5. FUNCTIONS MODE.....	31
5.1. OPEN POLL	31
5.1.1. <i>Print open poll statement</i>	32
5.1.2. <i>Show open poll statement on display</i>	34
5.2. CLOSE POLL	35
5.2.1. <i>Make back up and print statement</i>	36
5.2.2. <i>Make back up – show data on display</i>	38
5.3. TEST VOTING MACHINE	38
5.3.1. <i>Test printer</i>	39
5.3.2. <i>Test displays</i>	39
5.3.3. <i>Test buttons</i>	40
5.4. ABOUT VOTING MACHINE.....	41
5.4.1. <i>Versions and checksums</i>	41
5.4.1.1. <i>Main board</i>	42
5.4.1.1.1. <i>Hardware and software versions</i>	42
5.4.1.1.2. <i>Checksums</i>	42
5.4.1.2. <i>Connection board</i>	43

5.4.1.2.1.	Hardware and software versions	43
5.4.1.2.2.	Checksum	43
5.4.1.3.	LED display board	44
5.4.1.3.1.	Hardware and software versions	44
5.4.1.3.2.	Checksums	44
5.4.2.	<i>Clear back up ballot module</i>	45
5.4.3.	<i>Print information</i>	45
5.4.3.1.	Print information	46
5.4.3.2.	Print security check	47
6.	THE STATE “SERVICE” (ONLY FOR MAINTENANCE PURPOSES BY AUTHORISED SERVICE ENGINEERS)	48
6.1.	DEBLOCK VOTING MACHINE	48
6.2.	VOTING MACHINE SETTINGS	49
6.2.1.	<i>Print settings</i>	49
6.2.2.	<i>Change ID of the VM</i>	50
6.2.3.	<i>Change machine</i>	51
6.2.3.1.	Change hardware version	52
6.3.	SERVICE FUNCTIONS	52
6.3.1.	<i>Print history</i>	52
6.3.2.	<i>Display history</i>	54
7.	ERRORS	56
7.1.	ERROR TYPES	56
7.2.	THE “ERROR” STATE	56
7.3.	VOTER’S PANEL BUTTON ERROR	57
7.3.1.	<i>Button error at start-up</i>	57
7.3.2.	<i>Button error during normal operation</i>	58
7.4.	NO PRINTER PAPER	58
7.5.	PRINTER ERROR	59
7.6.	BLOCKAGE	59
8.	DIAGNOSIS	61
8.1.	START UP TEST	61
8.2.	DIAGNOSIS DURING NORMAL OPERATION	61
9.	FACILITY FOR VISUALLY IMPAIRED PERSONS	62

1. Nedap voting system

1.1. Introduction

This document describes the functions of the Nedap ESI2 Voting System which is developed for use at elections and referendums in Ireland.

The Election Management System (EMS) consists of the following components:

- One or more voting machines (VM)
- One programming/reading unit (PRU)
- One personal computer (PC)(connected to the programming/reading unit)

The PC, using IES software, prepares the layout of the ballot paper(s) and the ballot modules before the poll, reads the votes and presents the results of the poll. The IES software for the PC is described in a separate document.

The voting machine and programming/reading unit contains the following key components:

- MC68000 is used as the microprocessor on the main printed circuit board of the VM and PRU;
- Flash-E²PROM is used in the circuitry of the ballot module;
- Specially developed voter's panel screen with displays with light emitting diodes (LED's) to indicate order of preference(s);
- Integral printer;

1.2. Versions

An overview of the voting machines developed by Nedap is as follows;

Model	Year	Software	Country
ES3A	1993/5	2.6	The Netherlands
ES3B	1997	2.9	The Netherlands
ESD1	1997	2.8	Germany
ESI2	2003	2.0	Ireland

The ES3B model was certified for the Dutch elections on 7 October 1997 by TNO (The Institute for Applied Informatics), a Dutch test institute. The ESD1 model was certified for all elections in NordRhein-Westfalen from 12 April 2000 by the Physikalisch Technische Bundesanstalt (PTB), a German independent test institute. Since that approval, approvals for specific regional elections were obtained, of which the last one was received in January 2002 for the "Landtagswahl Sachsen Anhalt".

The ESI2 is not downwards compatible with other versions of the voting machine.

1.3. The voting machine (VM)

The VM replaces the traditional ballot paper, voting compartment and ballot box. The voter records his/her preferences for candidates/referendum choice on the ballot paper displayed on the screen of the VM and then casts his/her vote(s). The VM stores the votes cast by voters in a ballot module (see section 1.5) and following the close of the poll, the primary ballot module containing all the votes cast on the voting machine is downloaded to a PC at a count centre via the programming/reading unit (PRU) to determine the poll result.

The VM is designed and constructed to be a compact and lockable suitcase. On polling day, the suitcase is opened and becomes a voting compartment. The two main parts are connected through a cable.

- **The Control Unit.** The Control Unit (CU) is positioned during the poll on a table in the polling station under control of the polling station staff. It has a keyswitch, buttons for releasing polls and a function button, which, in combination with the function switch, can set the voting machine in different modes. There is also a liquid crystal display (LCD) to show the VM mode and summary data in relation to each poll being taken on the machine.
- **The voting compartment with the ballot paper.** The VM has a single large screen capable of displaying a maximum of 90 candidates on five ballot papers. Each ballot paper incorporates button symbols on top of active membrane switch touch points that detect pressing the buttons to register the voter's preferences. To the right of the buttons are green LED-displays on a dark background in which the preferences of the voter are displayed. At the top of the screen is an LCD on which messages are displayed for the voter. The "CAST VOTE(S)/CAITH VÓTA(Í)" button is located to the right of this voter's display. (Indicated as CV-button in the remaining of this document). The text and icon are black on yellow background. This button, when pressed, stores the voter's preferences in the ballot module. A keypad and four buttons located to the left of the LCD are covered and inactive except when the VM is in Functions or Service mode. To the left of the keypad a button is labelled "Gaeilge/English" for a voter to press to see the text in the LCD in Gaeilge or English. Cables connect all the touch points and buttons from the front of the machine to the main electronics in the rear of the VM.

The VM has a power-connection for 230V and two wires fitted with spring clips to enable easy and quick connection to the terminals of a 12V battery. The battery can power the VM in the event that the mains supply is interrupted or is unavailable.

The main features distinguishing the ESI2 from the other versions of the Nedap voting machines are:

- Capability of providing for 5 ballot papers in 5 columns on the machine screen at the same time for use at PR/STV elections or referendums or a combination of such elections or referendums. Each ballot paper column comprises 2 rows at the top for election/referendum details and 18 rows for candidate and/or referendum choices.
- An LED at the top of each ballot paper column is activated by the CU to indicate which ballot paper(s) a voter is entitled to vote on at the poll(s).
- LED-display columns are highlighted for each ballot paper, so that, along with the LED at the top of the ballot paper, the voter will see instantly the ballot paper(s) on which he or she is entitled to vote and the preferences he/she has recorded.
- A correction facility is available to delete a preference on a ballot paper without disturbing preferences recorded on other ballot papers.
- A reminder will appear on the voter's display, when there is more than one ballot paper and when a voter presses CV-button without recording at least one preference on each activated ballot paper on the screen.
- Two ballot modules (primary and back up) are used – see section 1.5.
- A printed statement produced by the VM at the start and close of poll will show details of the voting machine and, for each poll programmed in the primary ballot module, a list of candidates and/or referendum choices and number of times the VM was activated for the poll,

number of votes cast on the machine (including, in the case of multiple polls, the number of null votes (see section 1.3.1)) and the number of occasions the VM is manually deactivated during the day.

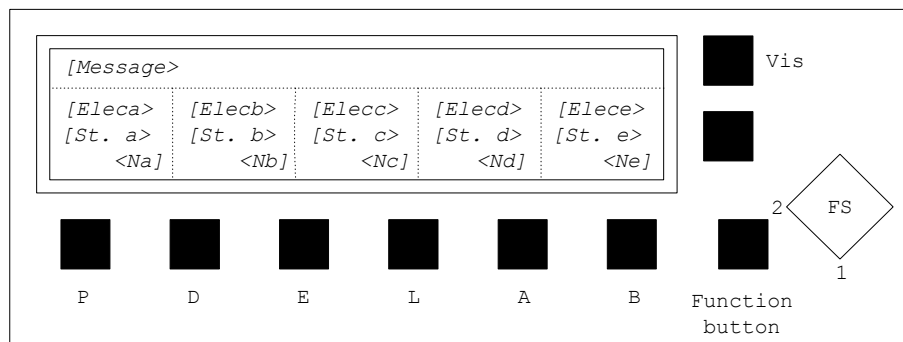
- A short ballot paper can be spread over a full column on the screen and a long ballot paper (i.e. more than 18 candidates) can be spread over two or more columns.
- A lock is provided for opening and closing the voting machine screen.
- Two carry points are provided at each end to assist the handling of the voting machine.
- A language button for displaying the text in the voter's display in Gaeilge or English.

1.3.1. The Control Unit (CU)

The CU is the part of the VM used by the polling staff to control access to the machine and to monitor the number of votes cast at each poll on the machine. The CU has the following operation and display elements:

- A four-line LCD, which displays the status of the VM and the number of votes cast at each poll including in the case of multiple polls, null votes¹. The state of the poll is shown with indication and error messages.
- A Keyswitch (FS) function switch on the CU is used to switch the VM between Pre-Voting and Voting modes. Only authorised staff are allowed to change the mode of the VM.
- The "FUNCTION" button, in combination with the keyswitch, is used to set the VM in the Functions mode.

The CU looks schematically as follows:



The double outlined box is the LCD. Expressions in this display have the following meanings:

- [Message> = Mode of the VM or an error message.
- [Eleca> to [Elece> = Names of the polls held at the same time. If there are less than 5 polls held there will be blank spaces.
- [St. a> to [St. e> = Mode of each poll.
- <Na> to <Ne> = For each poll, the number of votes cast (including, in the case of multiple polls, null votes).

¹ A null vote is recorded by the voting machine where, in a multiple ballot paper situation, after a message is displayed on the machine, a voter casts his/her vote(s) without recording a preference on each activated ballot paper. In such a situation, a null vote is stored in respect of each poll for which no preference was recorded. This enables the voting machine to maintain an electronic record of voting or non-voting at each poll on the machine and assists the reconciliation of the number of voters permitted to use the voting machine and the final statement produced by the voting machine of the votes cast at each poll on the machine.

FS is a keyswitch.

Buttons P, D, E and L are buttons that specify which polls should be activated on the VM screen.

Button P is pressed for Presidential electors and activates all ballot papers (including referendums) on the screen. Button D is pressed for Dáil electors and activates all ballot papers on the screen except Presidential elections and referendums. Button E is pressed for European electors and activates all European, local and Údarás ballot papers on the screen. Button L is pressed for local electors and activates all local and Údarás ballot papers on the screen.

Once any of the buttons P, D, E or L is pressed, the ballot paper(s) concerned is/are activated on the screen. If an incorrect button is pressed, the screen can be deactivated by turning the keyswitch.

A and B are spare buttons.

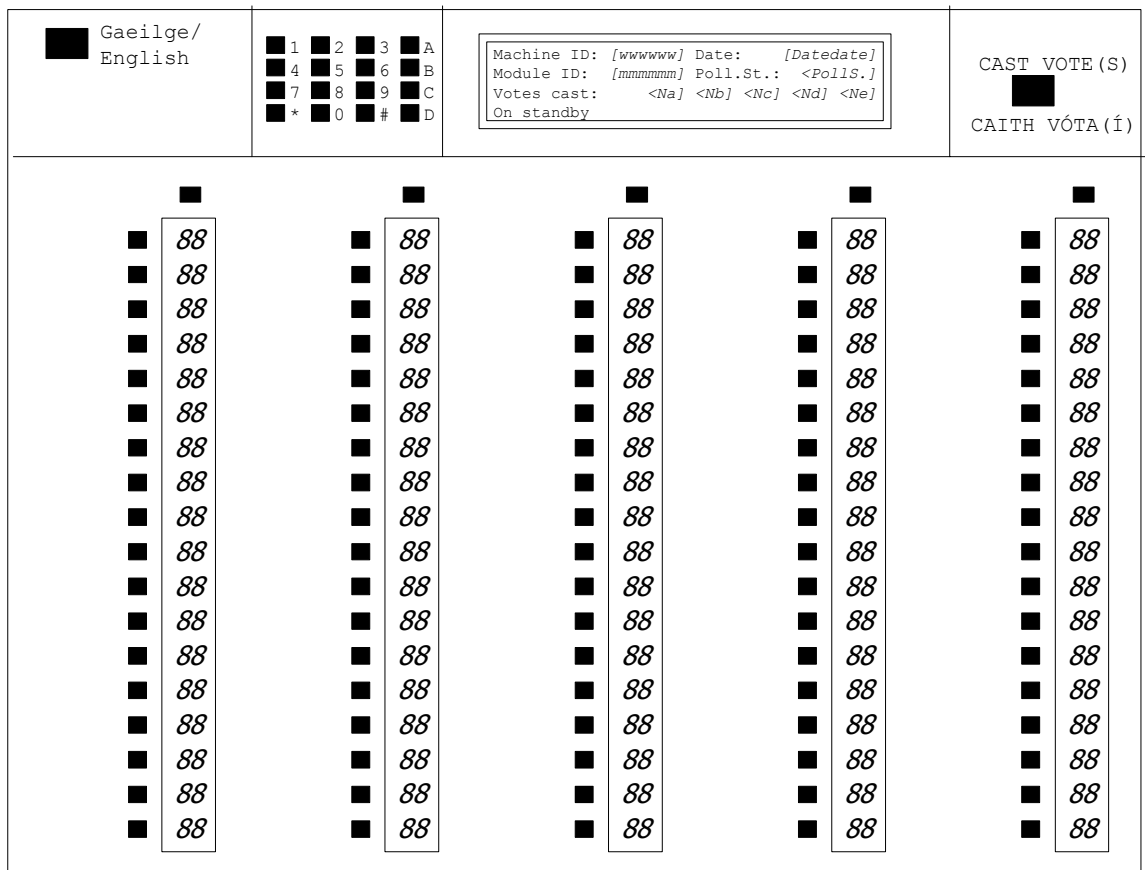
If an audio system for visually impaired voters is provided, the “Vis” button is pressed to activate the system before activation of the ballot paper(s) on the screen.

The Function button is pressed in conjunction with the keyswitch to set the VM in Functions mode.

The button beneath the “Vis” button is an inactive button.

1.3.2. The voting machine screen

The layout of the screen and front of the machine are as follows:



The double outlined box is the LCD. Expressions in this display have the following meanings:

- [wwwwww] = ID of the VM.
- [mmmmmm] = ID of the ballot module.

- [Datedate] = Date of the poll.
- <PollS.] = Number of the polling station where the poll(s) is/are being taken.
- <Na] to <Ne] = For each poll, number of votes cast on the VM (including, in the case of multiple polls, the number of null votes (see section 1.3.1)).

The screen and front of machine consists of the following parts:

- Five columns with 18 preference buttons in each column. A separate ballot paper is printed for each column of buttons and is secured on the screen by mechanical alignment points at the top and the bottom of the screen. Markings on the screen indicate the positions of the mechanical alignment points. After alignment the screen is covered with a clear protective cover. Mechanical clamps then ensure that all ballot papers and the cover are firmly held in place. The voting screen is secured by a lock. Each active button in a column is programmed, when pressed by the voter, to record a preference for the candidate or referendum choice in that row. In the case of a poll the LED display shows the number of that preference and, in the case of a referendum, an “X” will be on the left of the LED.
- One button labelled “CAST VOTE(S)/CAITH VÓTA(Í)” will, when pressed, store the voter’s preferences in the primary ballot module.
- A button to the left of the keypad, labelled “Gaeilge/English”, will provide the text in the display in Gaeilge or English. If a voter wishes to see the text in a language other than the default language, the button is pressed. The default language can be returned to by pressing the button. The text will default to the other language for the next voter.
- Underneath a protective cover at the top of the screen is a keypad with sixteen buttons labelled 1 – 9, *, 0 and #, and A – D. These buttons are used when the VM is in the Functions and Service modes.
- At the top of each LED-display column is a coloured LED that is lighted if the ballot paper(s) relating to that column is/are activated. This helps the voter to identify the ballot paper(s) on which he/she is entitled to vote.

1.3.3. The voters screen buttons – Acoustic feedback

If an active preference button (i.e. a candidate or referendum preference button on an activated ballot paper) is pressed, the VM reacts with a short beep, as well as displaying the preference number or “X” in the adjacent LED-display. This short beep can be switched off by means of a parameter in the memory module. This parameter is programmed by the PRU and tells the VM whether to beep or not. If an inactive preference button is pressed, the VM will not react. In addition, the following information is displayed on the last line in the display box “election, candidate’s surname, initial, political party initials, pref. no.”.

1.4. The programming/reading unit (PRU)

A PRU is a separate unit connected to a PC, which, in conjunction with the IES software, programmes a ballot module for a specific poll or group of polls. It is also used at the count centre to read the votes from each ballot module into the count software.

The PRU has two slots where a ballot module can be inserted, one for programming the module and the other for reading the module. Separate keyswitches (PP and RP) lock the ballot module in these slots. The PP keyswitch locks the programming slot and the RP keyswitch locks the reading slot.

1.5. Ballot modules

Two ballot modules are used in the VM, a primary module and back up module. The primary ballot module, when programmed in the PRU before a poll, contains the following information:

- Poll date, title and all various alphanumeric data that must be printed or displayed.
- Identification information for the ballot module.
- The assignment of preference buttons to the candidates and/or referendum choices on the ballot papers displayed on the VM screen.

The primary module is inserted in the VM in advance of each poll and it is locked in the VM by use of a keyswitch (MS) and a security flap. While storing the first vote cast, the ID of the VM is also stored in the primary ballot module. This ID ensures that this ballot module **cannot** be used in any other voting machine for the poll. In the case of multiple polls, the primary ballot module also stores the number of null votes (see section 1.3.1) cast at each poll. At close of a poll, it also stores the number of times the voting machine is activated and manually de-activated, when a voter does not press the CV button. During the day, this information is stored in the EEPROM in the voting machine.

The back up module is retained permanently under a special cover in the VM, except when the primary module is lost or damaged during transportation from the polling station to the local count centre or if there is a problem with reading the contents of the primary module into the PC at the count centre.

1.5.1. Storing votes in the primary ballot module

The votes are stored randomly as separate preferences in the primary ballot module according as they are cast. Every vote is stored four times, i.e. twice in each of the two redundant E²PROMs in the module. After storing the votes (including, in the case of multiple poll(s), the null votes (see section 1.3.1) cast on the VM), the CU counter of the total number of votes cast at each poll is increased. Every time a vote is stored, the data stored in the primary ballot module is checked fully to ensure that total integrity is maintained.

1.5.2. Storing of the votes in the back up module

After close of poll, the VM is set in the Functions mode. The function “Close polling” (§5.2) writes a code in the primary ballot module and after ensuring that the back-up module is empty, copies the contents of the primary ballot module to the back up ballot module, including the primary module unique ID number and, in the case of multiple poll(s), null votes (see section 1.3.1) stored on the primary module. This data remains in the back up module until deleted in a separate operation after the primary ballot module has been successfully read into the count software at the count centre. Self-checking is built into the VM and, in the event of this procedure not being completed, an error message would be displayed. The VM could not then be used.

1.6. The mechanical protection for ballot module and process

The ESI2 Powervote system has mechanical security measures activated by switches and keys.

	Protection name		Key number
Control Unit	Function switch	FS	126 (Red)
Voting machine	Module switch	MS	126 (Red)
Programming/reading unit	Programming slot	PP	348 (Black)
	Reading slot	RP	126 (Red)

In combination with the function button, the FS keyswitch on the CU is used to set the VM in several modes. The MS keyswitch is used to mechanically lock the primary ballot module in place and prevent its withdrawal from the machine. The switch must be turned to the locked position to complete the electrical circuit that enables the VM to start up. Similarly, switches PP and RP in the PRU must be turned to the locked position to enable the PRU to start up.

The action of opening any of the locks (MS, PP, RP) breaks the electrical circuit to the VM or PRU.

1.6.1. Other security features

With key 1D14 on the front of the voters panel it is possible to lock the ballot papers. It is not possible for any voter to change the ballot papers.

Internal security measures in the machine are referred to in sections 1.5.1, 1.5.2, 1.7, 2.2.1, 3.1, 5.2, 5.2.2, 7.3, 7.3.1 and 8

1.7. Identification numbers

Every VM, PRU and primary ballot module has its own unique Nedap identification number.

When the first vote cast on a VM at a poll is stored in the primary ballot module, the ID of the VM is also stored in that module. With this information it is always possible to identify the VM where a ballot module was used on the day of the poll. Storing the ID of the VM ensures that the primary ballot module cannot be used in any other VM during election day. In the functions mode a print out can be made showing details of last 3 primary ballot modules used in the voting machine.

When a ballot module is inserted in the PRU for reading in after polling, the PRU checks its ID to ensure that the contents of that module have not already been read into the IES software. In such circumstances, a prompt appears ‘module has already been read in – do you want to repeat?’

The identification numbers of the VMs, the primary ballot modules and the PRUs are made up as follows:

- First character is the year of production. ‘A’ = 1988, ‘N’ = 2001.
- Second character is the month of production. ‘1’ = January, ‘9’ = September, ‘O’ = October, ‘N’ = November, ‘D’ = December.
- The third character stands for the Nedap country code. For Ireland these are as follows, ballot module = C, voting machine = D, PRU = E.
- The next five characters are the serial number and must be numerical.

An example of an ID for the primary ballot module is “N2C00001”. This module is produced in February 2001 and used in Ireland.

Note: The back up module does not have an ID number as it assumes the ID of the primary ballot module at the close of poll when the contents of the primary module are copied to it.

1.8. Technical data

Description	
Maximum number of preferences a ballot module can store	Approximately 28000
Maximum number of polls on a machine	5
Maximum number of candidates at a single poll for which a VM is used	90
Maximum number of preferences a voter can record on all polls on the VM	90

1.8.1. Data

The maximum number of preferences that a ballot module can store is approximately 28,000. The maximum number of preferences that a voter can record on the VM screen is 90 (i.e. five columns of preferences with 18 preferences in each column). Thus, if there are five elections and each voter records a preference for every candidate, the maximum number of voters a ballot module can cater for is approximately 300. Thus, if the poll is open for twelve hours and each voter records a preference for every option, each voter has less than three minutes to vote on the machine.

The number of voters a ballot module can cater for is dependent on the number of preferences each voter records. A rule of thumb for the number of voters a ballot module can cater for is as follows - maximum number of preferences that a ballot module can store (i.e. 28,000), divided by the average number of preferences a voter records. Thus, if each voter records 50 preferences, the ballot module can cater for about 560 voters and each voter has just over one minute at the VM, assuming a polling period of twelve hours. Similarly, if each voter records 30 preferences, the ballot module can cater for about 930 voters and each voter has just over half a minute at the VM.

The maximum number of polls that can be held on a VM is five. More than one poll relating to the same category of electors can be placed in a single column on the screen, subject to the limit of 20 rows available in any column i.e. 18 rows for candidate details and/or referendum choices and 2 rows for title of poll. The maximum size of a poll that a VM can cater for is one with 90 candidates, spread over five columns.

2. Operation mode

2.1. Overview of operating functions

The VM can be placed in 4 different modes, depending on the position of the function switch on the CU and the service switch on the main electronic board in the VM.

- Pre-Voting mode is set automatically when the self-test of the VM is satisfactorily completed following the start-up of the VM with the function switch in the “1” position. The VM is inactive in this mode. This mode is described in section 3.
- The VM is switched from Pre-Voting mode to Voting mode by turning the keylock functions switch on the CU 90 degrees clockwise to position 2. This mode is described in section 4.
- The VM is switched from Pre-Voting mode to Functions mode by pressing the function button and turning the function switch on the CU 90 degrees clockwise to position 2 at the same time. In this mode the machine and the programming of the ballot module can be tested. This mode is described in section 5.
- Service mode is activated if the service switch on the main electronic board is turned manually to the service position (only to be carried out by service personnel) or if a ballot module with a special service ID is inserted in the VM. In this mode the parameters of the machine can be changed. This mode is described in section 6.

2.2. Different operating phases of the VM ESI2

2.2.1. Opening of Poll

The opened VM forms the voting compartment and uses 230V AC from the main power. The ballot module is locked in the VM by the MS keyswitch and the covering flap is sealed.

- At start-up (i.e. after connection to power), the VM performs a number of automatic tests, which are described in section 8.
- After the VM has completed its start up phase it automatically sets in Pre-Voting mode. It can be switched to Functions mode to execute tests other than those carried out automatically on start up.

One of the automatic start-up tests is an integrity test of the primary ballot module in the VM. If there is an error, it will be displayed on the display unit and the VM will not continue. If the test results are satisfactory for the primary ballot module, information about the poll is displayed. All information programmed, like the position and names of the candidates, poll information and programme information can be viewed in Functions mode either via display or on a printout. If all self-tests are completed satisfactorily, the VM is set in Pre-Voting mode. The actual preparation for the poll is now complete.

Some general points:

- The contents of the primary ballot module can **never** be deleted in the VM.
- The primary ballot module contents can only be deleted and provided with new information for another poll when it is placed in the programming slot of the PRU.

2.2.2. Voting

When the VM is in Pre-Voting mode, polling staff can switch it to Voting mode via the CU by first turning the keylock function switch 90 degrees clockwise to position 2 i.e. standby position and then pressing one of the buttons labelled P, D, E or L to “open” position to specify which polls should be activated on the VM screen for the next voter. In Voting mode, the CU displays, for every poll on the VM, its title, mode and the number of votes cast (including, in the case of multiple polls, null votes (see section 1.3.1)). The voter can record preferences for candidates/referendum choices with a touch of the finger on the preference button adjacent to the candidates/referendum details. The chosen option is also displayed on the bottom line of the voter’s display with a maximum of 40 characters.

A voter who makes a mistake or wants to correct a preference he/she has already recorded can press the button adjacent to that preference a second time. This deletes the preference in question and all subsequent preferences that the voter has recorded for that poll. The voter can then either re-record preferences from this point or record no further preferences for that election.

After recording his/her preferences, the voter must press the CV button to store his/her vote(s) in the ballot module.

In order to guard against a voter inadvertently casting a vote before recording his/her preferences, the CV button does not become active on the machine until at least one preference has been recorded.

Where a voter entitled to vote at more than one poll presses the CV button without recording at least one preference at each poll open on the machine, the machine advises the voter accordingly with a text message which flashes 3 times on the screen and with a distinctive audible bleep. The voter then has the option of:

- EITHER recording a preference(s) on the ballot paper(s) on which no preference is recorded and pressing the CV button again,
- OR pressing the CV button again without recording preferences at all polls open on the machine. In this case, in addition to storing the votes recorded by the voter, the machine will store a “null” vote (see section 1.3.1) for each open poll at which no preference was recorded.

If the voter leaves the VM without pressing the CV button, the polling staff must de-activate the VM by turning the keyswitch on the CU. In such a situation, no vote(s) is/are stored in the primary ballot module, even if the voter recorded a preference(s) before leaving the machine. The number of such de-activations is recorded in the system and will be included on the printed statement at close of polling and in the result sheet at the end of the vote counting.

The sequence for the voter at the VM is very similar to using a ballot paper and pencil:

Action	Existing procedure	Voting machine
1.	Receive ballot paper from presiding officer.	Receive permit ticket from presiding officer and present it to CU controller who activates on the VM screen those ballot papers on which the voter is entitled to vote.
2.	Go to compartment.	Go to voting machine.
3.	View ballot paper(s).	View ballot paper(s).
4.	Mark preferences with pencil.	Touch preference buttons with finger.
5.	Obtain replacement ballot paper(s) if accidentally spoiled.	Review recorded preferences and change them, if desired.
6.	Bring paper(s) to ballot box.	Not applicable
7.	Confirm vote by placing ballot paper(s) in ballot box.	Press CV button.

2.2.3. Close of Poll

After close of poll, the integral printer in the VM prints the total number of electors who were permitted to use the VM (number of activations), the number of votes cast at each poll on the machine (including, in the case of multiple polls, the number of null votes (see section 1.3.1) cast at each poll), and number of de-activations where the CV button is not pressed, plus other statutory information.

The primary ballot module is blocked by the voting machine software at the close of poll so that it is not possible to store more votes in it. The contents are copied to the backup module retained in the VM. The primary module is removed from the VM and transported to the count centre for reading into a PC via the PRU. The IES software programme on the PC will complete all necessary functions to determine the results of the poll. The contents of the primary modules can be deleted subsequently (after six months) in a separate operation by placing them in turn in the programming slot in the PRU. The contents of the back-up module can be deleted on return of the voting machine to the returning officer if not required.

The determination of the poll result is described in the Election Management System (EMS) Manual.

2.3. Service measurements

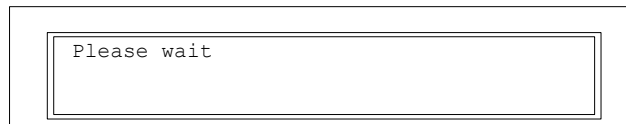
At Nedap, a special ballot module can be programmed, which automatically sets the VM in the Service mode when inserted in the VM. These ballot modules have a special ID and a special colour to identify them. This mode can also be set if the service switch on the main electronic board is turned manually to the service position (this should only be carried out by authorised, trained service personnel!). A full description is provided in section 6.

3. Pre-Voting mode

3.1. Starting up the VM

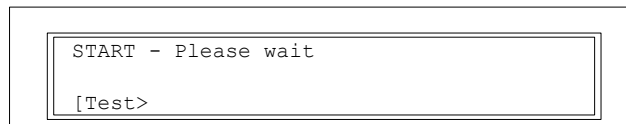
Connect VM to power source.

The following display will be shown on the VM at start up:



VD_S_99

And this display will be shown on the CU:

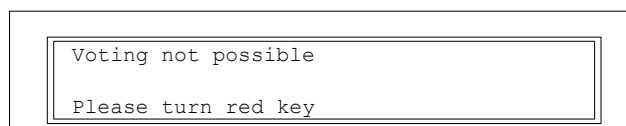


CD_S_99

In CD_S_99:

- The display [Test> = "Currently testing ballot modules" is displayed while the contents of the primary ballot module and the existence of the back-up module are tested.
- The display [Test> = "Currently testing the checksum" is displayed while the two EPROMs containing the programme are checked.

If the CU keyswitch is in the wrong position after testing the checksum, the following display will be shown:



CD_S_98h

Turning the red keyswitch 90 degrees anti-clockwise to position 1 resolves this situation.

3.2. Self-testing complete

When the self-testing of the machine is complete, the machine sets itself in Pre-Voting mode.

Depending on the circumstances, the **VM voters display** will show one of the following displays:

```
Machine ID: [wwwwww] Date: [Datedate]
Module ID: [mmmmmm] Poll.St.: <PollS.]
Votes cast: <Na] <Nb] <Nc] <Nd] <Ne]
On standby
```

VD_S_1

```
Machine ID: [wwwwww] Date: [Datedate]
Module ID: [mmmmmm] Poll.St.: <PollS.]
Votes cast: <Na] <Nb] <Nc] <Nd] <Ne]
The poll has closed
```

VD_S_2

```
Machine ID: [wwwwww]
No module present
```

VD_S_3

```
Machine ID: [wwwwww]
Ballot module not programmed
```

VD_S_4

```
Machine ID: [wwwwww]
Ballot module is blocked
```

VD_S_5

```
Machine ID: [wwwwww]
Module belongs to machine ID: [wwwwww]
```

VD_S_6

```
Machine ID: [wwwwww]
Error <eee]
```

VD_S_7

```
Machine ID: [wwwww]
No back up module present
```

VD_S_8

Depending on the circumstances, the **CU display** will show one of the following displays:

```
Turn key
[Eleca> [Elecb> [Elecc> [Elecd> [Elece>
[St. a> [St. b> [St. c> [St. d> [St. e>
<Na] <Nb] <Nc] <Nd] <Ne]
```

CD_S_1

```
The poll has closed
[Eleca> [Elecb> [Elecc> [Elecd> [Elece>
[St. a> [St. b> [St. c> [St. d> [St. e>
<Na] <Nb] <Nc] <Nd] <Ne]
```

CD_S_2

```
No ballot module present
```

CD_S_3

```
Ballot module not programmed
```

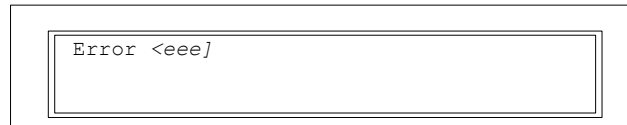
CD_S_4

```
Ballot module is blocked
```

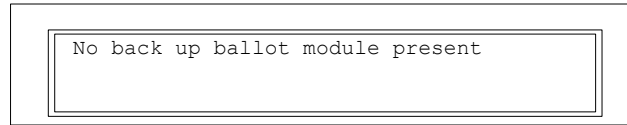
CD_S_5

```
Module belongs to machine ID: [wwwww]
[Eleca> [Elecb> [Elecc> [Elecd> [Elece>
[St. a> [St. b> [St. c> [St. d> [St. e>
<Na] <Nb] <Nc] <Nd] <Ne]
```

CD_S_6



CD_S_7



CD_S_8

Expressions in displays VD_S and CD_S have the following meanings:

- [wwwwww] = ID of the VM.
- [mmmmm] = ID of the ballot module.
- [Datedate] = Day, month and year of the poll e.g. "05.01.2001"
- <PollS.] = Polling station number where the poll is held.
- [Eleca> to [Elece> = Names of the polls held at the same time. If there are less than five polls held there would be blanks from right to left.
- [St. a> to [St. e> = Mode of each poll.
- <Na] to <Ne] = For each poll, number of votes cast on machine (including, in the case of multiple polls, null votes(see section 1.3.1)).
- <eee] = Errorcode.

4. Voting mode

The VM is switched from Pre-Voting mode to Voting mode at the CU by turning the keylock switch 90 degrees clockwise to position 2. When turning the keyswitch, the function button on the CU should NOT be pressed.

4.1. A poll

There are four submodes in the Voting mode, as follows:

- Awaiting activation for voting
- Open position (Recording preferences)
- Votes cast
- Storing votes

When the VM is switched at the CU to the Voting mode, it automatically goes into the “Awaiting activation for voting” submode. The VM is advanced to the open position (Recording preferences) submode by activating the VM for the individual voter at the CU. This is done by pressing on the CU the appropriate button from among buttons P, D, E or L (these specify which poll(s) should be activated on the VM screen for next voter).

The activation of the VM for voting is visible to the voter from the lighting up of the LED at the head of each LED-display preference column relating to a ballot paper(s) on which the voter is eligible to vote. In addition, the LED-display opposite each active preference button on the VM screen displays two horizontal bars to denote that they are active. There will also be appropriate text in the voter’s display.

In order to guard against a voter inadvertently casting a vote before recording his/her preferences, the CV button does not become active on the machine until at least one preference has been recorded.

When the voter presses a preference button, the number of that preference (or “X” in the case of a referendum) is shown on the adjacent LED-display. The bottom line in the VM display will also display the following information “Election, candidate surname, first initial, political party initials, pref No.”. There is no requirement to record a preference for every option on the screen and no specified order for recording preferences in the polls, i.e. the voter can switch from one poll to another at any stage and the VM will still display the correct order of selected preferences on each ballot paper.

When the voter has recorded all the preferences he/she wishes, he/she can amend a preference already selected by pressing again on the preference button concerned. This deletes that preference and all subsequent preferences recorded at that poll only. The voter can then, if he/she wishes, record further preferences on the ballot paper concerned.

If a voter records a preference for every option on all active ballot papers, the machine automatically goes into the Vote Cast sub mode and the CV button flashes to attract the voter’s attention.

When the voter is satisfied with the recorded preference(s), he/she must press the CV button to cast his/her vote(s). The VM goes to the third/fourth submode “Storing votes” in which all preferences recorded by the voter on all activated ballot papers are stored in the primary ballot module.

Where a voter entitled to vote at more than one poll presses the CV button without recording at least one preference at each poll activated on the machine, a message in the voters display advises the voter accordingly by an audible bleep and by flashing 3 times. The voter then has the option of

- either recording a preference(s) on the ballot paper(s) he/she has not recorded a preference and pressing the CV button again,
- or pressing the CV button again without recording preferences at all polls activated on the machine. In this case, in addition to storing the votes recorded by the voter, the machine will store a “null” vote (see section 1.3.1) for each open poll at which no preference was recorded.

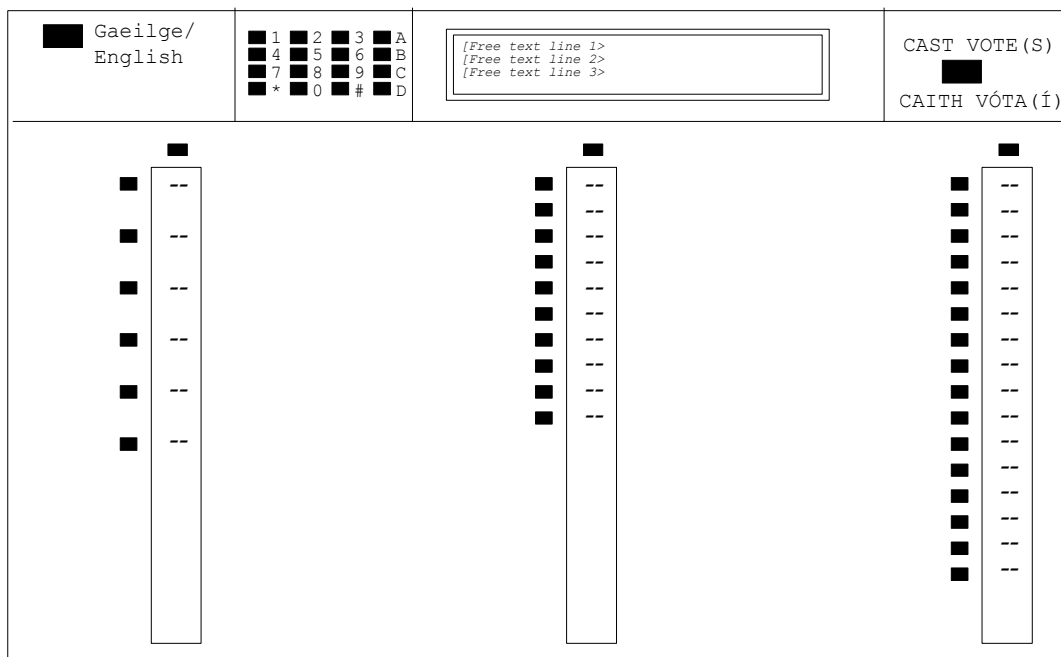
If a voter leaves the machine without pressing the CV button, the machine is deactivated by the polling station staff by turning the keyswitch on the CU to position 1. No votes or null votes are stored in such cases even if the voter recorded preference(s) before leaving the machine. The system records the number of such de-activations.

4.1.1. Examples of an election

4.1.1.1. Voter’s panel

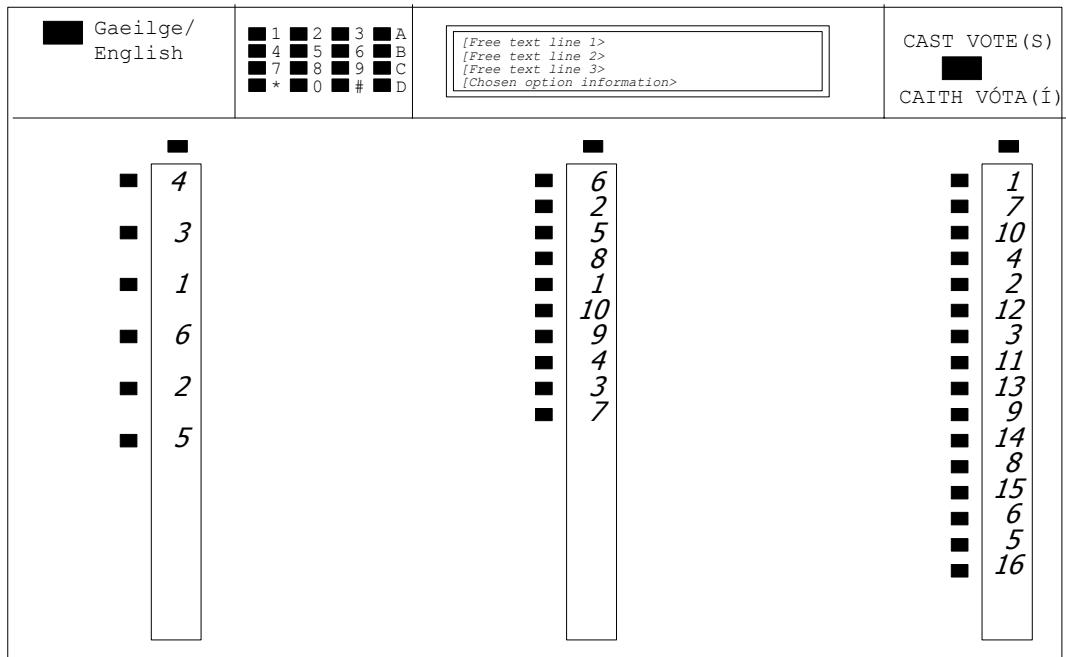
Some examples of the VM voter’s panel follow with a short description below each panel.

The keypad and buttons A to D are covered and inactive when voters are voting on the VM.



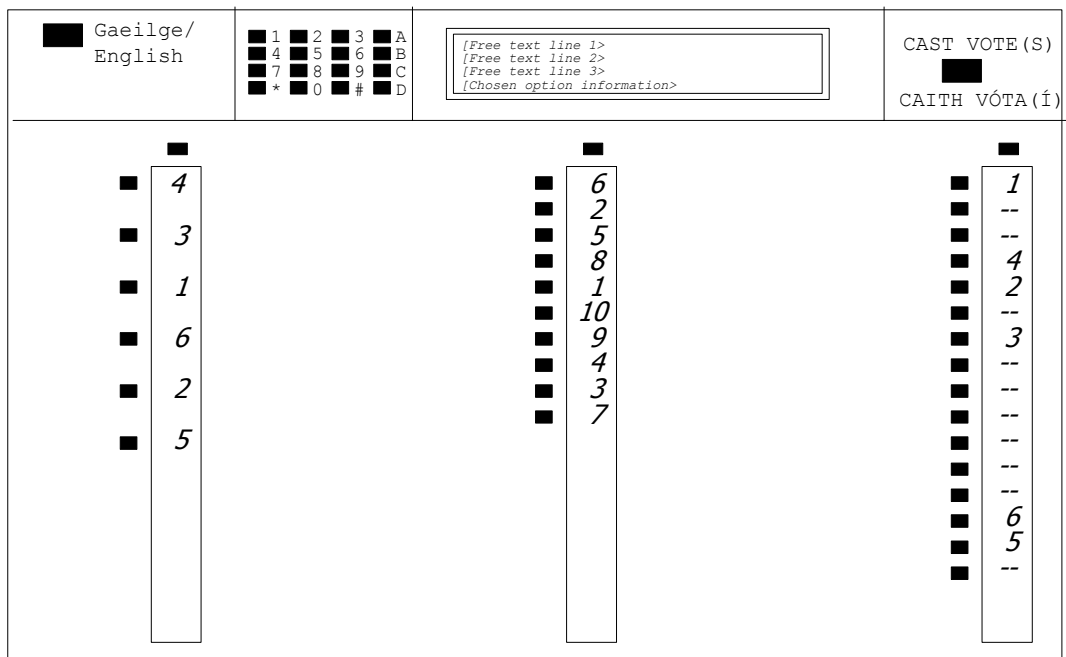
VP_V_1

The voter’s panel shows three ballot papers, which are all activated for the voter currently at the machine. The first ballot paper has six candidates, the second has ten candidates and the third has sixteen candidates. In the LED-display adjacent to each set of candidates details two horizontal bars are lighting to indicate that this ballot paper is activated. In addition, an LED is lit at the top of each column of active LED-displays.



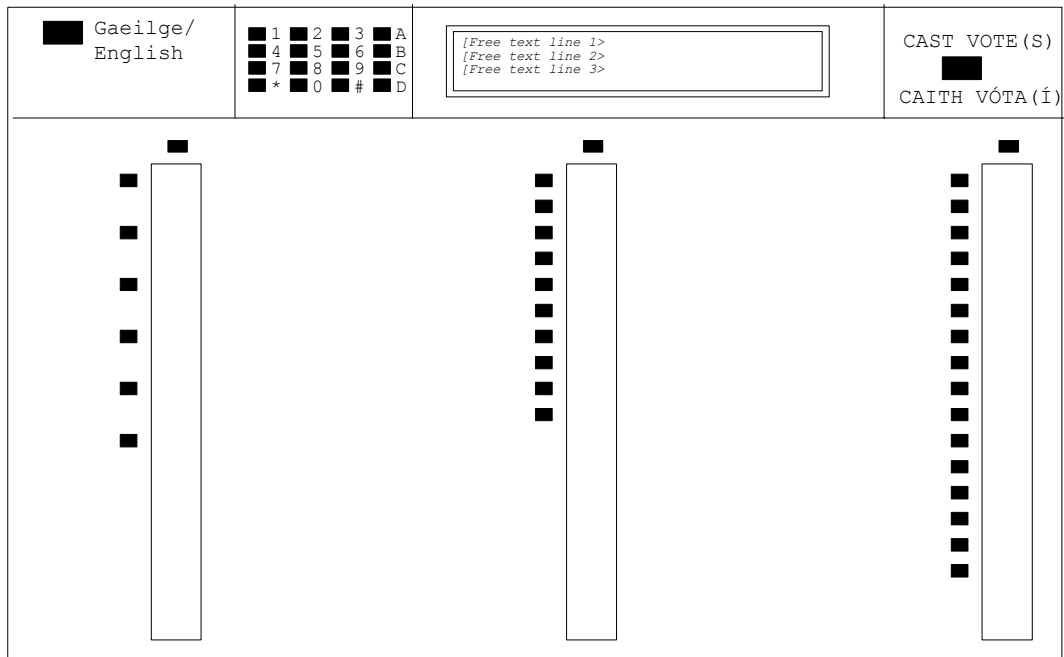
VP_V_4

Preferences have been recorded for all options on every ballot paper activated on the screen. The text on the first three lines on the voters display and the CV button are both blinking ten times to get the attention of the voter to press the CV button.



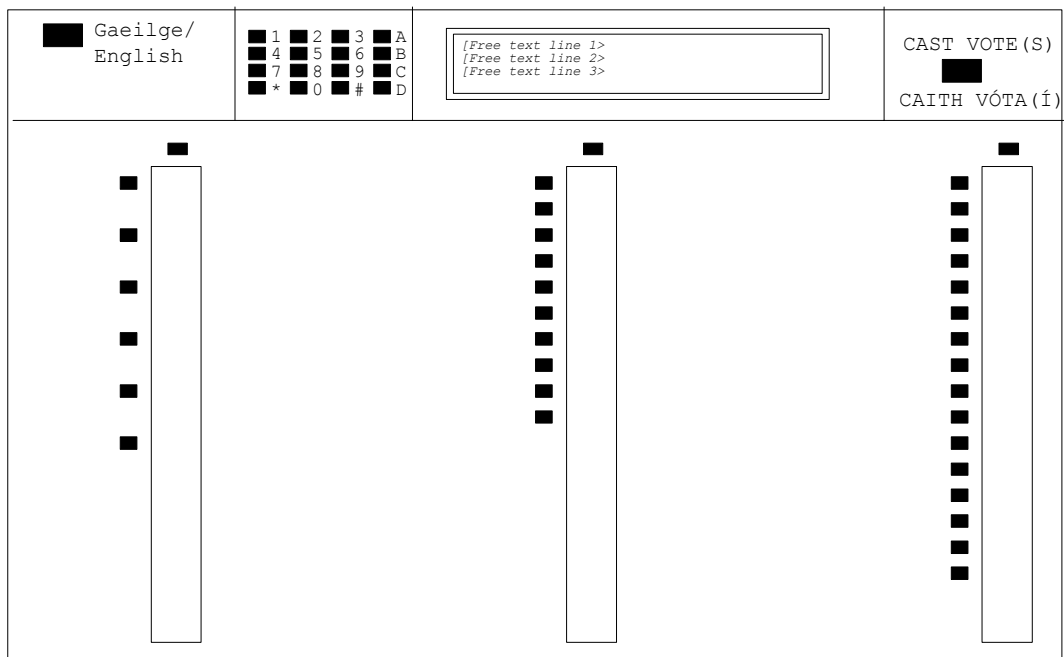
VP_V_5

The voter has amended his/her preferences at the third poll by pressing for a second time the preference button adjacent to the LED-display showing 7 on the third ballot paper.



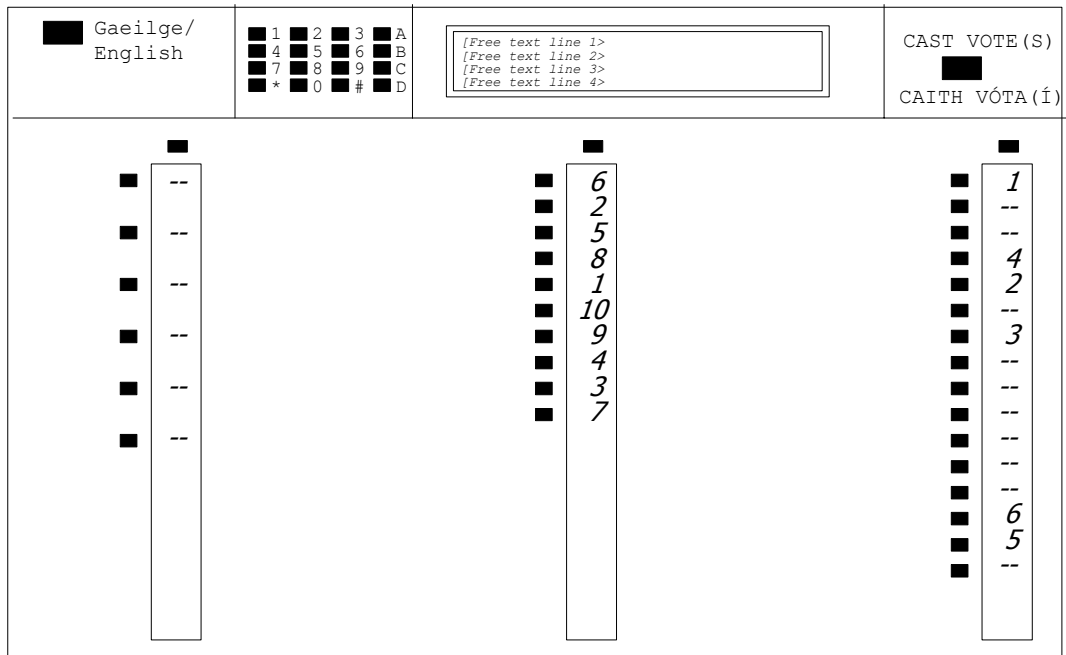
VP_V_6

The voter has pressed the CV button and his/her vote(s) are being stored in the primary ballot module. The backlighting is switched off in the voter's display, together with the lighting in all LED-display columns and the LEDs at the head of these columns.



VP_V_7

After the votes have been stored in the primary ballot module, the backlight of the voter's panel goes on and the voter can leave the voting compartment. No further voting is possible until the CU controller activates the ballot paper(s) on the VM for the next voter arriving at the CU.



VP_V_8

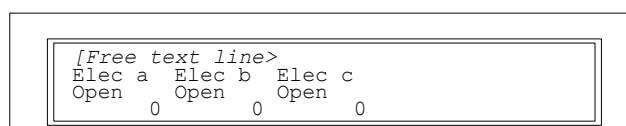
The voter has pressed the CV button in a multiple polls situation but has not recorded any preference on one or more ballot papers activated on the screen. The text in the display will blink three times to get the attention of the voter and the audio signal after pressing the CV button is longer. The voter has the option of recording preferences on the ballot paper(s) that he/she has not recorded a preference or of pressing the CV button again in which case the votes are stored in the primary ballot module, including a null vote for those polls activated on the screen in respect of which no preferences were recorded.

The expressions in the above displays have the following meanings:

- [Free text line x> = Three lines of free text to program in the ballot module for the specific states.
- [Chosen option information> = Information of the last chosen option. The layout will be as follows: [Pl] [Surname In.] [Pt] Pref:[Nr]
 - [Pl] = Maximum of 4 characters for a poll title
 - [Surname In.] = Maximum of 17 characters for the surname, followed by a maximum of 4 characters for the initials
 - [Pt] = Maximum of 4 characters for a party shortname
 - [Nr] = 2 characters for the number of preference

4.1.1.2. Control Unit display

The corresponding displays on the CU are illustrated as follows:



CD_V_1, CD_V_2, CD_V_3, CD_V_4, CD_V_5, CD_V_8

In this example the displays shows 3 polls are open. The display is the same for the submodes i.e. prior to storing votes. If 5 polls were open then these would be displayed.

- [Free text line> = One line of free text to program in the ballot module for this specific state.

```

[Free text line>
Elec a   Elec b   Elec c
Store  0   Store  0   Store  0

```

CD_V_6a

After the voter presses the CV button (or, in the case of multiple polls where he/she has not cast any preference on one or more ballot papers activated on the screen, after the voter presses the CV button a second time), the backlight of the CU display goes out and the VM stores the votes.

- [Free text line> = One line of free text to program in the ballot module for this specific state.

```

[Free text line>
Elec a   Elec b   Elec c
Check  0   Check  0   Check  0

```

CD_V_6b

When the voter's preferences are stored and checked, the voter can leave the voting compartment. Directly afterwards, the VM checks that all the votes are stored and the polling station staff member will see this on the display. If all votes are validated correctly, the next display will appear.

- [Free text line> = One line of free text to program in the ballot module for this specific state.

```

[Free text line>
Elec a   Elec b   Elec c
Standby 1   Standby 1   Standby 1

```

CD_V_7

For each poll activated for the voter whose vote(s) has/have just been stored, the figure in the fourth row of the above display is increased by one (i.e. it includes, in the case of multiple polls where the voter did not record any preference for one or more polls, null votes (see section 1.3.1)).

- [Free text line> = One line of free text to program in the ballot module for this specific state.

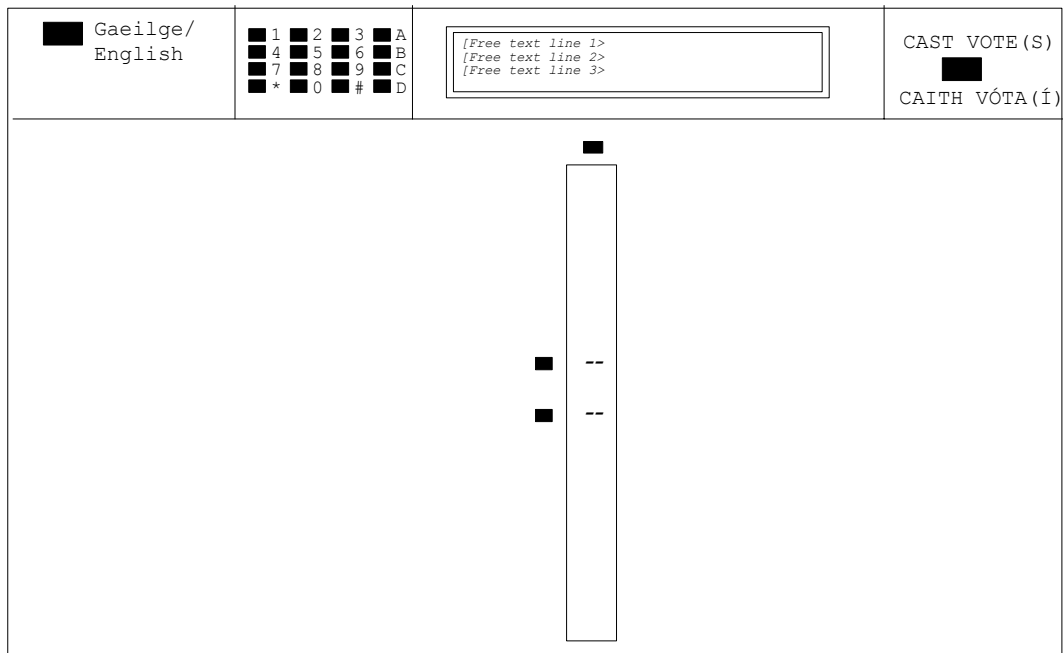
4.2. A referendum

A poll at a referendum is the same as at an election except that the preference to be recorded is either yes or no. When the preference button concerned is pressed, an 'X' will appear in the LED-display adjacent to that button and the chosen option is displayed on the bottom line of the voters display with a maximum of 40 characters. A voter can change the recorded preference either by pressing the related preference button a second time (thus cancelling that preference) or by pressing the preference button adjacent to the other option for that referendum.

4.2.1. Examples of a referendum

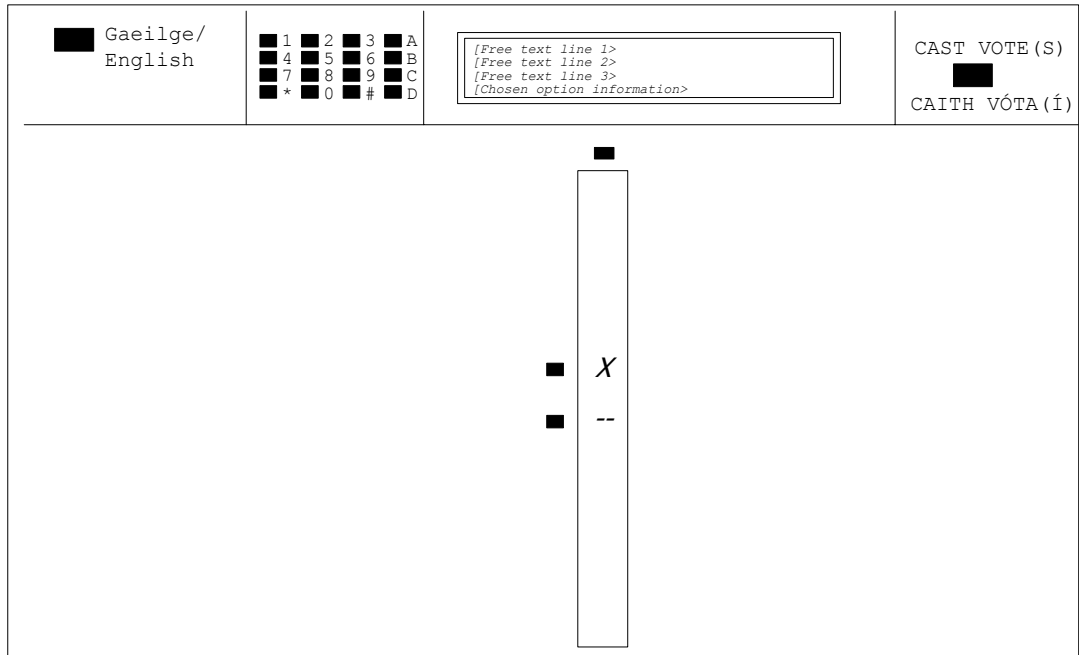
4.2.1.1. Voters panel

The sequence of the voter's panel is shown with a short description. The keypad and buttons A to D are covered and inactive when voters are voting on the VM. Up to 5 referendums can be held at the same time.



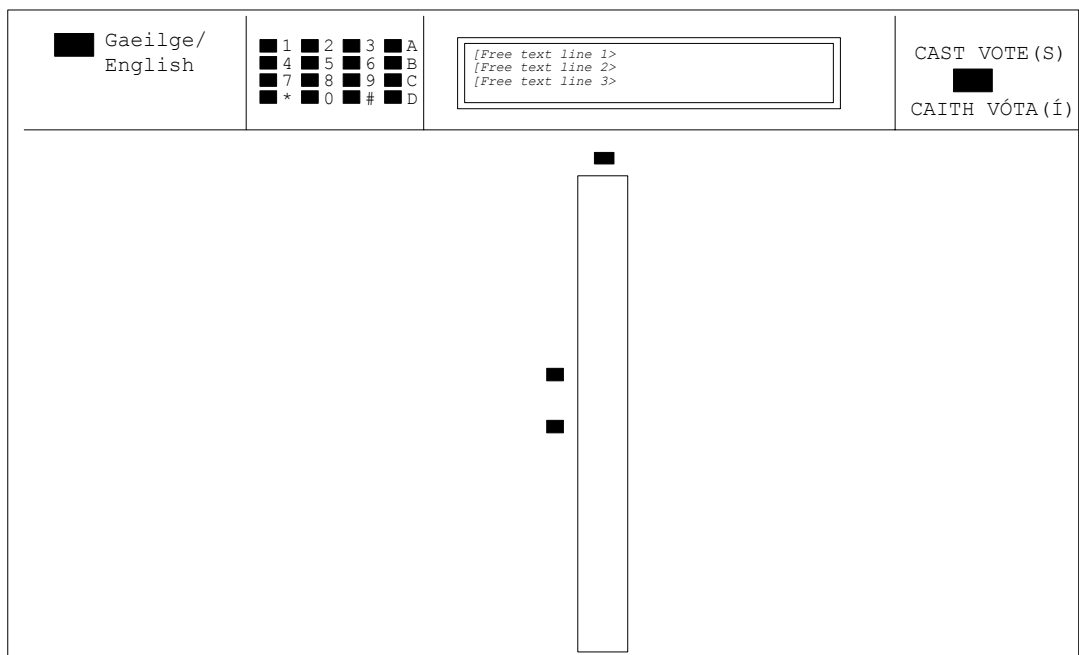
VP_R_1

The voters panel shows one referendum, which is activated. One of two options must be chosen. Two visible horizontal bars in the LED-display indicate that this referendum is activated. The LED at the head of the LED-display column will light if the referendum relating to that column is active.



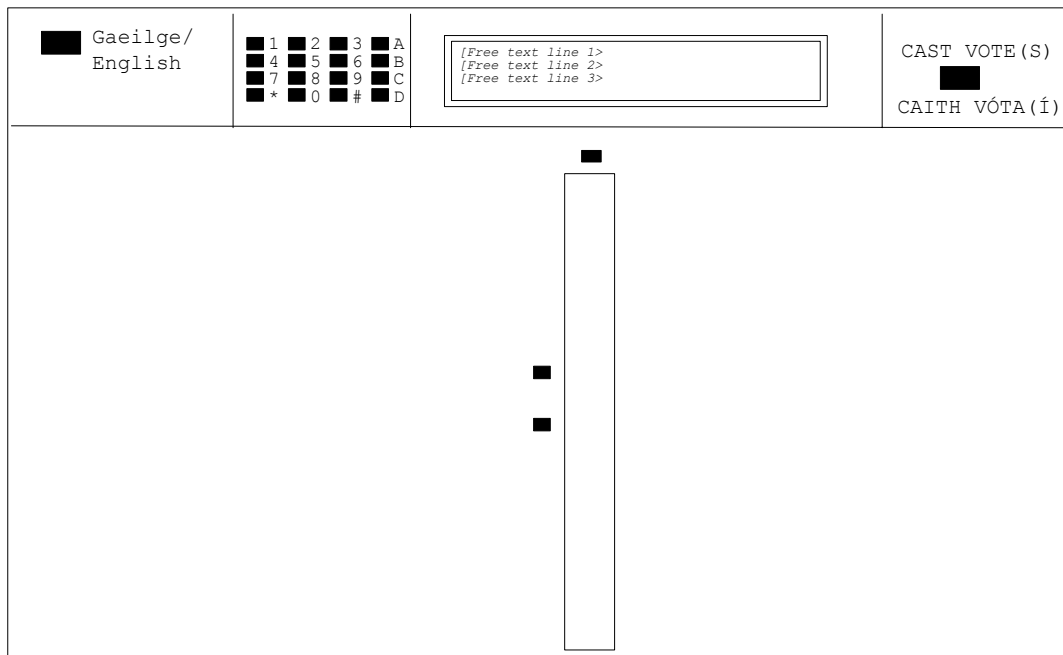
VP_R_2

The voter has made a choice. The text on the first three lines on the voters display and the CV button are both blinking ten times to get the attention of the voter to press the CV button.



VP_R_3

The voter has pressed the CV button and his/her vote is being stored in the primary ballot module. The backlighting is switched off in the voters display, together with the lighting in the LED-display column and the LED at the head of this column.



VP_R_4

After storing the vote, the backlight of the voter's display goes on and the voter can leave the voting compartment. No further voting is possible until the CU controller activates the machine for the next voter arriving at the CU.

The expressions in the above displays have the following meanings:

- [Free text line x> = Three lines of free text to program in the ballot module for the specific states.
- [Chosen option information> = Information of the last chosen option. The layout will be as follows: [Pl] [No] Preference:[Ra]
 - [Pl] = Maximum of 4 characters for a referendum title
 - [No] = Maximum of 4 characters for the referendum number
 - [Ra] = Maximum of 4 characters for the answer of the referendum

4.2.1.2. Control Unit display

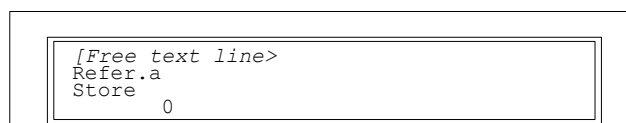
The corresponding displays on the CU are illustrated as follows:



CD_R_1, CD_R_2

The displays for the first two submodes are the same i.e. prior to the voter pressing the CV button.

- [Free text line> = One line of free text to program in the ballot module for this specific state.



CD_R_3a

After the voter presses the CV button to cast vote, the backlight of the display goes out and the VM stores the vote.

- [Free text line> = One line of free text to program in the ballot module for this specific state.

```
[Free text line>
Refer.a
Check 0
```

CD_R_3b

When the vote is stored and checked, the voter can leave the voting compartment. Directly afterwards, the VM checks that all the votes are stored and the polling station staff member will see this on the display. If all votes are validated correctly, the next display will appear.

- [Free text line> = One line of free text to program in the ballot module for this specific state.

```
[Free text line>
Refer.a
Standby 1
```

CD_R_4

The counter is increased by one for the referendum voted on.

- [Free text line> = One line of free text to program in the ballot module for this specific state.

4.3. Voting not possible

The VM is switched from Pre-Voting mode to Voting mode at the CU by turning the keylock switch 90 degrees clockwise to position 2 and if voting is not possible, the next display is shown:

```
Voting impossible
```

VD_O_1

On the display of the CU one of the next messages can appear:

```
ERROR <eee>
[Eleca> [Elecb> [Elecc> [Elecd> [Elece>
[St. a] [St. b] [St. c] [St. d] [St. e]
<Na> <Nb> <Nc> <Nd> <Ne>
```

CD_O_1

```
No module present
```

CD_O_2

```
Ballot module is blocked
```

CD_O_3

```
No back up ballot module present
```

CD_O_4

```
The poll has closed
```

CD_O_5

```
Module belongs to machine ID: [wwwww]
[Eleca> [Elecb> [Elecc> [Elecd> [Elece>
[St. a> [St. b> [St. c> [St. d> [St. e>
<Na] <Nb] <Nc] <Nd] <Ne]
```

CD_O_6

If the VM is in Voting mode and, after opening the poll(s), the program determines that the ballot module is full, the next displays are shown on the VM and the CU:

```
Voting impossible
```

VD_V_0

```
Ballot module full, voting not possible
[Eleca> [Elecb> [Elecc> [Elecd> [Elece>
[St. a> [St. b> [St. c> [St. d> [St. e>
<Na] <Nb] <Nc] <Nd] <Ne]
```

CD_V_0

The expressions in the displays have the following meanings:

- <eee] = Errorcode.
- [wwwww] = ID of the VM.
- [Eleca> to [Elece> = Names of the polls held at the same time. If there are less than five polls held there will be blanks from right to left.
- [St. a> to [St. e> = Mode of the election.
- <Na] to <Ne] = Number of votes cast on the machine at this poll including, in the case of multiple polls, the number of null votes (see section 1.3.1).

5. Functions mode

The VM is switched from Pre-Voting mode to Functions mode at the CU by turning the keyswitch 90 degrees clockwise to position 2 and pressing functions button ‘F’ at the same time.

The CU shows the following display as long as the VM is in Functions mode:

```

FUNCTIONS Turn red key to exit Functions
[Eleca> [Elecb> [Elecc> [Elecd> [Elece>
[St. a> [St. b> [St. c> [St. d> [St. e>
<Na] <Nb] <Nc] <Nd] <Ne]

```

CD_F

When the VM is switched to Functions mode, the VM voter’s display shows the main Functions menu, as follows:

```

<A OPEN POLL
<B CLOSE POLL
<C TEST VOTING MACHINE
<D ABOUT VOTING MACHINE

```

VD_F

By pressing the relevant button on the keypad under the protective cover to the left of the voter’s panel (see section 1.3.2), the VM will switch to one of the following functions:

- A...Open poll (§5.1)
- B...Close poll (§5.2)
- C...Test the VM (§5.3)
- D...About the VM (§5.4)

5.1. Open poll

When the VM is in Functions mode and button “A” is pressed on the VM keypad, the voter’s display shows the following “Open poll” menu if the VM detects a programmed ballot module:

```

<A PRINT OPEN POLL STATEMENT
<B SHOW OPEN POLL STATEMENT ON DISPLAY
<D BACK

```

VD_F_2a

With this function it is possible to compare the contents of the ballot module to the positioning and naming on the screen ballot paper of the candidates/referendum choices. This enables the assignment of individual preference buttons on the voter’s panel to particular candidates or referendum choices to be verified. See statement on page 33.

The user has the following options:

- PRINT OPEN POLL STATEMENT. The layout of the voter's panel and some other data regarding the poll is printed on paper (§5.1.1)
- SHOW OPEN POLL STATEMENT ON DISPLAY. The layout of the voter's panel is displayed on the voter's display (§5.1.2)
- BACK. The VM exits the "Open poll" function and returns to the main Functions menu (§5)

When the VM is in the Functions mode and button "A" is pressed on the VM keypad, the voter's display shows the following display if no ballot module is present in the VM:

```
OPEN POLL
No ballot module present or it has not
been programmed correctly
<D BACK
```

VD_F_2b

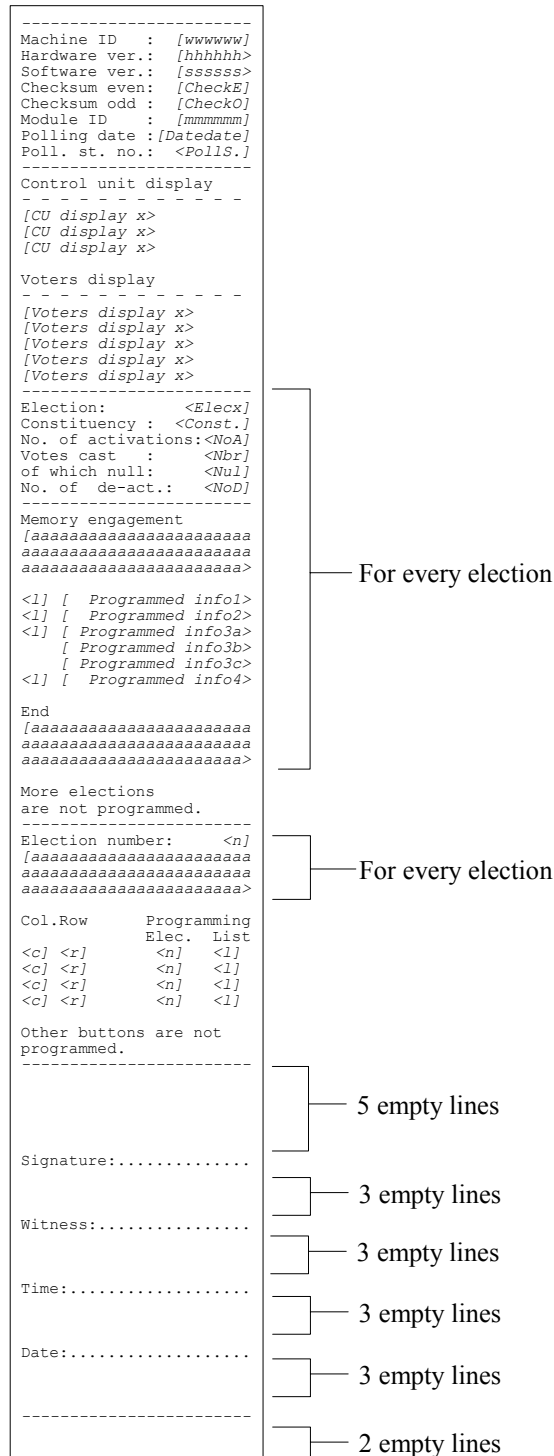
5.1.1. Print open poll statement

When this function is activated from the "Open poll" menu, the voter's display shows the following:

```
PRINT OPEN POLL STATEMENT
Printing open poll statement
<D STOP
```

VD_F_2_1

The layout of the printed statement of the “programming” material looks as follows:



Expressions in the printout have the following meanings:

- [wwwwww] = ID of the VM
- [hhhhh]> = Hardware version of the VM in E²PROM, e.g. 02.00
- [sssss]> = Software version of the program in EPROM, e.g. 01.00
- [CheckE] = Checksum of the software in the even EPROM, e.g. 0012EF34

- [CheckO] = Checksum of the software in the odd EPROM, e.g. 0065BA93
- [mmmmmm] = Ballot module ID
- [Datedate] = Date of the poll, e.g. 03.11.2001
- <PollS.] = Polling station number were the poll(s) is/are being taken
- [CU display x> = Display lines on the CU
- [Voters display x> = Display lines on the VD
- <Elecx] = Name of the poll
- <Const.] = Name of the constituency
- <NoA] = Number of activations
- <Nbr] = Total number of votes cast on the machine at this poll (including, in the case of multiple polls, the number of null votes (see section 1.3.1))
- <Nul] = Number of null votes (see section 1.3.1) stored for this poll
- <NoD] = Number of de-activations
- [aa..aa> = String printed for current poll, maximum 72 characters
- [Programmed infox> = Candidates details, listed in ballot paper order of candidates, or referendum choices
- <c] = Column number of the preference button
- <r] = Row number of the preference button
- <n] = Poll number
- <l] = Number of the candidate/referendum choice assigned to the specified preference button

If button “D” (“STOP”) is pressed, the printing process is cancelled and the VM returns to the “Open poll” menu (§5.1). When the printing cycle is completed the VM automatically returns to the “Open poll” menu.

5.1.2. Show open poll statement on display

When this function is activated from the “Open poll” menu, when the printer is not functioning, the following display is shown:

```

SHOW OPEN POLL STATEMENT ON DISPLAY
Press a button to check its programming
<D BACK

```

VD_F_2_2a

If a button is pressed which is programmed, the following display is shown:

```

PROGRAMMING  BUTON: Col.:<c] Row:<r] >
[Programmed information a >
[Programmed information b >
<D BACK      Election: [n] List:<l] >

```

VD_F_2_2b

If a button is pressed which is not programmed, the following display is shown:

```

PROGRAMMING  BUTTON: Col.:<c] Row:<r]
Button has not been programmed
<D BACK

```

VD_F_2_2c

Expressions in the displays VD_F_2_2a, VD_F_2_2b and VD_F_2_2c have the following meanings:

- <c] = Column number of the button pressed
- <r] = Row number of the button pressed
- [Programmed information a], [Programmed information b] = Information programmed in the ballot module for the button pressed, maximum 80 characters
- [n] = Poll number of the button pressed
- <l] = Button row number which corresponds to the candidate/referendum choice within the poll/referendum

If button “D” (“BACK”) is pressed, the VM returns to the “Open poll” menu (§5.1).

5.2. Close poll

When the VM is in Functions mode and button B is pressed on the main Functions menu, the voter’s display shows the following:

```

Warning - pressing B or C closes poll
<B MAKE BACK UP AND PRINT STATEMENT
<C MAKE BACK UP - SHOW DATA ON DISPLAY
<D BACK

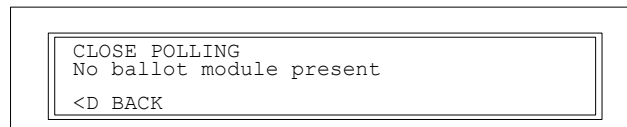
```

VD_F_1a

By pressing the relevant button on the VM keypad, the VM will carry out one of the following functions:

- **MAKE BACK UP AND PRINT STATEMENT.** Pressing button B causes the complete contents of the primary ballot module to be copied to the back up ballot module. If this process is not completed correctly, the contents of the primary module remain intact and the voter’s display presents an error message. Pressing button B also causes to be printed the following information programmed in the ballot module about each poll, the total number of activations, the number of votes cast at each poll and referendum on the machine (including, in the case of multiple polls, the number of null votes (see section 1.3.1) cast at each poll) and the number of de-activations (§5.2.1).
- **MAKE BACK UP – SHOW DATA ON DISPLAY.** Pressing button C causes the voter’s display to display the total number activations, the number of votes cast at each poll and referendum on the machine (including, in the case of multiple polls, the number of null votes (see section 1.3.1) cast at each poll) and the number of de-activations (§5.2.2).

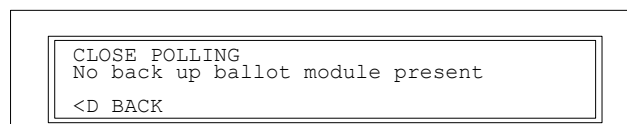
If there is no ballot module in the VM when button “B” is pressed in the main Functions menu, the following display is shown:



VD_F_1b

If button “D” (corresponding to “BACK”) is pressed, the VM will return to the main Functions menu (§5).

If there is no back up ballot module in the VM when this function is activated, the following display is shown:

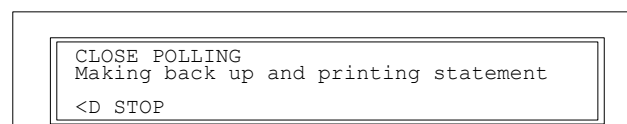


VD_F_1c

If button “D” (corresponding to “BACK”) is pressed, the VM will return to the main Functions menu (§5).

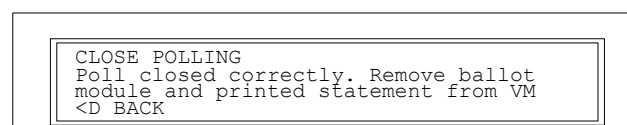
5.2.1. Make back up and print statement

When this subfunction is activated, the contents of the primary ballot module are copied to the back up ballot module. Once this is done, a print out is made from the VM of the total number of activations, the number of votes cast at each poll and referendum on the machine (including, in the case of multiple polls, the number of null votes (see section 1.3.1) cast at each poll) and the number of de-activations. During the printing it is possible to abort the printing by pressing the button “D”. The following display is shown:



VD_F_1_1a

When the printout statement is ready the following display is shown:



VD_F_1_1b

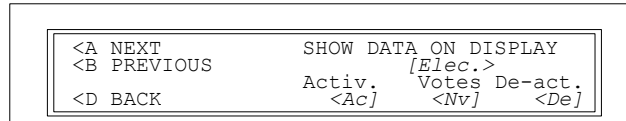
If button “D” (corresponding to “BACK”) is pressed, the VM will return to the “Close poll” menu (§5.1).

- [Programmed infox> = Candidates details, listed in ballot paper order of candidates or referendum choices

After the printing is finished the VM returns to the “Close poll” menu (§5.2).

5.2.2. Make back up – show data on display

When this function is activated, the VM shows the following display:



VD_F_1_2

This menu has the following options:

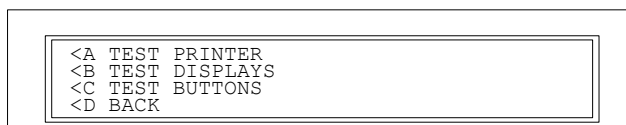
- A...NEXT. Details of the next election are shown. This option will not be shown on the display if there are no more elections to show details of.
- B...PREVIOUS. Details of the previous election are shown. This option will not be shown if the details of the first election are shown.
- D...BACK. Return to the “Close poll” menu (§5.2).

Expressions in this display have the following meanings:

- [Elec.> = Title of the election.
- <Ac> = Total number of activations for this poll.
- <Nv> = Total number of votes cast (including, in the case of multiple polls, null votes (see section 1.3.1)).
- <De> = Number of de-activations for this poll.

5.3. Test voting machine

When the VM is in the Functions mode and button “C” is pressed on the main Functions menu, the following “Test voting machine” menu is displayed:



VD_F_3

By pressing the relevant button on the VM keypad, the VM will switch to particular functions as follows:

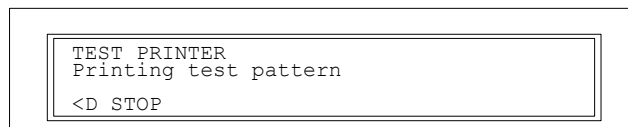
- A...“TEST PRINTER”. Test if the printer print all characters (§5.3.1)
- B...“TEST DISPLAYS”. Test if all displays function correctly (§5.3.2)
- C...“TEST BUTTONS”. Tests that buttons can be detected (§5.3.3)
- D...“BACK”. The VM exits the “Test voting machine “ function and returns to the main Functions menu (§5)

5.3.1. Test printer

When this function is activated in the “Test voting machine” menu, the printer prints a test pattern. The test pattern comprises the characters ‘!’ (ASCII 21H) to ‘y’ (ASCII 79H) and this pattern will shift one character to the left every line. The printout looks as follows:

```
!"#$%&'()*+,-./012345678
"#$%&'()*+,-./0123456789
#$%&'()*+,-./0123456789:
$%&'()*+,-./0123456789:;
%&'()*+,-./0123456789:;<
&'()*+,-./0123456789:;<=
'()*+,-./0123456789:;<=>
() *+,-./0123456789:;<=>?
) *+,-./0123456789:;<=>?@
*+,-./0123456789:;<=>?@A
+,-./0123456789:;<=>?@AB
,-./0123456789:;<=>?@ABC
-./0123456789:;<=>?@ABCD
./0123456789:;<=>?@ABCDE
/0123456789:;<=>?@ABCDEF
0123456789:;<=>?@ABCDEFG
123456789:;<=>?@ABCDEFGH
23456789:;<=>?@ABCDEFGHI
3456789:;<=>?@ABCDEFGHIJ
456789:;<=>?@ABCDEFGHIJK
56789:;<=>?@ABCDEFGHIJKL
6789:;<=>?@ABCDEFGHIJKLM
789:;<=>?@ABCDEFGHIJKLMN
89:;<=>?@ABCDEFGHIJKLMNO
9:;<=>?@ABCDEFGHIJKLMNOP
:;<=>?@ABCDEFGHIJKLMNOQ
```

During this test the following display is shown:

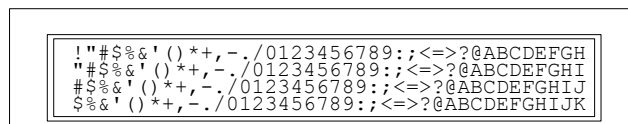


VD_F_3_1

The VM returns to the “Test voting machine” menu (§5.3) after finishing the printer test or by aborting the process by pressing button “D” (“STOP”).

5.3.2. Test displays

When this function is activated in the “Test voting machine” menu, the following test pattern is shown on both the voter’s display and the CU display:



VD_F_3_2, CD_F_3_2

The test pattern comprises the characters ‘!’ (ASCII 21H) to ‘y’ (ASCII 79H) and this pattern will shift left until the end of the test is reached or button “D” is pressed on the VM keypad. The test pattern on the voter’s panel shows characters in the following sequence:

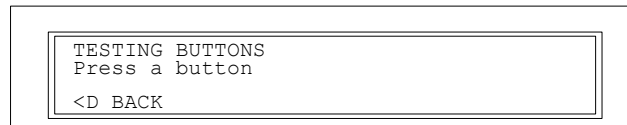
- All horizontal bars
- Shift numbers 1 to 90 from up to down
- Shift X from up to down

- Shift all segments on from up to down

All segments will stay on until the test is finished. The VM returns to the “Test voting machine” menu (§5.3).

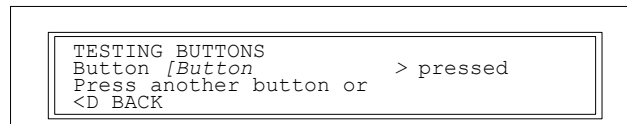
5.3.3. Test buttons

When this function is activated in the “Test voting machine” menu, all buttons on both the CU and voters panel can be tested. The following display is shown:



VD_F_3_3a

If the first button is pressed, the following display is shown:



VD_F_3_3b

Expressions in the displays VD_F_3b have the following meanings:

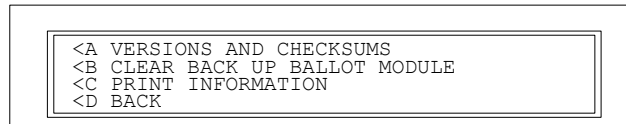
- In case of the CU [Button> = Respectively “FUNCTIONS”, “VISUAL IMP”, “SPARE BUTTON 2” and “ACTIVATE w” where the last expression means the buttons below the CU display and w = P, D, E, L, A and B
- In case of the VM keypad [Button> = Respectively “0”, “1”, “2”, “3”, “4”, “5”, “6”, “7”, “8”, “9”, “*”, “#” and “SOFTKEY x” where x = from A to C
- In case of the voter’s panel [Button> = Respectively “LANGUAGE BUTTON”, “SPARE BUTTON 1”, “CAST VOTE(S)” and “column y, row zz” where y = from 1 to 5 and zz = from 1 to 20, right aligned

When a button operates correctly, i.e. it closes upon being pressed, the display will show the corresponding message followed by “ pressed”. Should a button be faulty and not close then the display will not change. This would then require further investigation by a qualified service technician.

When button “D” (“BACK”) is pressed, the VM returns to the “Test voting machine” menu (§5.3).

5.4. About voting machine

When the VM is in the main Functions menu and button “D” is pressed on the VM keypad, the following “About voting machine” menu is displayed:



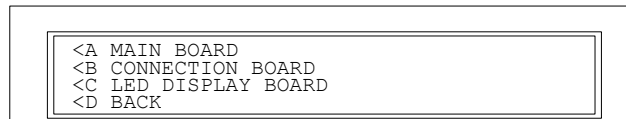
VD_F_4

This menu offers the following options:

- A...VERSIONS AND CHECKSUMS. Menu for displaying the hardware versions of the main electronic board, communication board and LED display boards and the software version of the program in EPROM, communication board and LED display boards (§5.4.1)
- B...CLEAR BACK UP BALLOT MODULE. Delete the contents of the back up ballot module (§5.4.2)
- C...PRINT INFORMATION. Menu for print the information of the VM (§5.4.3)
- D...BACK. The VM returns to the main Function menu (§5)

5.4.1. Versions and checksums

When this function is activated in the “About voting machine” menu, the following display is shown:



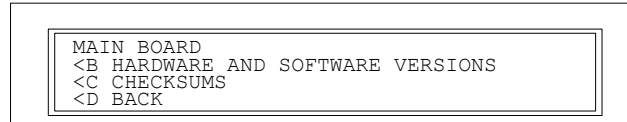
VD_F_4_1

This menu offers the following options:

- A...MAIN BOARD. Menu for versions and checksums of the main electronic board (§5.4.1.1)
- B...CONNECTION BOARD. Menu for versions and checksum of the connection board (§5.4.1.2)
- C...LED DISPLAY BOARD. Menu for versions and checksums of the 5 LED display boards (§5.4.1.3)
- D...BACK. The VM returns to the “About voting machine” menu (§5.4).

5.4.1.1. Main board

When the VM is in the “Versions and checksums” menu and button “A” relating to the main electronic board is pressed, the following menu is displayed:



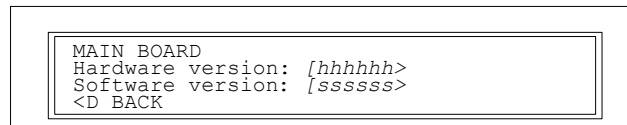
VD_F_4_1_1

This menu offers the following options:

- B...HARDWARE AND SOFTWARE VERSIONS. Displays the hardware version of the main electronic board and the software version of the program in EPROM (§5.4.1.1.1)
- C...CHECKSUMS. Displays the checksums of the even and odd EPROM (§5.4.1.1.2)
- D...“BACK”. The VM returns to the “Versions and checksums” menu (§5.4.1).

5.4.1.1.1. Hardware and software versions

When this function is activated in the “Main board” menu, the following display is shown:



VD_F_4_1_1_1

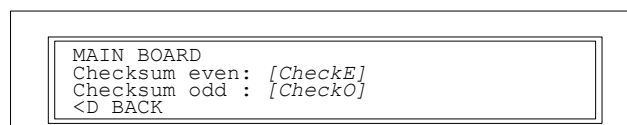
Expressions in this display have the following meanings:

- [hhhhh] = Hardware version in E²PROM of the voting machine, e.g. 02.00
- [sssss] = Software version of the program in EPROM, e.g. 01.00

When button “D” (“BACK”) is pressed, the VM returns to the “Main board” menu (§5.4.1.1).

5.4.1.1.2. Checksums

When this function is activated in the “Main board” menu, the following display is shown:



VD_F_4_1_1_2

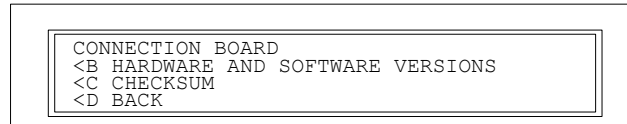
Expressions in this display have the following meanings:

- [CheckE] = Checksum of the program in the even EPROM, e.g. 01AB6C41
- [CheckO] = Checksum of the program in the odd EPROM, e.g. 3109FA76

When button “D” (“BACK”) is pressed, the VM returns to the “Main board” menu (§5.4.1.1).

5.4.1.2. *Connection board*

When the VM is in the “Versions and checksums” menu and button “B” relating to the connection board is pressed, the following menu is displayed:



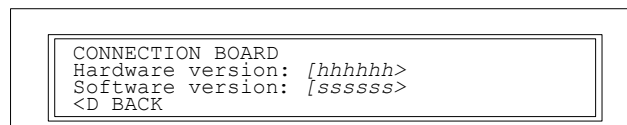
VD_F_4_1_2

This menu offers the following options:

- B...HARDWARE AND SOFTWARE VERSIONS. Displays the hardware version of the connection board and the software version of the program in the connection board (§5.4.1.2.1)
- C...CHECKSUM. Displays the checksum of the software in the connection board (§5.4.1.2.2)
- D...“BACK”. The VM returns to the “Versions and checksums” menu (§5.4.1).

5.4.1.2.1. **Hardware and software versions**

When this function is activated in the “Connection board” menu, the following display is shown:



VD_F_4_1_2_1

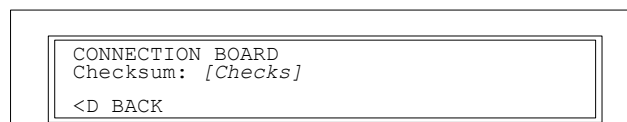
Expressions in this display have the following meanings:

- [hhhhh]> = Hardware version of the connection board, e.g. 02.01
- [sssss]> = Software version of the connection board, e.g. 01.03

When button “D” (“BACK”) is pressed, the VM returns to the “Connection board” menu (§5.4.1.2).

5.4.1.2.2. **Checksum**

When this function is activated in the “Connection board” menu, the following display is shown:



VD_F_4_1_2_2

Expression in this display has the following meaning:

- [Checks] = Checksum of the program in the connection board, e.g. 01AB6C41

When button “D” (“BACK”) is pressed, the VM returns to the “Connection board” menu (§5.4.1.2).

5.4.1.3. LED display board

When the VM is in the “Versions and checksums” menu and button “C” relating to the LED display board is pressed, the following menu is displayed:

```

LED DISPLAY BOARD
<B HARDWARE AND SOFTWARE VERSIONS
<C CHECKSUMS
<D BACK
  
```

VD_F_4_1_3

This menu offers the following options:

- B...HARDWARE AND SOFTWARE VERSIONS. Displays the hardware versions of the 5 LED display boards and the software version of the program in the 5 LED display boards (§5.4.1.3.1)
- C...CHECKSUMS. Displays the checksums of the 5 LED display boards (§5.4.1.3.2)
- D...“BACK”. The VM returns to the “Versions and checksums” menu (§5.4.1).

5.4.1.3.1. Hardware and software versions

When this function is activated in the “LED display board” menu, the following display is shown:

```

LED DISPLAY BOARD
HW ver.: <hhh] <hhh] <hhh] <hhh] <hhh]
SW ver.: <sss] <sss] <sss] <sss] <sss]
<D BACK
  
```

VD_F_4_1_3_1

Expressions in this display have the following meanings:

- <hhh] = Hardware version of the 5 LED display boards, e.g. 02.01
- <sss] = Software version of the 5 LED display boards, e.g. 01.03

When button “D” (“BACK”) is pressed, the VM returns to the “LED display board” menu (§5.4.1.3).

5.4.1.3.2. Checksums

When this function is activated in the “LED display board” menu, the following display is shown:

```

Chksum1 Chksum2 Chksum3 Chksum4
[Checks> [Checks> [Checks> [Checks>
Chksum5
<D BACK [Checks>
  
```

VD_F_4_1_3_2

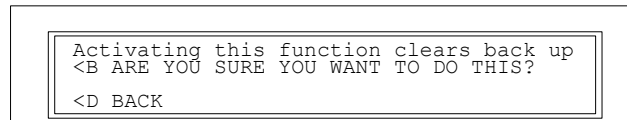
Expression in this display has the following meaning:

- [Checks] = Checksum of the program in the 5 LED display boards, e.g. 0FA37C49

When button “D” (“BACK”) is pressed, the VM returns to the “LED display board” menu (§5.4.1.3).

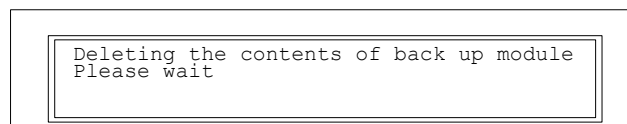
5.4.2. Clear back up ballot module

When this function is activated in the “About voting machine” menu, the following display is shown:



VD_F_4_2a

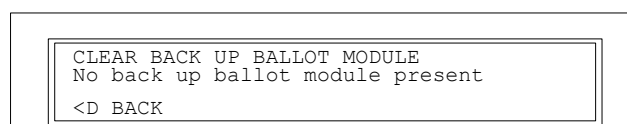
When button “B” is pressed, the contents of the back up ballot module are deleted and the following display is shown:



VD_F_4_2b

When this function is finished the VM automatically returns to the “About voting machine” menu (§5.4).

If there is no back up ballot module in the VM when this subfunction is activated, the following display is shown:

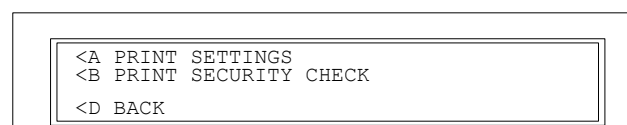


VD_F_4_2c

When button “D” (“BACK”) is pressed, the VM returns to the “About voting machine” menu (§5.4).

5.4.3. Print information

When this function is activated in the “About voting machine” menu, the following display is shown:



VD_F_4_3

This menu offers the following options:

- A...PRINT SETTINGS. Printing the settings of the VM (§5.4.3.1)
- B...PRINT SECURITY CHECK. Printing the information of the security check (§5.4.3.2)
- D...BACK. The VM returns to the “About voting machine” menu (§5.4).

5.4.3.1. *Print settings*

When button “A” is pressed in the “Print information” menu, the settings of the VM are printed and the following display is shown:



VD_F_4_3_1

The printout looks as follows:

```

-----
Machine ID      : [wwwwww]
Hardware ver.. : [hhhhh>
Software ver.. : [sssss>
Checksum even:  [CheckE]
Checksum odd  :  [CheckO]
HW ver. comm.: [xxxxxx>
SW ver. comm.: [xxxxxx>
Chksum comm.  : [Checks]
HW ver. dsp1  : [xxxxxx>
HW ver. dsp2  : [xxxxxx>
HW ver. dsp3  : [xxxxxx>
HW ver. dsp4  : [xxxxxx>
HW ver. dsp5  : [xxxxxx>
SW ver. dsp1  : [xxxxxx>
SW ver. dsp2  : [xxxxxx>
SW ver. dsp3  : [xxxxxx>
SW ver. dsp4  : [xxxxxx>
SW ver. dsp5  : [xxxxxx>
Checksum dsp1 : [Checks]
Checksum dsp2 : [Checks]
Checksum dsp3 : [Checks]
Checksum dsp4 : [Checks]
Checksum dsp5 : [Checks]

Possible elections:
- [Poll type 1>
- [Poll type 2>
- [Poll type 3>
- [Poll type 4>
- [Poll type 5>
- [Poll type 6>
- [Poll type 7>
- [Poll type 8>

-----
  
```

☐ — 2 empty lines

Expressions in the printout have the following meanings:

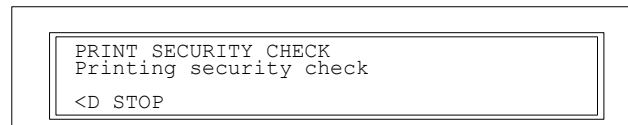
- [wwwwww] = ID of the VM
- [hhhhh> = Hardware version of the VM in E²PROM, e.g. 02.00
- [sssss> = Software version of the program in EPROM, e.g. 01.00
- [CheckE] = Checksum of the software in the even EPROM, e.g. 0012EF34
- [CheckO] = Checksum of the software in the odd EPROM, e.g. 0065BA93
- [xxxxxx> = Hardware and software versions of communication and LED display boards, e.g. 01.03

- [Checks] = Checksums of the communication and LED display boards, e.g. 0145AF1B
- [Poll type x> = Type of poll which can be held with this VM

When the printout is finished or button “D” (“STOP”) is pressed, the VM returns to the “Print information” menu (§5.4.3).

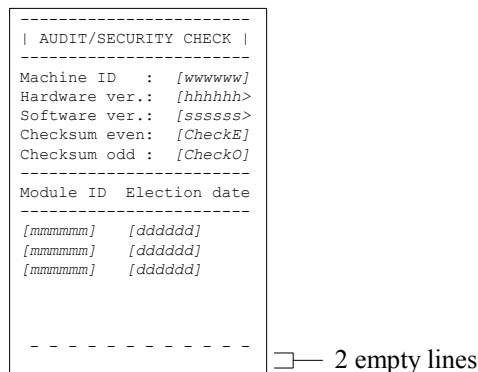
5.4.3.2. *Print security check*

When button “B” is pressed in the “Print information” menu, the security check information of the VM is printed and the following display is shown:



VD_F_4_3_2

The printout looks as follows:



Expressions in the printout have the following meanings:

- [wwwww] = ID of the VM
- [hhhhh> = Hardware version of the VM in E²PROM, e.g. 02.00
- [sssss> = Software version of the program in EPROM, e.g. 01.00
- [CheckE] = Checksum of the software in the even EPROM, e.g. 0012EF34
- [CheckO] = Checksum of the software in the odd EPROM, e.g. 0065BA93
- [mmmmmm] = Module ID stored in EEPROM
- [ddddd] = Date of election stored in EEPROM

When the printout is finished or button “D” (“STOP”) is pressed, the VM returns to the “Print information” menu (§5.4.3).

6. The state “Service” (Only for maintenance purposes by authorised service engineers)

The VM is placed in the Service mode either by manually turning a DIPswitch on the main electronic board or by inserting a ‘SERVICE’ ballot module with a special ID. When connected to power in this mode, the VM operates only limited functions to enable servicing to take place.

The VM voters panel displays the following Service menu:

```

SERVICE ESI2 1 SW [sssss> HW [hhhhh>
<B DEBLOCK VOTING MACHINE
<C VOTING MACHINE SETTINGS
<D SERVICE FUNCTIONS

```

VD_M

Expressions in this display have the following meanings:

- [sssss> = Software version of the program in EPROM, e.g. 01.00
- [hhhhh> = Hardware version of the VM in E²PROM, e.g. 02.00

By pressing the relevant button on the VM keypad, the VM will switch to particular functions as follows:

- Deblocking the VM. This line is displayed only if the VM is blocked (§6.1)
- Changing the settings of the VM (§6.2)
- Execution of service functions (§6.3)

The CU shows the following display as long as the VM is in Service mode:

```

SERVICE

```

CD_M

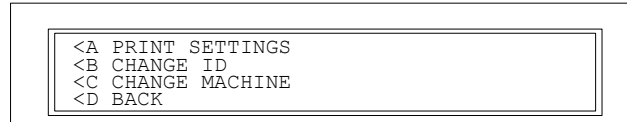
6.1. Deblock voting machine

When a checksum in one of the ballot modules is not correct (arising from a vote or some other information) this ballot module will be blocked. As a consequence the VM will not accept any further votes. Deblocking a ballot module involves deleting all data in the module. This can only be done when the module is placed in the programming slot of the PRU and votes stored in the module have been downloaded into the IES software.

If the VM itself detects an error, which can be traced back to incorrect functioning of the VM hardware, it will be blocked. If a VM is blocked, the second line of VD_M is displayed and by pressing button “B”, the VM can be deblocked. In Service mode it is possible to trace how the VM became blocked.

6.2. Voting machine settings

When the VM is in the main Service menu and button “C” is pressed, the following Voting machine settings menu is displayed:



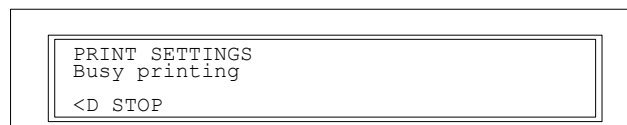
VD_M_1

The service engineer has the following options:

- A...Print the settings of the VM (§6.2.1)
- B...Change the ID of the VM (§6.2.2)
- C...Change the type of hardware used by the VM (§6.2.3)
- D...Go back to the main Service menu (§6)

6.2.1. Print settings

When the service engineer activates this function in the “Voting machine settings” menu, the VM prints its settings and displays the following while printing is in progress:



VD_M_1_1

An example of the print out is shown:


```

-----
Machine ID   : [wwwwww]
-----
Machine type : [Type >
Hardware ver.: [hhhhh>
Software ver.: [sssss>
Checksum even: [CheckE]
Checksum odd : [CheckO]
HW ver. comm.: [xxxxxx>
SW ver. comm.: [xxxxxx>
Chksum comm. : [Checks>
HW ver. dsp1 : [xxxxxx>
HW ver. dsp2 : [xxxxxx>
HW ver. dsp3 : [xxxxxx>
HW ver. dsp4 : [xxxxxx>
HW ver. dsp5 : [xxxxxx>
SW ver. dsp1 : [xxxxxx>
SW ver. dsp2 : [xxxxxx>
SW ver. dsp3 : [xxxxxx>
SW ver. dsp4 : [xxxxxx>
SW ver. dsp5 : [xxxxxx>
Checksum dsp1: [Checks]
Checksum dsp2: [Checks]
Checksum dsp3: [Checks]
Checksum dsp4: [Checks]
Checksum dsp5: [Checks]
Baudrate 1  : [Baud >
Baudrate 2  : [Baud >

Possible elections:
- [Poll type 1>
- [Poll type 2>
- [Poll type 3>
- [Poll type 4>
- [Poll type 5>
- [Poll type 6>
- [Poll type 7>
- [Poll type 8>

-----

```

 2 empty lines

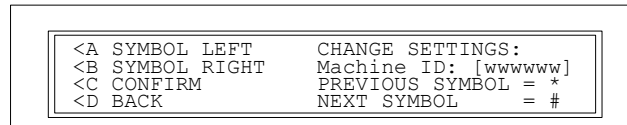
The expressions in the print out have the following meanings:

- [wwwwww] = ID of the VM
- [Type> = Type of machine: VM for voting machine or PRU for programming/reading unit
- [hhhhh> = Hardware version of the VM in E²PROM, e.g. 02.00
- [sssss> = Software version of the program in EPROM, e.g. 01.00
- [CheckE] = Checksum of the software in the even EPROM, e.g. 0012EF34
- [CheckO] = Checksum of the software in the odd EPROM, e.g. 0065BA93
- [xxxxxx> = Hardware or software version of communication or display board, e.g. 01.03
- [Checks] = Checksum of the software in the communication or display board, e.g. 0125BF93
- [Baud> = Baud rate of the communication port, e.g. 2400 or 9600
- [Poll type n> = Names of the poll types available in the software

If button “D” (“STOP”) is pressed, the printing process is cancelled and the VM returns to the “Voting machine settings” menu (§6.2). If the printing cycle is completed, the VM returns to the “Voting machine settings” menu.

6.2.2. Change ID of the VM

When this function is activated in the “Voting machine settings” menu, the following display is shown:



VD_M_1_2

This menu has the following options:

- A...SYMBOL LEFT. The cursor moves one position to the left and the symbol is deleted. This option will not be shown on the display if the cursor stands on the most left position.
- B...SYMBOL RIGHT. The cursor moves one position to the right and a new symbol is added. This option will not be shown on the display if the cursor stands on the most right position.
- C...CONFIRM. Saves the new VM ID. The E²PROM, containing all errors and events, will be deleted completely and the new ID will be assigned to the VM.
- D...BACK. Return to the state “Voting machine settings” (§6.2)

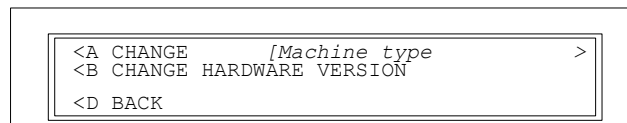
To enter the ID the following options are available:

- A digit can be entered via the VM keypad
- PREVIOUS SYMBOL (* from VM keypad). The symbol underneath the cursor will be replaced by the previous symbol from the ASCII set.
- NEXT SYMBOL (# from VM keypad). The symbol underneath the cursor will be replaced by the next symbol from the ASCII set.

6.2.3. Change machine

This function enables the type of hardware used by the machine to be altered. The hardware can be used in a PRU or a VM. The difference between the VM and PRU is the displays and the keyboard/buttons otherwise the hardware for both types is the same. The software uses the “Change machine” function to determine which part of the program should be activated after starting up.

If the service engineer activates this function in the “Voting machine settings” menu, the following display is shown:



VD_M_1_3

In display VD_M_1_3 the current settings of the machine are displayed:

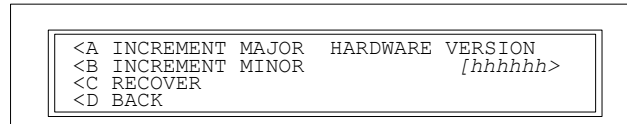
- [Machine type> = “Voting machine” or “Programming/reading unit”

The following options are possible:

- A...CHANGE. Machine can be switched from VM to PRU and back
- B...CHANGE HARDWARE VERSION. Set the hardware version of the main electronic board (§6.2.3.1)
- BACK. Return to the “Voting machine settings” menu (§6.2)

6.2.3.1. *Change hardware version*

If the service engineer selects this option in the “Change machine” menu, the following display is shown:



VD_M_1_3_1

In display VD_M_1_3_1 the current hardware version is shown.

The following options are possible:

- A...INCREMENT MAJOR. Increase the major number of the hardware version
- B...INCREMENT MINOR. Increase the minor number of the hardware version
- C...RECOVER. First decrease the minor number to zero and then the major number to zero by one step at a time. Every step has to be activated by the service engineer
- D...BACK. Return to the “Change machine” menu (§6.2.3)

6.3. Service functions

The VM records data about some major actions and any (machine) errors. The Service function enables these historical data to be viewed either on the voter’s display or on printout.

When the VM is in the main Service menu and the service engineer presses the button ”D”, the following display is shown:



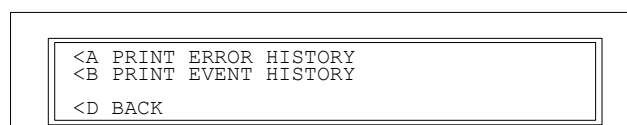
VD_M_2

The “Service functions” menu has the following options:

- A...PRINT HISTORY. Print the historical data (§6.3.1)
- B...DISPLAY HISTORY. Displays the historical data (§6.3.2)
- D...BACK. Return to the main Service menu (§6)

6.3.1. Print history

When this function is activated in the “Service functions” menu, the following is shown in the voters display:

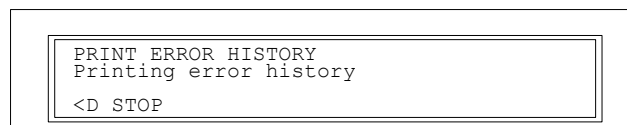


VD_M_2_1

This menu has the following options:

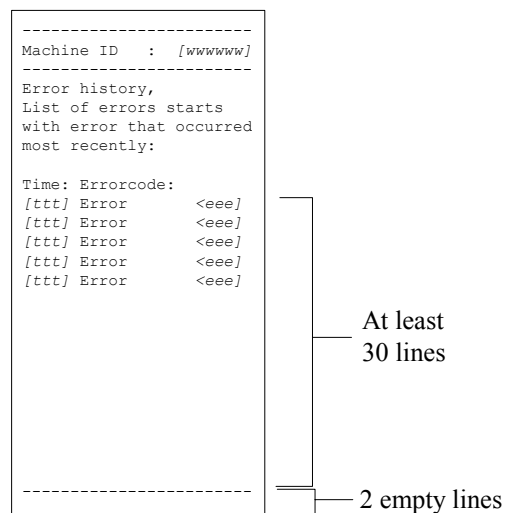
- A...PRINT ERROR HISTORY. Printing of the data from the error history
- B...PRINT EVENT HISTORY. Printing of the data from the event history
- D...BACK. Return to the “Service functions” menu (§6.3)

If button “A” (“PRINT ERROR HISTORY”) is pressed the following display appears:



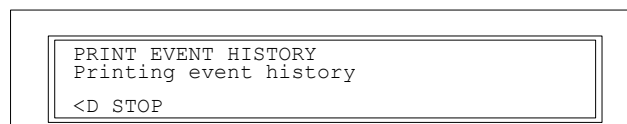
VD_M_2_1_1

The print out looks as follows:



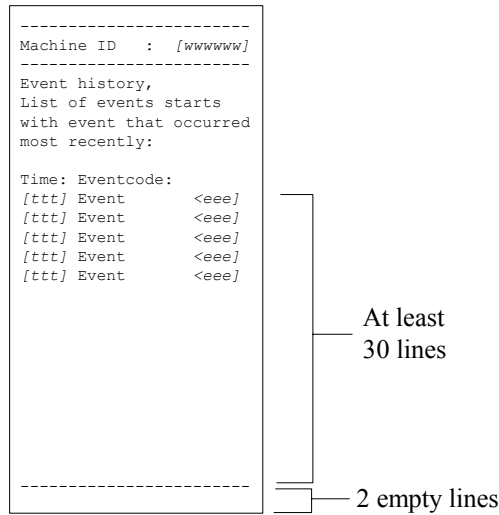
When printing is finished or if button “D” (“STOP”) is pressed, the display VD_M_2_1 reappears.

If button “B” (“PRINT EVENT HISTORY”) is pressed the following display appears:



VD_M_2_1_2

The print out looks as follows:



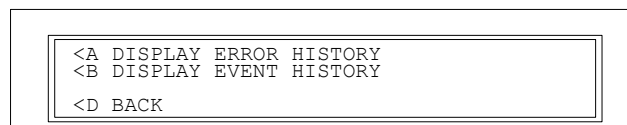
When printing is finished or if button “D” “STOP”) is pressed, the display VD_M_2_1 reappears.

The expressions in both print outs have the following meanings:

- [wwwww] = ID of the VM
- [ttt] = Hour and minutes after start up, e.g. “ 8:25”
- <eee> = Code of the error or event

6.3.2. Display history

When this function is activated in the “Service functions” menu, the following is shown in the voters display:

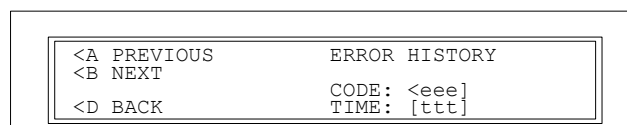


VD_M_2_2

This menu has the following options:

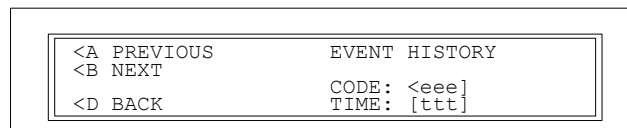
- A...DISPLAY ERROR HISTORY. Displaying of the data from the error history
- B...DISPLAY EVENT HISTORY. Displaying of the data from the event history
- D...BACK. Return to the “Service functions” menu (§6.3)

If the “DISPLAY ERROR HISTORY” option is selected, the following display appears:



VD_M_2_2_1

If the “DISPLAY EVENT HISTORY” option is selected, the following display appears:



VD_M_2_2_2

The expressions in both displays have the following meanings:

- <eee] = Code of the error or event
- [ttt] = Hour and minutes after start up, e.g. “ 8:25”

The first error or event shown is the most recent one to have occurred. The choice “NEXT” is not on the display. If the first error or event to have occurred is displayed, the choice “PREVIOUS” disappears from the display. When button “D” (“BACK”), is pressed, the display VD_M_2_2_2 reappears.

7. Errors

7.1. Error types

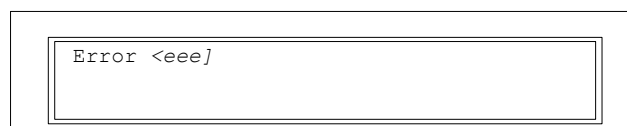
- Operating errors. These errors occur if the voter does not follow the prescribed voting sequence. Any such error is shown as a message on both the voters display and on the CU. When an error occurs an audio feedback signal of 3 short beeps is made to get the attention of the voter.
- Hardware errors. These errors are divided in two categories.
 - Ballot module errors. The machine goes to “Error” mode. After restarting, the machine will be blocked and it is **not** possible to vote with this machine (§7.2).
 - Other hardware errors. The machine goes to “Error” mode. The VM has to be restarted before it will allow further voting (§7.2).
- Keyboard/button errors. These are generally accidental errors where someone or something presses a button (e.g. something is lying on the voters panel or someone is leaning on the voters panel) (§7.3).

7.2. The “Error” state

If an error occurs, the VM will go into the “Error” state. The error code will be stored in the error history and event history. In cases where the error can threaten the ballot module, the “BLOCK” code will be stored in the history.

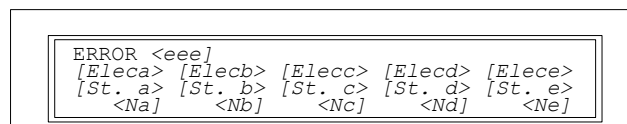
Errors which can affect the ballot module are those that switch the status of the ballot module in normal mode from “OK” to an error code. This would occur for example when a write action (storing a vote, storing the ID of the VM before the first vote) in the ballot module is not completed correctly.

The voters display will show the following:



VD_E_1

The CU will show the following display:



CD_E_1

The expressions in both displays have the following meanings:

- <eee] = Errorcode.

- [Eleca> to [Elece> = Names of the polls held at the same time. If there are less than five polls held there will be blanks from right to left.
- [St. a> to [St. e> = Mode of the election.
- <Na] to <Ne] = Total number of votes cast on the machine at this poll including, in the case of multiple polls, the number of null votes (see section 1.3.1).

The only way to exit the “Error” state is to switch off the mains power and then switch it on again. This must be done for two reasons:

- By switching off and on the mains power all hardware is initialised and in a predefined state
- After power is switched on the complete machine is tested again (inclusive ROM and RAM)

7.3. Voter’s Panel button error

There are two reasons why an error could occur:

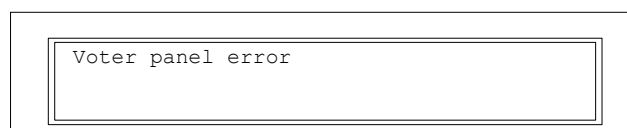
- A button cannot be pressed and is permanently an open circuit.
- A button is permanently closed, and in effect acts like a short circuit.

There is no electronic method of detecting a button that cannot be pressed. The malfunctioning of a button can be detected only by pressing all buttons in the “Test buttons” subfunction of the “Test voting machine” Function (§5.3.3).

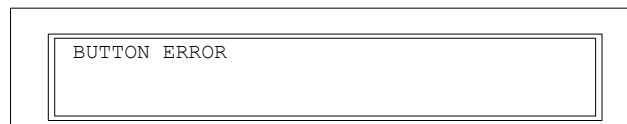
The software can always detect a button that is pressed. The software does not know if the button pressed is defective or if someone or something is pressing that specific button. The button test is automatically carried out at start up and during the normal operation of the VM at polling day. If a button gets stuck in the “pressed” position during polling day, it will be detected automatically because of tests done while the machine runs.

7.3.1. Button error at start-up

At start up, a test is performed to check if any button is stuck in the “pressed” position. If this is the case then after several seconds, the VM goes to the “Button error” mode and the next displays are shown:



VD_E_2

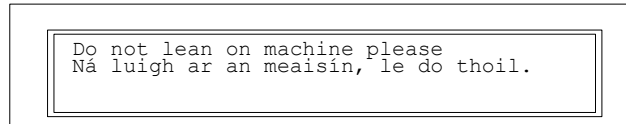


CD_E_2

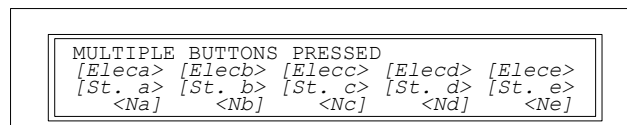
As indicated above, the only way to exit this “Error” state is to switch off the mains power and then switch it on again. An error code will be written in the E²PROM so the service engineer can check which button causes the problem.

7.3.2. Button error during normal operation

If during normal operation several buttons are pressed at the same time, this will result in an error message. The person who causes the problem will be informed by the display and by a beep. The following displays are shown:



VD_E_3



CD_E_3

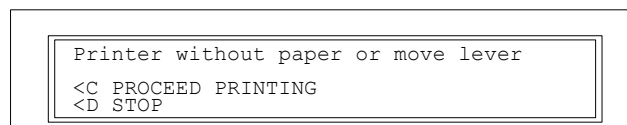
If one button is pressed longer than 5 seconds, the VM will react with a series of beeps. There are two possible solutions:

- Someone is leaning on the Voter's Panel by mistake. The beeps prompt the person to release the button in which case the error is solved and the beep stops.
- It is a real button error. The polling station staff cancels the beep by turning off the mains power and switching it on again. This causes the VM to test the buttons as described in §7.3.1 and detect if it is a real error.

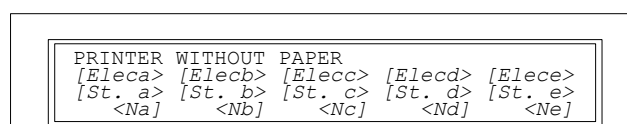
If a button error appears during normal operation, after 10 seconds an event code is written in E²PROM.

7.4. No printer paper

If the printer runs out of paper during printing, the following displays are shown:



VD_E_4



CD_E_4

There are two options for the user:

- “PROCEED PRINTING”. After a new roll of paper has been inserted in the printer, pressing button C will cause printing to proceed.
- “STOP”. The printing aborts.

This error is not written in E²PROM.

7.5. Printer error

If the printer reports an error, the following displays are shown:

```
Printer error
<C PROCEED PRINTING
<D STOP
```

VD_E_5

```
PRINTER ERROR
[Eleca> [Elecb> [Elecc> [Elecd> [Elece>
[St. a> [St. b> [St. c> [St. d> [St. e>
<Na] <Nb] <Nc] <Nd] <Ne]
```

CD_E_5

There are two options for the user:

- “PROCEED PRINTING”. Machine proceeds printing after the error is resolved by operator action.
- “STOP”. The printing aborts.

This error is written in E²PROM.

7.6. Blockage

If an error code occurs in the E²PROM that threatens the ballot module, the voting machine cannot be used for voting.

After start up the following displays are shown:

```
Error <eee]
<D CONTINUE
```

VD_E_6

```
ERROR <eee]
[Eleca> [Elecb> [Elecc> [Elecd> [Elece>
[St. a> [St. b> [St. c> [St. d> [St. e>
<Na] <Nb] <Nc] <Nd] <Ne]
```

CD_E_6

In case of a blocked module or the printer will not operate, the staff are able to let the program continue by pressing “D” (“CONTINUE”). This line is shown on the VM if a ballot module is put into a non-blocked machine to obtain a print out of the poll. If this line is not shown, the machine is blocked and cannot be used. Only a Nedap service engineer can deactivate a blockage. The blockage can be solved (§6.1) only in Service mode which is set either by manually turning a DIP-switch on the main electronic board or by installing a special ballot module in the VM.

The expressions in both displays have the following meaning:

- <ee] = Errorcode
- [Eleca> to [Elece> = Names of the polls held at the same time. If there are less than five polls held there will be blanks from right till left.
- [St. a> to [St. e> = State of the poll.
- <Na] to <Ne] = Total number of votes cast on the machine at this poll including, in the case of multiple polls, the number of null votes (see section 1.3.1).

8. Diagnosis

8.1. Start up test

When the VM is connected to a power source the following tests are performed automatically within the VM. This occurs every time the VM is started up. As some of the tests are completed a beep can be heard. Information relating to the progress of tests is displayed on the CU display.

- Test the functioning of the Vpp panic circuit
- Test the functioning of the watchdog panic circuit
- Test the programming voltage circuit
- Test the watchdog timeout
- ROM test. The checksum of the program in EPROM is checked against the last two bytes in EPROM.
- RAM test. Patterns are used to check if the RAM is secure.
- Keyboard test. The keyboard is tested for any short-circuits.
- Ballot module test. The contents of the ballot module are tested for integrity.

8.2. Diagnosis during normal operation

During normal operation, the following tests are performed automatically to check that the machine is continuing to function correctly, e.g.:

- Test that programming voltage is within limits for storing votes.
- Check all devices (e.g. buttons, displays, ballot module) to ensure that operational status is unchanged after start up.
- The ballot module is tested in the “Voting” mode to check that all votes already stored are still stored correctly.

If an error is found in the “Voting” mode, the VM will change to the “Error” state.

9. Facility for visually impaired persons

There is an RS-232 port on every VM, which can be connected to an external device. The output to this port corresponds to the preference buttons pressed. The external device has to convert this output to the spoken names of the candidates and their political party or to the referendum choices.

The CU button controlling the visually impaired device must be pressed before one of the poll activation buttons P, D, E or L is pressed. If the button for the visually impaired on the CU is pressed, an X is displayed on the upper right corner of the CU display, indicating that the device for the visually impaired has been activated. The last line of the display on the VM will also show the text: "Device for visually impaired active" and this text will blink. This option will overrule the showing of information of the selected preference.