DIAGNOSTIC FUNCTIONS MANUAL

FWR0002-03-EN

CDS 707

Release 3.00

Release	***Date***	***Description***
2.00	13/02/08	Draft for cds equipment
2.01	21/02/08	Added self locking bag management
2.02	14/10/08	Added self locking bag error
2.03	5/03/09	Added new error descriptions
2.04	20/03/09	Typos correction and new editing
2.05	21/05/09	Added workmode for brushless version
3.00	25/06/09	Release 3.00

1 Table of Contents

2 Preface

The machine described in this manual, manufactured by Cima S.p.A., is:

- CDS 707

This manual reports only the behavior of the internal test system of the machine and its messages, in order to let the service engineers to better understand both the error messages and the internal log file.

This manual does not report how to solve problems: please refer to the technical manual for this.

It is also required that all the service operations will be performed through the service application program; this program has an user-friendly interface for all the machine servicing operations. There is a manual for this program.

In this manual there are two application program cited: the service application program, for the authorized technical engineers only, and the user application program, for the user.

3 Machine functions: a brief explanation

In this chapter the functions of the CDS707 machine are briefly explained; for more details the technical manual should be consulted.

The machine has mainly one tasks: deposit banknotes into the bag.

The deposit process feeds banknotes, from the input tray, one by one into the transport; they are aligned, identified and stored in the bag. Rejected notes are returned through the outlet.

This operation counts the banknotes by value.

In Fig. 1 it is shown the path of the banknotes in the device (in red).

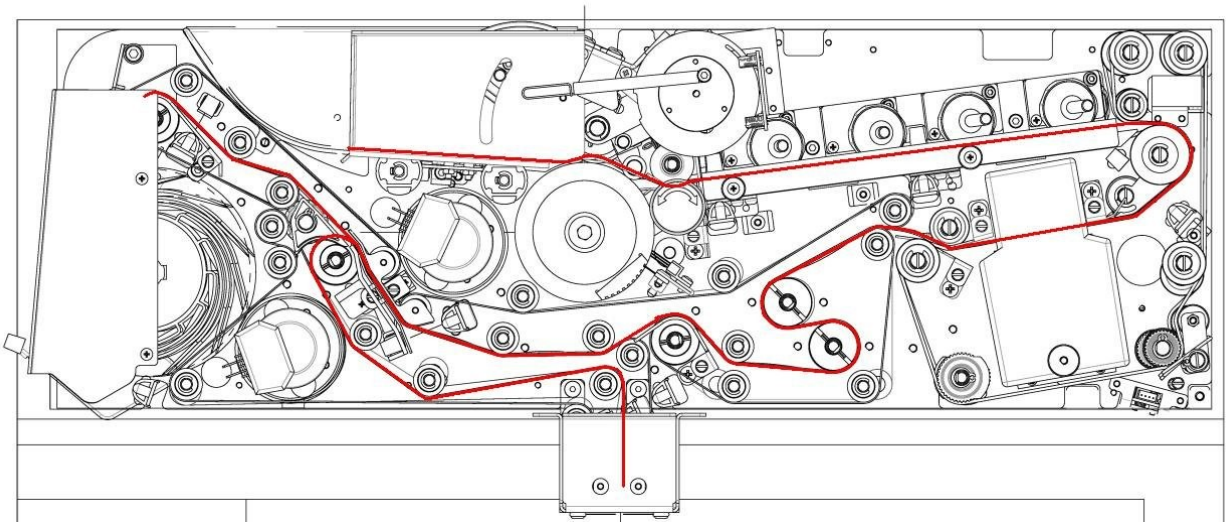

Fig. 1: CDS707 whole image

3.1 Functional areas

Here follows a list of the machine areas, from the input tray to the outlet. This is mainly a logic subdivision and each “area” is strictly related to the internal test system coding (see 3.1.1).

1. Input tray, where the banknote bundle is placed for the deposit.
2. Banknote feeder: separates the bundle of banknotes, one by one, feeding them into the transport.
3. Aligner: shifts and rotates the banknotes to make them parallel to the transport.
4. Banknote identification module: detects the banknote value and its class (validity).
5. Internal transport: is the part of the whole transport system which carries the banknotes from the identification module to bag and to the outlet, through the diverter.
6. Bag: hold the banknotes coming from the transport system through the diverter.
7. Outlet: collects the rejected banknotes.
8. Powersupply.

These areas contain several sensors and/or actuators.

3.1.1 Area codes

Bit #	*Hex code*	*Description*
0	00000001	Input tray and banknote feeder.
1	00000002	Aligner.
2	00000004	Banknote identification module together with the transport through it.
3	00000008	Internal transport (after banknote identification module).
4	00000010	Diverter area.
7	00000080	Outlet.
8	00000100	Bag.
9	00000200	Powersupply.

The areas are bit coded. Multiple faults are reported as a single hex number.

The image in Fig. 2 shows the position of each functional area inside the machine.

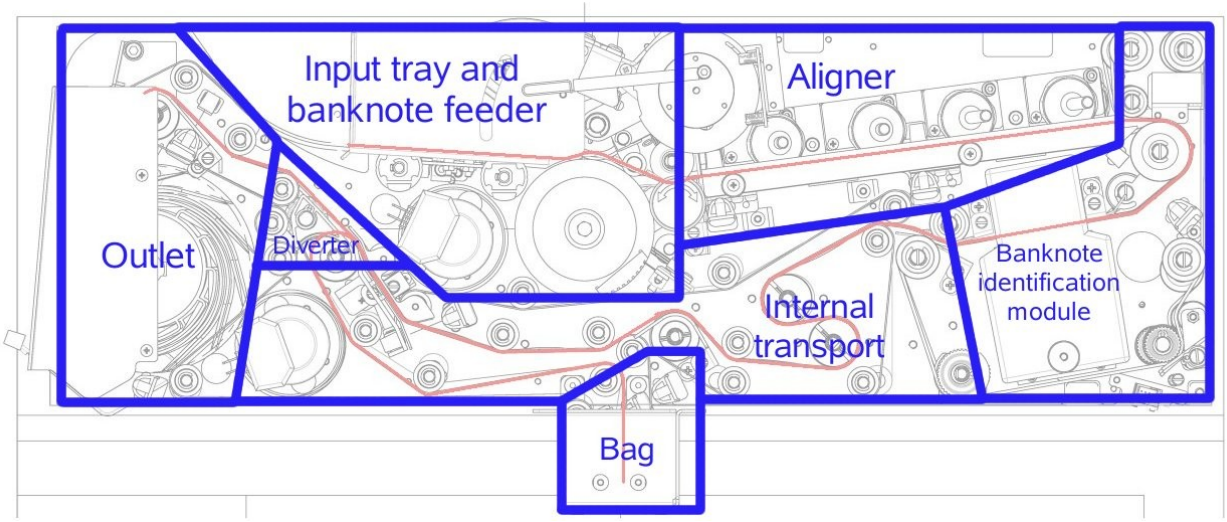

Fig. 2: Areas positioning

3.2 Sensors and actuators

The diagnostic system reads the signals from the sensors spread throughout the machine and uses them to find out its state.

The error messages, usually, comes from the analysis of these signals. The error codes will be explained in the sections of chapter 7, together with the coding of sensors, motors and actuators.

3.3 485 bus

It is a communication structure going across all the electronic boards. It carries all the messages between boards and its malfunction leads to communication errors with all the boards.

Since it is a bus structure, any board may be the origin of its failure, and its failure may origin communication troubles on all other boards.

The troubleshooting is carried on a try and test basis, replacing one board at a time.

3.4 Hardware versions

MOTHER DEPRULL BOARD : MOTHERDEPRULL-BEB

MOTHER BOARD : MOTHER BOARD 7000NT Rev2

HEAD BOARD : Rev 0.7

CASS BOARD : Rev 0.9 (if present with self-sealing bag)

3.5 Test modes

When an error is detected, the machine becomes blocked – out of service. Authorized technicians have to restore the functionality by removing blocked banknotes, replacing defected / fault mechanical or electronic components and resetting the machine.

4 Test tasks

The CDS machine executes diagnostic test in order to verify the good operating condition.

The tests should be divided by three different groups :

1 Start-up tests

1.1 **Start-up test (after switch on).** This test is performed after switch on the equipment. These tests are executed with motors powered off.

Goal of this tests is:

- to detect a failure into the electronic boards (memory integrity, CPU workload etc.);
- to check the boards communication line (RS-485);
- to activate and check the banknote identification module.

1.2 **Complete self-test.** Complete test is executed after <Reset> request by the service program.

Goal of this test is:

- to detect a failure into the electronic boards (memory integrity, CPU workload etc.);
- to check the boards communication line (RS-485);
- to activates the transport in order to eject blocked banknotes;
- to self-calibrate the optical sensors;
- to move the diverter;
- to activate and check the banknote identification module.

2 Periodic tests

2.1 **Stand by tests**: these tests are performed while the device is in idle mode.

The device tests periodically:

- the serial communication between electronic boards;
- the banknote identification module state.

3 On-process tests

3.1 **Pre-operation tests**: the machine has to be in a proper state to begin the operation.

For the deposit process, the system checks if:

- the machine is in a ready state (no pending errors);
- the input tray contains banknotes;
- the outlet is free;
- doors are closed and the bonnet is in place;
- bag is in place and is not full.

3.2 **Operation tests**:

- motor speeds are correct;
- the diverter is in the correct position;
- the banknotes pass the sensors in the correct time ranges.

3.3 **Operation end tests**:

- the sensors are not covered;
- the electronic boards are responding;

- the banknote counts are double checked.

All these tests may lead to an error message for the user (command error) and an internal error messages; the latter is stored in the machine log and may be read by the service personnel.

5 Command errors

Each command sent to the machine by the user application program, gets an error code in its answer; this code says if the command was performed or not. Of course, these codes are handled directly by the application program while user sees only a human readable description (like the description in the “meaning” column of the following table).

In this chapter are described the main errors (except for the error of the serial protocol, which are useless for the user). This should be a reference for the technical engineers for both the origin and the possible solution of the error.

Please remember that the word “application program” here used stands for both the user application program and the service application program.

Error code	***Description***	***Meaning***	***Possible solution***
0	No error	The command is correctly executed.	Not applicable.
10	Device busy	The machine is in use by another user or it is already executing an operation.	Wait the end of the operation.
11	Deposit void	The input tray was empty when the deposit command was issued.	Put the money in the input tray and redo the command.
12	Banknotes have been rejected	Some banknotes processed was rejected and now are in the outlet.	Pick up the rejected banknotes and retry the operation if required.
13	Complete stop of operations for failure.	The diagnostic software reported an error and the machine cannot operate anymore.	Reset / Resume procedure is requested.
15	Command fail	The requested command failed (it is typical on configuration commands).	Check if the machine is ready for this type of command; retry the operation; check the log for the failure origin.
16	Too many banknotes rejected.	There is a limit on the rejected banknotes which the outlet can hold (default is 50 banknotes). This limit has been reached.	Collect the rejected banknotes and retry the operation.
17	Partial stop of operations for failure.	The diagnostic software reported an error and the machine cannot operate anymore.	Same of error 13.
18	Forbidden command.	The machine does not allow this command in its actual state.	Check the operation order and the readiness of the machine. Check the configuration of the machine.
21	Outlet not empty	The outlet still holds banknotes from a previous operation. It is not permitted to start a new operation in order to avoid mixing.	Collect the banknotes from the outlet (and put them in their own place) and retry the operation.
42	Error on self locking bag	Error raised during the locking process. The device can't operate.	Perform the self locking bag restore procedure.
46	Self locking bag out of place	The self locking bag isn't correctly engaged or it isn't in the right position (completely opened), or the chassis isn't inserted.	Check the self locking bag.
47	Bag account failure / corrupted	Due to a hw failure the bag account is not worthy.	The bag has to be emptied.
48	Bonnet out of place.	Bonnet is out of place.	Engage the bonnet.
49	Door opened, Bag	The machine cannot work with door	Close the door, close the bag’s cover,

Error code	*Description*	*Meaning*	*Possible solution*
	not engaged / Bag cover not engaged	opened or without the bag.	engage the bag
50	Banknotes blocked in the input tray	Process is stopped. Banknotes are blocked.	Remove the remaining banknotes.
52	Bag is full (see 8.3, bit 31)	The bag capacity has been reached.	The bag has to be replaced or emptied
53	Not enough memory for accounting.	Only on some configurations of machine, the number of different currencies handled at the same time by an user, is too high.	Reduce the number of currencies handled.
59	Deposit too long.	It is possible to configure the machine in order to put a time limit in the length of the operations.	Start a new deposit, if needed.
120	Device not ready.	The power-on self test is in progress.	Wait the end of the power-on self test signaled by the 2 or 3 rings.
121	Configuration error.	The machine is started for the first time or the parameter memory (non volatile) is damaged.	Check or replace the master electronic board and reconfigure the machine.
122	Function not available.	The requested function is not available because it requires a missing optional part.	Don't use this function or install the required hardware part.
123	Wrong configuration.	The function is not permitted by the configuration of the machine.	Don't use this function or change configuration.
129	Power failure.	A power failure has been detected and the machine now is out of service.	Restart the machine. This occurs automatically when the power comes back.
132	Door opening not allowed now.	The opening the door is not allowed at the time of the command.	Wait the opening time; check the machine configuration (time frames); check the machine clock.
201	Serial communication timeout.	The connection between CDS707 and PC is broken.	Check the cable between PC and CDS707; check the machine power state; check the PC.
202 **203** **204**	Communication errors	Noise on the communication line.	Retry the command; check the communication cable; check the application program configuration and the PC.
205	Process running	Process running	Wait the end of the process.
208	Serial port configuration error.	The serial port on the PC is not available for the application program.	Check the PC and application program configuration.
250	Command construction failure	The application program is not able to execute the command.	Check the PC and application program configuration.
301	Insufficient rights for the user.	The user doesn't have the rights to execute the operation.	Only the administrator can do this task.
901	Syntax error.	The CDS707 don't understand the command.	Check the connection cable and PC; check the application software configuration.
902	Parameter error.	The command is correct but its parameters are not valid.	Check the application program configuration.

Error codes between 200 and 899 are produced by the application software with no communication involved

with the CDS707; actually, for these errors, the machine is not responsible.

There are many other error codes in the serial protocol between the PC and the CDS707; however they are not useful for the technical service, neither for the normal operations of the machine.

6 Log

6.1 General description

During the machine's jobs, several events are traced into a non volatile structure called “log”; this leads to a chronological record of all the relevant data and let the technical engineers to reconstruct the way each job has done.

The events recorded are about the machine configuration, the kind of operation done, the banknote counted and the exceptions (error events). All these events are recorded in chronological order and read back starting from the latest one.

In the service application software, each event is shown as a row in a list where the time goes back reading from the top to the bottom.

Each line resembles the following structure:

Event type (1 char)	spc (1 char)	Date (DD/MM/YY)	spc (1 char)	Time (HH:MM:SS)	spc (1 char)	Event string (max 64 char)

Where:

Event type is a single character identifying the string type:

- **E** the string is an blocking exception (error message).
- **e** the string is a secondary blocking exception (error message).
- **W** the string is a non blocking exception (warning message).
- **I** the string is a generic information string (human readable English).
- **C** the string is a counter.
- **t** the string is a test message (reserved, not explained here).
- ***** the string is a withdrawal summary dump.

spc the space character.

Date is the event date in the format DD/MM/YY.

Time is the event time in the format HH:MM:SS.

Event string is “the string” referenced above.

Each log row is an event written exactly when it happens (with a few milliseconds delay); hereafter the sequence of the rows let the technical engineers to reconstruct the process and to guess the way a failure turned out.

In the following sections, each kind of event is explained.

6.2 Exception event

Is the exception description and resembles the following structure:

EX: error (4 digits)	Mnemonic (4 char)	SN: Sender (4 digits)	**D1**: Data1 (4 digits)	**D2**: Data2 (8 digits)	**D3**: Data3 (8 digits)	**ST**: Systime (8 digits)

Where:

Error Is the error code, explained in chapter 7. This is the most important reference to the type of error.

Mnemonic Is a mnemonic code identifying the part of the diagnostic functions which issued the error.

Sender Is the task address which runs the function referred by the mnemonic code. For service engineers, the only important thing is the electronic board address, made by the first two digit of this number.

Data1 Is the first data field and depends on the error code and, to a lesser extent, the mnemonic code. Is a 4 digit hex number.

Data2 Is the second data field and depends on the error code and, to a lesser extent, the mnemonic code. Is a 8 digit hex number.

Data3 Is the third data field and depends on the error code and, to a lesser extent, the mnemonic code. Is a 8 digit hex number. In the blocking errors, it holds the area code of the failure.

Systime Is the internal clock time, expressed as number of milliseconds from the machine power-up. It is useful to measure time deltas with 1 mS resolution.

All the numerical data are in hexadecimal (base 16) form.

The error codes are explained in the chapter 7.

6.3 Counters

The counter string is a list of quantity:code pairs and resembles the following structure:

Counter name (up to 3 letters)	spc (1 char)	User (2 digits)	"=" (1 char)	Quantity (1 to 4 digits)	":" (1 char)	Code (3 digits)	spc (1 char)	...

Where:

Counter name is the counter name:

- **Ka** = user total cash.
- **Km** = device total cash.
- **Kp** = last process count.

spc is the space character.

= is the "=" character.

: is the ":" character.

Quantity is the quantity of counted banknotes (signed).

Code is the banknote type code programmed in the machine (it is written together with the currency name and value in the start-up messages in the log).

6.4 Generic information messages

The information messages and identify a specific point in the machine operations (i.e. process start ...). They are in English language.

Each message has an header which identifies the originating task (i.e. proc:); these tasks are:

ffile: Log and internal clock manager.

proc: Operation task (deposit, resume, ...).

root: Supervisor.

cmd: Serial command parser.

cron: Periodic task handler.

ex: Exception handler.

diag: Diagnostic system.

user: User management and accounting system.

Here follows the message list with explanations:

- **ffile: System reset** Start up message.
- **root: System started with** List of the slave boards responding at the start-up; it if followed by a string like:

  ```
  root: System started with [ -------HM------- ]
  ```

  Where, enclosed by square brackets, each position is a board address on the internal 485 bus (16 positions, numbered from 0 to 15); each position may be one of the following characters:
  - The corresponding board is absent (typical for positions from 0 to 6 and from 9 to 15)

  C CASSCDS board found at the address (should be on position 6, if self-sealing bag present)
  H HEADCDS board found at the address (should be on position 7)
  M MAINCDS board found at the address (should be on position 8)
  n The board or the 485 is faulty
  b The board seems to be not programmed with firmware
  The above string resembles the correct CDS707 response.
- **root: Power off** The power has turned off.
- **root: Serial number:** Serial number of the machine.
- **root: Version:** Software version for the MAINCDS electronic board..
- **root: Subversions:** Software version for the slave electronic board (sorted by address).
- **root: Currency in bag:** List of “store #:currency code and description” pairs, which relates the bag with the currency it stores. The code is the same used by the counters. Since it may hold more than one currency, it may have several messages of this kind.
- **root: Nvram status** Non volatile memory status, on the master electronic board; it is followed by a string describing the memory blocks status, like the following:

  ```
  root: Nvram status: 0>---------<
  ```

  Where each position is a memory block; each position may be one of the following characters:
  - The block is ok, all writing operation are finished and the checksum are correctly evaluated.
  w The writing operation was interrupted.
  W The writing is finished, but the checksum was not evaluated.
  k The writing is finished, but the checksum evaluation was interrupted.
  x Unknown state.
- **root: Nvram check** Non volatile memory check, on the master electronic board; it is followed by a string describing the memory's blocks check results, like the following:

  ```
  root: Nvram checks: 0>---------<
  ```

  Where each position is a memory block; each position may be one of the following characters:
  - Ok: the data in the block match their checksum.
  i The data don't match their checksum: data corrupted.
- **diag: BIM info:** **B**anknote **I**dentification **M**odule info (serial number and sw version).
- **root: Configured:** Machine configuration, followed by the W(Workmode), O(Opzioni, Options) and D(Diagnosi, Diagnosys) values.
- **cron: Periodic timings started** Message at the time at which all the periodic operations start. It is at the end of the start-up message sequence in the log.
- **root: All systems started** The initial phase is finished and the machine is ready for operations.
- **root: Init check done:** The power on self test is finished (it is followed by an error code).

- **root: Zombie process** A power fail has happened but the power supply is still present; maybe a too fast power switch cycle.
- **proc: Deposit start** Deposit operation start.
- **proc: Deposit end, code:** Deposit operation end, followed by an error code.
- **proc: Bag sealing start** Bag sealing operation start. (only with self-sealing bag)
- **proc: Bag sealign end:** Bag sealing operation end. (only with self-sealing bag).
- **cmd: Stop by user** Emergency stop.
- **root: Abort process!** The operation has stopped due to a blocking error.
- **cmd: New par** A new parameter is programmed; follows the parameter string (partial).
- **cmd: Dly par** Like above, but this parameter will be applied after a safety delay. All the parameters change which results in a lesser safe device are treated in this way.
- **cron: Activating delayed parameter** All the parameters programmed but held are now activated (the safety delay has expired).
- **cmd: Bim denominations adj** The **B**anknote **I**dentification **M**odule has been synchronized with the currencies programmed in the machine.
- **cmd: Sensors autoset on:** The sensors are being self adjusted. The number following is the board address which sensors are adjusted (255 = the whole machine).
- **cmd: Parameter synchro on:** The slave board's parameters has been synchronized with the master board. The number following is the board address which sensors are adjusted (255 = the whole machine).
- **cmd: PC:** Serial command error. It is followed by the command string and the error code. This message is shown only if the error is not 0, unless the serial communication dump option is activated (see 8.2).
- **root: Slave restarted:** The slave boards are reset after a communication problem. It is followed by a description string like the one in “root: System started with”.
- **ffile: Time adjusted from:** The internal clock is adjusted by a command or by the automatic daylight save change.
- **cmd: Parameter fixate on:** The programmed parameters are written onto a non-volatile structure. The number following is the board address which sensors are adjusted (255 = the whole machine).
- **cmd: Start Boot-Loader:** The firmware update process begins; the bit-coded number of the involved slaves follows.
- **proc: Warm up from idle for xxx min** Automatic warm-up process after xxx minutes of inactivity.
- **proc: Bag status** Bag status; it is followed by a string like:

```
proc: Bag status: [ - ]
```

  Where the field enclosed between square brackets may be one of the following characters:
  - Bag ok.
  e Bag empty.
  f Bag full.
  i Bag infect.
  ? Bag blocked.
- **root: Slave inquiry:** Slave status at end of operation; it is followed by a string like:

```
root: Slave inquiry: [ --------M------- ]
```

  Where, enclosed by square brackets, each position is a board address on the internal 485 bus (16 positions, numbered from 0 to 15); each position may be one of the following characters:

- Slave ok.
N Communication error for this slave.
B,b Unexpected reset of a slave board (maybe power supply problems).
k Slave board not responding (maybe the board is blocked, powered off or the communication link doesn't work).

- **proc: Fill:** Number of banknotes for each store; it is followed by the 8 values.
- **root: Door check** Door and locks status (where these functions are enabled).
- **user:** User message (free form message written by the application program).
- **root: Bonnet pulled out** The bonnet has been removed.
- **root: Bonnet replaced** The bonnet is replaced.
- **root: Door opened (or bag/cover unplugged, if present)** Safe door is open, or bag/cover is unplugged.
- **root: Door closed (or bag/cover OK, if present)** Safe door is closed, and bag/cover is plugged correctly.
- **proc: Resume start** Resume process start.
- **proc: Resume end, code:** Resume process end, with error/warning.
- **root: : Bag infect** During the last process a note has infect the bag; countings may be wrong
- **ffile: Boundary of block:** Beginning of a new log block of memory.
- **cmd: Alarm launched:** An alarm output is activated; it is followed by the alarm source and the output involved.
- **bim: Denominations:** Currencies handled by the banknote identification module (only in some configurations).
- **cmd: Crs:** Info message during the accounting data restore procedure, following a firmware update.
- **init: Counters migrated** Info message during the automatic accounting data migration between firmware release, following a firmware update.
- **cmd: Bim firmware download start** Start of the firmware upgrade of the banknote identification module.
- **cmd: Bim firmware download end** End of the firmware upgrade of the banknote identification module.
- **root: Clean necessary** It is necessary to clean optical sensor and banknote recognition module.
- **root: Bag OK** Self-sealing bag engaged correctly.
- **root: Bag not open/inserted or chassis not closed** Self-sealing bag not engaged correctly, or chassis not correctly closed.

7 Exception description

All blocking errors (the log line starts with 'E' or 'e'), the field D3 holds the area code of the involved parts. The area codes are explained in 3.1.1.

All the values of the event line are hexadecimal (base 16).

Cod.	*Mnem*	*Data1*	*Data2*	*Data3*	*Description*
001	-	-	-	-	Internal error
002	-	-	-	-	Internal error
003	GVAF PVAF SGET SPUT	Data length	Sent data (first 4 bytes)	Command (first 4 bytes))	Command error *(The application software issued a malformed command; check its configuration)*
003	COUI	Memory address	Counter size	-	Internal error
004	DBFP	-	Pointer	PC command	Internal error
004	PBAL	-	“	“	Internal error
004	PBFR	-	“	“	Internal error
005	SCRT	00 E0	Banknote parameters *normal deposit: 00 00 ID 00* *dimensional deposit: YY XX ID 00*	Banknote id	The banknote maybe jammed in the transport. *(XX = length, YY = height, ID = unique progressive number)*
005	SCRT	00 E1	“	“	Banknotes too close together *(There should be more gap between notes; check the banknote feeder).*
005	SCRT	00 E2	“	“	Banknotes too close together *(There should be more gap between notes; check the banknote feeder).*
005	SCRT	00 E3	“	“	Banknote overlap *(Banknote too opaque or more than one banknote overlapped).*
005	SCRT	00 E4	“	“	Banknote misaligned *(Check the aligner).*
005	SCRT	00 E5	“	“	Banknote not identified *(The “piece of paper” seems not to be a banknote).*
005	SCRT	00 E6	“	“	Unhandled banknote *(The sensor identifies the banknote but the currency is not programmed into the machine:synchronize the sensor with the machine or check the machine's configuration.* *This error is normal for the dimensional deposit; in this case reports a not identified banknote.*
005	SCRT	00 E7	“	“	Unclassified banknote *(The identification module misses this banknote: maybe it is too close to another banknote; if it persists, the sensor may be defective).*

Cod.	*Mnem*	*Data1*	*Data2*	*Data3*	*Description*
005	SCRT	00 E8	"	"	Unexpected banknote *(During the power on self test, some banknotes exits the machine unexpectedly; they may belongs to a previous aborted operation).*
005	SCRT	00 E9	"	"	The store is full *(The banknote is rejected because its recipient is full).*
005	SCRT	00 EA	"	"	Transport speed fault *(The transport speed is outside range: check the transport system).*
005	SCRT	00 EB	"	"	Environmental noise *(The sensor is disturbed by light).*
005	SCRT	00 EC	"	"	Not genuine banknote *(The banknote's dimensions are correct but it don't seem to be a genuine banknote.* *For some configurations, this message is not present and substituted by the forgery counter).*
005	SCRT	00 ED	Banknote parameters *normal deposit: 00 00 ID 00* *dimensional deposit: YY XX ID 00*	Banknote id	Transport failure *(This banknote is rejected because may be overlapped with the preceding one)*
005	SCRT	00 EE	"	"	Store problem *(the store failed to collect the banknote: motor was stopped; check the store).*
005	SCRT	00 EF	"	"	Store problem *(the store failed to collect the banknote: it was too close to the preceding one; check the banknote feeder).*
005	SCRT	00 F0	"	"	Store problem *(the store failed to collect the banknote: unknown reason; check the store).*
005	SCRT	00 F5	"	"	Diverter problem *(the banknote was recognized, but the diverter doesn't move and the note is discarded).*
005	SCRT	Other codes	CCxxxxxx Where CC is the BCE class		Simple reject *(The banknote is forgery or alike (doubtful) or the destination store is full. See 7.7.13).*
005	Other values	-	-	-	Debug info *(This is only a diagnostic information).*
006	DEPO	Time	-	-	Debug info *(This is only a diagnostic information).*
010	ADCO	DAC channel	Offset and read value *OO AA*	-	Hardware error *(The calibration test for the motor current circuit fails; replace the board).*
010	COUI	-	-	-	Hardware error on the master board *(The non volatile memory is missing or defective or too small; replace the memory or the entire board).*
010	NVRM	Bad blocks	Initial status	-	Hardware error on the master board *(A block of the non volatile memory is corrupted: replace the memory and reconfigure the machine).*
010	POWR	-	-	-	Hardware error on the master board *(The "power fail" sense circuit is missing or faulty: the machine can operate but a power off may compromise the data integrity; check the power supply and the main board).*
010	WRCH	Device and	Data read and	-	Hardware error on the board *(The internal machine communication doesn't work: replace the*

Cod.	*Mnem*	*Data1*	*Data2*	*Data3*	*Description*
		channel address *DD CC*	write *RR WW*		*board).*
011	POWR	-	-	-	Operation error *(The machine was turned off during an operation; check the accounts and empty it if needed).*
012	PSCV	Filter	-	-	Operation error *(The safe is open at the power-on, or the bag is unplugged: the machine stops for safety reasons; close the safe, and check if safe and cover are plugged. Then reset the device.)*
013	BONN	Filter	-	-	Operation error *(The bonnet is open; replace the bonnet, then reset the device).*
014	SUPR	-	Config	Marker	Configuration error *(IButton on board isn't properly configured.)*
016	SORE	-	-	-	Block during resume process *(No communication between mainboard and headboard; check the connection and the state of the board, especially the supply voltage; if necessary, replace the board).*
016	REFA	-	-	-	Resume process failed *(The resume process is failed; risk of bag infection; manually remove notes)*
016	Others	-	-	-	Warning during resume process *(Only for CIMA internal use)*
020	OSTC	Task	-	-	Internal error
021	OSTC	Task	-	-	Internal error
022	OSTC	Task	-	-	Internal error
023	RMTC RMTW SEND SNDR SNDS	Receiver	Data	Message type	Internal error *(This error may happen during an "abort process"; don't care).*
024	RMTC RMTW SEND SNDR SNDS	Receiver	Data	Message type	Internal error *(This error may happen during an "abort process"; don't care).*
025	OSTD	-	-	-	Internal error *(If it persists, replace the board).*
026	R485	-	-	-	Communication error between boards *(The internal bus 485 is troubled).*
027	OSRC	RTT handle	Function address	-	Internal error *(If it persists, replace the board).*
028	OSRC	RTT #	Function address	-	Internal overflow *(If it persists, replace the board).*
029	RMTC RMTW SEND SNDR SNDS	Receiver	Data	Message type	Hardware error on the board *(A board address is missing; maybe the board is not connected).*
050	FILE	ID	memory address	-	Hardware error on the master board *(The flash memory is defective: replace the board).*
051	FILE	Status register	Block address	-	Hardware error on the master board

Cod.	*Mnem*	*Data1*	*Data2*	*Data3*	*Description*
					(The flash memory is defective: replace the board).
052	FILE	Status register	Address	-	Hardware error on the master board *(The flash memory is defective: replace the board).*
053	FILE	Status register	Address	-	Hardware error on the master board *(The flash memory is defective: replace the board).*
060	FLSE	Block	Address	-	Hardware error on the board *(The parameter memory is defective: replace the board).*
061	FLSP	Block	Address	-	Hardware error on the board *(The parameter memory is defective: replace the board).*
063	NVRM	Bad blocks	Status	-	Non volatile memory fault *(The parameter area is not valid; it is normal during a firmware upgrade, otherwise the board has to be replaced).*
063	LISB LISD	-	-	-	Non volatile memory fault *(The parameter area is not valid; it is normal during a firmware upgrade, otherwise the board has to be replaced).*
064	BTLD	Board	Bootloader answer	Time	Bootloader error *(The bootloader of the board encountered a problem while downloading the firmware to the flash eprom; retry the download and, is still unsuccessful, replace the board).*
160	SOLE	Actuator time	Operation 00 dd xx yy (dd = 1 stuck open, 2 = stuck closed)	-	Diverter error *(The diverter is stuck in the wrong position: check the diverter).*
160	SOLD SOLE	Wrong position: 0= closed, 1= open.	-	-	Diverter error *(The diverter is found to be in the wrong position during the operations, without having activated it; the software cannot reset the diverter. Check the transport).*
162	OVCU	-	-	-	Overcurrent error *(The current adsorbed by a motor is toot high)*
16A	SOLD	Wrong position: 0= closed, 1= open.	-	-	Diverter warning *(The diverter is found to be in the wrong position during the operations, without having activated it; the software reset its position. Check the transport).*
180	SETR	Sensor #	-	-	Sensor error *(The sensor is not calibrated; reset the machine or issue a calibration command).*
182	SEAS	Sensor #	-	-	Sensor self adjust error *(The receiver is always lighted: check the connections).*
183	SEAS	Sensor #	-	-	Sensor self adjust error *(The receiver is never lighted: check for the presence of something jammed at the sensor).*
185	GLTC	Sensor #	Time elapsed (ms)	-	Glitch on sensor (A sensor is malfunctioning and produces glitches at its output: clean or replace the sensor. Remark: sometimes it may occur with polymer banknotes)
18B	SETR	Sensor #	-	-	Sensor error *(The receiver is always lighted at operation start: check the connections).*
18C	SETR	Sensor #	-	-	Sensor error *(The sensor is covered at operation start; check for the presence of something jammed at the sensor).*
18D	DEPO SETR	Sensor #	-	-	Sensor error *(The sensor is covered at operation end; check for the presence of something jammed at the sensor).*
1A0	DIAG	Motor #	Rpm set /	-	Motor's encoder disturbed

Cod.	*Mnem*	*Data1*	*Data2*	*Data3*	*Description*
			measured		*(The speed measured is greater than required; check the encoder).*
1A1	DIAG	Motor #	Rpm set / measured	-	Motor stuck *(The measured speed is less than required; check the transport and the motor).*
1A3	DIAG	Banknote # *10	Step	-	Jammed banknotes *(Check the transport).*
1A6	FITT	Banknote type	Banknote identifier	-	Jammed banknotes *(One or more banknote are jammed in the transport at the end of operation).*
1AA	DEPO	Step	Cover time	-	Jammed banknotes *(One or more banknotes are jammed over a sensor; check the transport system).*
1B0*	LOCe	-	-	-	Bag motor stuck *(During a sealing process, motor is running, but the on-motor encoder doesn't sense any movement; check motor cabling, transmission).*
1B1*	LOCd	-	-	-	Bag motor wrong direction *(During a sealing process, the motor moves in the wrong direction; check motor cabling).*
1B2*	LOCt	-	-	-	Bag process timeout *(Timeout in reaching the plate correct position during the sealing process).*
1B3*	LOCs	-	-	-	Bag wrong state *(Bag isn't in correct position at the end of the sealing process, or power failure during the proces, or the door is opened during the processs).*
1B4*	LOCc	-	-	-	Bag motor overcurrent *(During a sealing process,current in opening is too high. Check transmission).*
1B5*	LOCl	-	-	-	Bag motor stuck *(During a sealing process, motor is running, but the plate's movement to lock the bag is too short. Check the bag, then check the motor cabling).*
1B6*	LOCa	-	-	-	Bag sealing: resume failed *(Device tried to resume the sealing after a power-off, but an error occurred).*
1C0 1C1 1C2 1C6 1C7	SRNK SRPC	-	-	-	PC communication error *(Maybe a problem in the connection cable or in the PC itself or in the application program settings).*
1CA	ISPC	BaudRate	-	-	Wrong parameter *(The machine baudrate is wrong: reconfigure the machine).*
1CA	PPAV	Parameter #	-	-	Wrong parameter *(A parameter value is outside of its allowed range: check the configuration).*
1CB	PPAV _wPA	Parameter #	-	-	Wrong parameter *(A parameter is not changeable: check the configuration).*
1CC	GPAA PPAV WRPA _wPA	Parameter #	-	-	Wrong parameter *(A parameter is unknown: check the configuration).*
1CE	PPAV	Parameter #	-	-	Parameter busy

* Only with self-sealing bag configuration

Cod.	*Mnem*	*Data1*	*Data2*	*Data3*	*Description*
					(A parameter is not changeable at the moment: check the configuration and the state of the machine).
1CF	PAIN	-	-	-	Parameter area corrupted *(The parameters for a board are corrupted; it is normal during a firmware upgrade, otherwise replace the board).*
1D0	SUPR	Operation	Command	-	Operation error *(A board is already busy with another process, when requesting an operation; typically a wrong sequence during service tests).*
1D0	DEPO	Board	-	-	Operation error *(A board is already busy with another process, when requesting an operation; typically a wrong sequence during service tests).*
1D0	CHCK	Board	-	-	Initialization error *(The initialization phase for a board takes too long, more than 10sec.; if the problem persists, replace the board).*
1D1	DEPO DIAG RMPE RMSE WSAN	Board	-	-	Slave board error *(A slave board doesn't react anymore; check the connection and the state of the board, especially the supply voltage; if necessary, replace the board).*
1D2	INIT	Board	Status: F1 = only bootloader FF = absent	-	Slave board error *(A slave board is not addressable at the power on; check the connection and the state of the board, especially the supply voltage; if necessary, replace the board).*
1D4	DEPO	-	-	-	Head board error *(The head board doesn't react correctly for a specific command; check the connection and the state of the board, especially the supply voltage; if necessary, replace the board).*
1D6	PREL	Board	-	-	Slave counting error *(A store dispenses more banknotes than requested; check the store).*
1D8	BWIN	Step	Banc: TTTT NNNN T = Type code N = identifier	-	Banknote transport error *(A banknote is jammed in the transport and doesn't reach the "step"; see 7.6).*
1D8	LBIN LBMO LBRD	Banknote type	Banknote identifier	List base	Banknote transport error *(A banknote is stuck in the transport system; this is a secondary message so don't care it)*
1D8	LBOU	Banknote type	List base	-	Banknote transport error *(A banknote is stuck in the transport system; this is a secondary message so don't care it)*
1D8	LBSM	Step	-	-	Banknote transport error *(A banknote is stuck in the transport system; this is a secondary message so don't care it)*
1D8	LBSG LBST	Step	Banknote type code	-	Banknote transport error *(A banknote is stuck in the transport system; this is a secondary message so don't care it)*
1D8	LBSW	Step	List base	-	Banknote transport error *(A banknote is stuck in the transport system; this is a secondary message so don't care it)*
1D9	COUA	Banknote type	Count	-	Internal error *(The counter memory is over: reduce the number of currencies handled at the same time).*
1DB	DEPO	Step	-	-	Banknote transport error *(A banknote reaches a sensor outside its time slot: check the transport).*
1DE	INFE	Banknote type	1 = without moving motor	-	Bag infected

Cod.	*Mnem*	*Data1*	*Data2*	*Data3*	*Description*
			2 = moving motor		*(A note has infect the bag; countings may be wrong)*
1E0	DEPO	Banknote type	Banknote identifier	Time	Banknote transport error *(A banknote is stuck in the transport; this is a secondary message so don't care it)*
200	SRBI SRBT	-	Command (hex)	-	Error of the banknote identification module *(Not responding or absent).*
202	SRBI	Sensor answer (hex)	Command (hex)	-	Warning of the banknote identification module *(Faces too dirty: clean the face plates of the module).*
203	SRBI	Sensor answer (hex)	Command (hex)	-	Error of the banknote identification module *(Sensor's diagnostic error).*
204	SRBI	Sensor answer (hex)	Command (hex)	-	Error of the banknote identification module *(Too many environment noise, either magnetic or light).*
205	SRBI	-	Command (hex)	-	Warning of the banknote identification module *(Missing answer).*
206	SRBI	Sensor answer (hex)	Command (hex)	-	Warning of the banknote identification module *(Forbidden command: maybe the sensor misses a optional feature which is requested. Check the machine configuration).*
207	SRBI	Sensor answer (hex)	Command (hex)	-	Warning of the banknote identification module *(The banknote synchronization with the machine has failed; check the machine configuration. Note that on certain sensors, it is not possible to change again configuration in less than 10 min).*
209	DEPO	-	-	-	Error of the banknote identification module *(Generic error in banknote identification module; check previous warnings of banknote identification module on logs).*
20C	SRBC SRBD	Sensor's error code	Internal command	-	Error of the banknote identification module *(Sensor's diagnostic error at operation start).*

Whenever the description says to *"check"* something, refer to the service manual for the proper troubleshoot operations.

In the next paragraphs the principal errors will be explained.

7.1 Errors on the pass-through sensors

These error codes are in the form **EX:**x**18**x. They refers to the banknote pass through sensors, which detect the banknote position; these sensors are identified by the couple of numbers **SN:** and **D1:**.

Example:

```
e 21/08/06 17:55:53 EX:A180 SETR SN:071A D1:0003 D2:00000000 D3:00000010 ST:000024E5
```

This line marks a failure on the sensor #3 of the board at address 7 (7 hexadecimal); remark that all values of the event line are hexadecimal. The following table will help to identify the electronic component by its function, starting from the **SN:** and **D1:** pair.

SN	D1	DESCRIPTION
SN:07xx	D1:0000	Clutch on sensor (in the middle of the aligner).
SN:07xx	D1:0001	Output sensor (close to the outlet).
SN:07xx	D1:0003	Bag counting sensor (placed immediately before safe entrance).
SN:07xx	D1:0004	Synchronization sensor (placed in the input vertical part of the internal transport system, before banknote identification module).
SN:07xx	D1:0005	Clutch off sensor (the first one after the banknote feeder).
SN:07xx	D1:0006	Diverter control sensor (in the horizontal part of the transport system, in the middle of the main transport)

The position of the sensors in the transport is shown in Fig. 2.

The sensor here described, are named “pass through” because they signal the banknote transit through them.

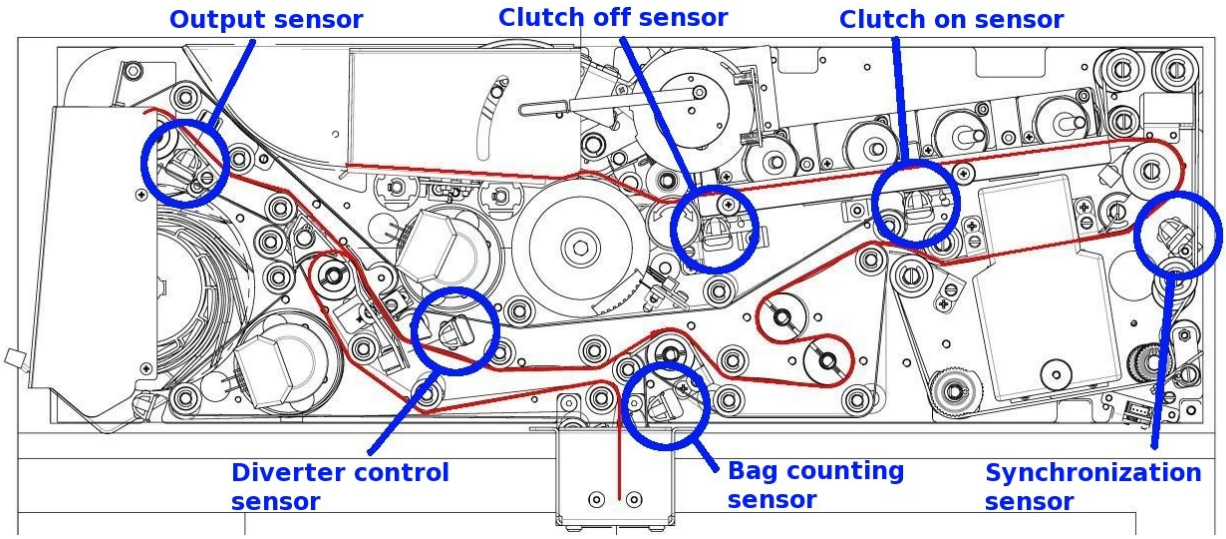

Fig. 3: Pass through sensor (transport)

The pass-through sensors need to be calibrated in order to achieve the correct light emission from the transmitter side. This operation is made through the service application program or automatically during the power on self test (after machine power on). The sensors have to be free from any obstruction in the light path, during the calibration.

Important: the errors for the pass through sensors may happen both during an operation and during the calibration activity. The latter are much more detailed, so it is recommended to calibrate the sensors before proceeding with the troubleshooting.

7.1.1 Code 180: Generic error on the pass through sensors at the beginning of operation

The sensor is not properly calibrated. Proceed with the calibration procedure: if the sensor passes it, consider the opportunity to replace the board (unless it is a new one) because its configuration may be faulty.

7.1.2 Code 182: The receiver sensor is always lighted

During the calibration process, the sensor is tested before turning it on (the transmitter) to verify if it is able to signal the interruption of the light by a banknote. Since the same situation happens when the sensor is not connected, this error may evidence a cabling problem.

Troubleshooting list:

1) Check the connections of the sensor
2) Replace the sensor
3) Replace the board

7.1.3 Code 183: The receiver sensor is never lighted

As opposite to the previous code, during the calibration process, the receiver sensor doesn't signal the light presence even if the transmitted is powered at its maximum intensity. Normally it is due to the presence of something in the light path, over the sensor.

Troubleshooting list:

1) Check for the absence of banknotes (or other things) over the sensor
2) Check if the sensor and its light guide are mounted correctly
3) Check the connections of the sensor
4) Replace the sensor
5) Replace the board

7.1.4 Code 185: Glitch on sensor

During a process, a defective or dirty sensor could produce a glitch at his output. A glitch denotes a malfunctioning of the sensor.

Remark: sometimes it may occurs with polymer notes, even if the sensor isn't dirty or broken.

Troubleshooting list

1. Clean the sensor
2. Replace the sensor

7.1.5 Code 18B: The receiver sensor is always lighted at operation start

Very close to the code 182 (paragraph 7.1.2), but at the **beginning** of an operation. If the sensor is broken, the calibration should fail as well; otherwise may there be an occasional interruption of connections.

7.1.6 Code 18C: The receiver sensor is never lighted at operation start

Very close to the code 183 (paragraph 7.1.3), but at the **beginning** of an operation. Maybe a piece of paper is still jammed over the sensor since the previous operation.

7.1.7 Code 18D: The receiver sensor is never lighted at operation end

Very close to the code 183 (paragraph 7.1.3), but at the **end** of an operation. Maybe a piece of paper or a banknote is jammed over the sensor.

7.2 Errors on actuators

These error codes are in the form **EX:**x**16**x. They refers to the diverter and its actuator (solenoid); it is used to determine direction (bag or output tray) for the banknotes.

The actuator combines a solenoid, which acts the diverter, and a sensor, which checks the diverter position.

Example:

```
E 11/10/07 11:40:26 EX:A160 SOLE SN:070A D1:0000 D2:000A0101 D3:00000010 ST:00011258
```

is an error on the solenoid.

7.2.1 Code 160: Actuator stuck in the wrong position

The diverter is actuated but its status sensor doesn't report the correct position, even after the maximum switching time allowed. Typically, this means that the diverter doesn't move at all.

This problem may be due to:

1) Jammed banknote across the diverter.
2) Defective status sensor.
3) Connection problem.
4) Electronic board failure.

The error line interpretation depends also on the mnemonic code (see the error reference table, chapter 7).

Example #1:

```
E 11/10/07 11:40:26 EX:A160 SOLE SN:070A D1:0000 D2:000A0101 D3:00000010 ST:00011258
```

The solenoid doesn't close (D2:000Axxxx); so, with the mnemonic “SOLE”, the number D2 specifies the type of error:

- “SOLE” -> D2:000Axxxx -> “stuck out position (doesn't go in bag position)”
- “SOLE” -> D2:000Bxxxx -> “stuck bag position (doesn't go in out position)”

Example #2:

```
E 11/10/07 11:50:39 EX:A160 SOLD SN:0714 D1:0004 D2:00000000 D3:00000010 ST:00023D36
```

The solenoid connected went to bag position (without software activation) while it should be still to out position (D1:0004) it means:

- “SOLD” -> D1:0004 -> “wrongly in bag position while should be in out position” (and it's too late to move the diverter)

The software cannot set it to the correct position because there is a banknote across it (the diverter control, pass through sensor, detected a banknote). There is only this type of error; other cases aren't blocking (cod. 16A).

7.2.2 Code 16A: Actuator stuck in the wrong position (resettable)

The diagnostic system checks regularly whether the diverter is in the correct position or not; it may happen (rarely) that it switches itself without software intervention, only due to a transport trouble.

If something is wrong, the actuator is activated to restore the correct diverter position, unless there is a banknote across it. In the first case, no exception is thrown but only a warning message with code 16A; the latter case is already explained in the code 160.

The warning line looks like the following:

```
W 11/10/07 11:50:39 EX:616A SOLD SN:0714 D1:0003 D2:00000000 D3:00000010 ST:00023CDE
```

Where D1:0003 means that the solenoid was found in bag position:

- “SOLD” -> D1:0001 -> “wrongly in out position (but the diverter can still be moved)”
- “SOLD” -> D1:0002 -> “wrongly in out position ” (and it's too late to move the diverter)
- “SOLD” -> D1:0003 -> “wrongly in bag position” (but the diverter can still be moved)

If the forced activation fails, there will be a second error, code 160, after this one.

7.3 Errors on the transport

These errors codes are in the form **EX:**x**1A**x. They refers to problems to the motors and to the banknote transport.

The speed of each motor is checked through an encoder tied to the transport section moved by the same motor; so the test checks also the quality of this mechanical part of the transport.

The diagnosis system checks if the speed is not too low (which lead to a immediate stop of all motors that feed the area at fault) and not too high (in which case only a warning is issued).

Motor positioning is shown in Fig. 4.

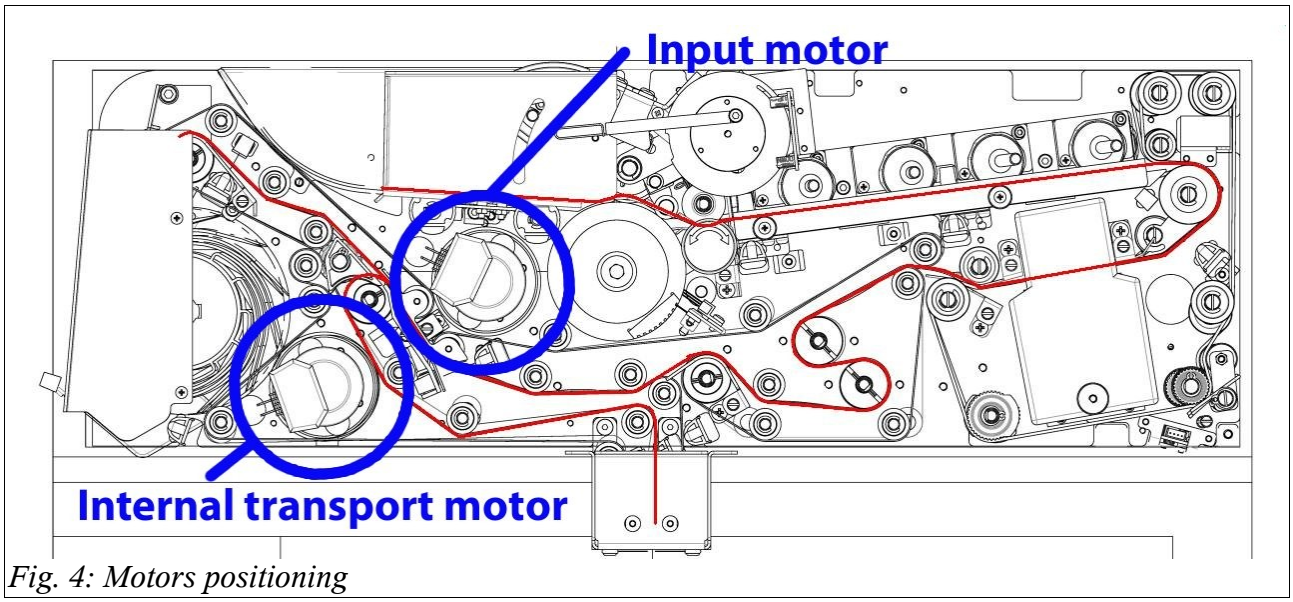

Fig. 4: Motors positioning

7.3.1 Code 1A0: Motor speed too high

The measured speed is too high; it is due to difficulties in transport (in this case, usually comes with 1A1),or to noise in the measuring circuit. For this reason this message is only a warning.

The origin of noise may be of:

- The connection of the encoder is faulty.
- The encoder optical sensor is defective.
- The electronic board is defective.

A few messages with this code don't lead to a true problem and no servicing has to be done; however, several messages may reveal either a machine configuration or a mechanical transmission problem (maybe after a technical service).

7.3.2 Code 1A1: Motor speed too low

The measured speed is either too low (less than 80% of its nominal value) or the motor is completely blocked. This error could be caused by a banknote jam in the transport, problems on the transmission, or in the electronic boards.

Troubleshooting list:

1. Check that no jammed banknotes or other things are blocking the transport.
2. Check manually the mechanical torque.

3. Check if all the belts are in the correct position.
4. Check the belt tensioning.
5. Activate the motor with the service application, then check its movement and the measured speed.
6. If the motor doesn't move, check the connections or replace the board or replace the motor.
7. If the motor works correctly but a valid speed value is not measured, check the encoder, its connections or replace the board.

The motor is identified by the numbers **SN:** and **D1:**. They are shown in the following tables.

SN	*D1*	*DESCRIPTION*
SN:07xx	D1:0000	Input motor (input tray and aligner)
SN:07xx	D1:0001	Main internal transport motor (notes recognition sensor, main transport, output tray)

REMARKS:

1. The DC motors are software controlled to achieve a constant speed; so their encoders are used for such a control and not only for diagnostic purposes. These motors are:
    1. Input motor.
    2. Main transport motor.
2. The input motor doesn't throw any exception even if the speed drops too low.
3. There are encoders which are not linked to transport motors; they are neither linked to the speed diagnostic function here described.

Exception examples in the log:

- Main transport motor
  ```
  E 11/10/07 12:28:55 EX:A1A1 DIAG SN:0732 D1:0001 D2:3D1855F0 D3:0000000C
  ST:0000DD35
  ```
  The analysis of the field D2 shows that the expected speed is 22000 rpm*10 (55F0 hex) while the measured speed is 15640 rpm*10 (3D18 hex).

7.3.3 Code 1A3: Banknote transport error

Too many banknotes are detected in between of two sensors and they may be jammed there. The operation is stopped to prevent a huge stack of banknotes jammed in the transport.

The only remarkable data is in the field D3 which codes the affected areas (in hexadecimal format, see 3.1.1), and in the field D2, where is mentioned first of two sensor involved with jamming.

7.3.4 Code 1A6: A banknote is jammed in the path

The diagnostic system detects that one or more banknotes haven't reached their destination and should be still into the path (i.e. the last banknote reached the N^{th} sensor but missed the $(N+1)^{th}$ and following).

Also here the remarkable data in the exception line is the field D3, who has the affected areas (coded in hexadecimal format, see 3.1.1).

7.3.5 Code 1AA: Jammed banknote

A pass through sensor has a banknote across it for a too long time: a banknote jam is assumed over this sensor and the operation stopped.

The field D1 has the logical step (see 7.6), and the field D3 has the area code (see 3.1.1).

If the pass through sensor is a store counter (SN:00xx to 07xx and D1:0001), the store itself is disabled since it's not possible to assure its counting. When a store is disabled, the machine is still working but this store will not get any banknote and not dispense them either (unless a special option is set). To get back the store working, it is necessary to empty it out.

7.4 PC communication errors

7.4.1 Codes from 1C0 to 1C7: PC serial errors

These error codes are related to communication problems between the machine and the PC.

```
W 20/02/08 11:37:17 EX:41C6 SRPC SN:0896 D1:0003 D2:00000001 D3:00000B3B ST:00BD066F
```

A few error like these is normal onto a communication line; 2 or 3 messages of this kind each day are tolerable.

During special operation like firmware upload there are always some of these messages, without real failure; it is allowed to have a peak of communication errors while uploading the master board firmware.

However, if there are many PC serial errors, sparse in the day of activity, and the user complains about sluggish or faulty operations, it is suggested to check the following:

- If the PC is connected to the machine through an RS232 cable, check the cable itself, the PC and the machine. The simplest way to do this is to operate the machine with another PC (and another cable).
- If the PC is connected to the machine through an USB or Ethernet port, check the converter boards (USB<->RS232 and Ethernet<->RS232) inside the connection box of the machine.
- If the errors come out seldom (but more often than 2 or 3 per day), the problem may reside in a faulty electrical ground connection of the machine and/or the PC.

7.4.2 Codes from 1CA to 1CE: Parameter programming errors

The parameter programming procedure fails; usually this is not a machine fault, it is either a bad configuration data set or a bad state of the machine.

The parameter has to be programmed in the idle state of the machine.

7.4.3 Code 1CF: Parameter's memory corrupted

The parameter data set stored into the machine is no longer valid: it doesn't match the checksum codes. This situation is normal when coming from a firmware update or if the board is brand new. Otherwise it is a good advice to replace the board, even if a reprogramming of the parameters seems to be successful.

7.5 Slave boards errors

7.5.1 Code 1D1: Slave not responding

The addressed board (address value in the D1 field) suddenly doesn't respond to commands on the 485 bus. This code means also that the board was responding almost once during the power on self test, then failed (for a while or forever); but the board was connected and working at the beginning.

If the error is episodic, may reveal either a faulty 485 bus or defective power supply on the board. See 3.3.

Example:

```
E 11/10/07 12:47:20 EX:A1D1 WSAN SN:0814 D1:0007 D2:02000000 D3:00000007 ST:0005AA0F
```

The board address is in D1 (board 7).

7.5.2 Code 1D2: Slave absent

It is similar to the 1D1 code, however the board was never been responding and the diagnostic system stops to send messages to it, treating it as missing. A special case is if the board has no firmware on it yet.

The board address is in the D1 field.

7.6 Errors on the banknote transit

To deliver each banknote to its destination (either the bag or the outlet), the machine has its own logical image of the transport path named as “banknote list”. This is a logical structure which holds the actual position of each banknote, together with the estimated transit times (named “time windows”) through the sensors.

This logic structure lets the machine to activate all the actuators in the correct way and in the correct times as well as making diagnostic tests on the transit of banknotes.

This structure is also robust against jams and overlapping of banknotes during their path; sometimes indeed, a banknote may stop and may overlap the following one, going on as a single item.

In deposit, the “list” starts from the “enter” sensor and ends either at each store counter sensor or at the outlet.

Each relevant timing point in the “list” is referred as “step”; they are described in the following table:

Steps in the deposit operation		
SN:	***Step (D1:)***	***Description***
08xx	0	The banknote enters (covers) the **synchronizaton sensor**: it is a reference point for all timings and the list start point..
08xx	1	The banknote exits (uncovers) the **synchronizaton sensor**
08xx	5	The banknote enters (covers) the **diverter control sensor**. It is used to move the diverter.
08xx	6	The banknote exits (uncovers) the **diverter control sensor**.
08xx	9	The banknote enters (covers) the **output sensor**.
08xx	A	The banknote exits (uncovers) the **output sensor**.
08xx	B	The banknote enters (covers) the **bag counting sensor**.
08xx	C	The banknote exits (uncovers) the **bag counting sensor**.
07xx	7	The banknote enters (covers) the diverter control sensor: used also for timing test by the store itself.
07xx	9	The banknote enters (covers) the bag counting sensor: used also for timing test by the store itself and as a list end point.

7.6.1 Code 1D8, Mnemonic “BWIN”: A banknote missed a step

If a banknote enters the machine, goes through the “enter” sensor (is then listed) and suddenly misses a step or reaches it too late; the warning line looks like:

```
W 11/10/07 12:28:55 EX:61D8 BWIN SN:0814 D1:0005 D2:00E7DBC8 D3:00000008 ST:0000DD18
```

The step is in the field D1 (in the example is 0005).

Typically this error shows a speed problem on the transport related to one specific banknote; usually the banknote is jammed somewhere before the missed step. Actually, the following banknote have many chances to overlap the jammed one, freeing it and going on together with it; for this reason, the banknote after the jammed one is marked as “bad” (error code ED) and rejected.

Usually, this is not a machine fault but a transport problem of a troubled banknote.

Only in case this error appears too often, it may be symptom of either a wrong configuration of the machine or a faulty sensor (see the step table to found it).

7.6.2 Code 1D8, other mnemonic: Generic error on the “banknote list”

Is a group of warnings, typically as a follow-up of a “BWIN” or other banknote jams; they are sign of a difference between the list and the reality and are only warnings. Remark that “BWIN” kicks the banknote away from the list, but this may re-appear to another sensor.

Like “BWIN”, these errors are not related to a machine fault but only to a transport trouble (banknote about to jam, to fold, to tear, ... in the transport).

7.6.3 Code 1DB: unexpected banknote

An unexpected object (typically a banknote) crosses a sensor; the banknote, of course, is not in the list and the machine cannot know what to do with it; maybe a banknote previously removed from the list (“BWIN”), that reappears too late.

Example:

```
W 11/10/07 12:28:55 EX:41DB DEPO SN:0814 D1:0009 D2:00000000 D3:00000000 ST:0000DB1B
```

D1 has the step related to the sensor who detected the unexpected object.

Typical situations are:

- Two banknote so close that they are detected as one when entering the machine (slightly overlapped) then came apart during their journey.
- A banknote with a large tear (across almost all its width).
- A banknote which reaches a pass-through sensor too late; in this case there will be a “BWIN” before it.
- A banknote which reaches a pass-through sensor too early; in this case there will be a “BWIN” after it.

Like “BWIN”, this is usually not a machine fault but a transport problem of a troubled banknote.

Only in case this error appears too often, it may be symptom of either a wrong configuration of the machine or a faulty sensor (see the step table to found it).

7.7 Rejected banknote messages (mnemonic "SCRT")

This kind of message is logged when the banknote, directed to the outlet, crosses the output sensor.

This is not an error since it is part of the machine job to reject some banknotes. Only a plenty of these messages may reveal a malfunctioning part (typically the banknote identification module).

The majority of "SCRT" messages comes from the banknote identification module, which evaluates the banknote not suitable to be stored into the machine.

Example:

```
W 11/10/07 12:28:54 EX:4005 SCRT SN:0814 D1:00E5 D2:0000E400 D3:0000D846 ST:0000DA26
```

The following table explains simply the reason of the reject; for a deeper description please see next paragraphs.

Rejection CODE (D1 field)	Description	Reason and possible solution
E1	Banknotes too close (for the transport)	Insufficient feeder efficiency; check the feeder
E2	Banknotes too close (for the identification module)	Insufficient feeder efficiency; check the feeder
E3	Banknote overlapped (too dark)	Two or more banknote overlapping, or single soiled note; check the feeder
E4	Banknote not aligned	Insufficient aligner efficiency; check the aligner
E5	Unknown banknote	Not a real note; clean and check the identification module; check encoder and belts under the module
E6	Wrong configuration of the identification module	Identification module not synchronized with device; synchronize.
E7	Banknote not classified	Banknote not present in module database
E9	Bag full	The bag is full; empty the bag
EA	Banknote identification module encoder failure	Check the identification module encoder
EB	Environmental noise	Identification module is disturbed by light or electromagnetic interferences.
EC	Counterfeit	(Only if counterfeit detection active)
ED	Banknote overlapped	Insufficient feeder efficiency; check the feeder
01 -> DF	Simple reject	
F5	Reject following an error	Check device errors; if bag is infected, empty the bag

7.7.1 Code E1: Banknotes too close (for the transport)

The gap between two banknotes is too small to be compatible with the transport of the machine; this gap is measured between the end of one banknote and the beginning of the next one, at the position of the synchronization sensor.

A different test which leads to the same error is made at the entrance of the depositing store; in this case the first banknote has to leave the counter sensor before the following reaches the diverter control sensor of this very store.

In the first case, there are always two rejected banknotes, while in the latter one only one banknote is rejected.

The origin of this error is an insufficient feeder efficiency so the banknotes are not enough separated. However the feeder has to be adjusted only if there are many banknote rejected for this reason.

Be careful when adjusting the feeder.

7.7.2 Code E2: Banknotes too close (for the identification module)

Two banknotes are too close together to be accepted by the identification module; in this case the distance is measured from the beginning of one banknote to the beginning of the next one.

This test is made by the identification module itself and the requirement may change with the sensor model.

Like code E1, the origin of this error is an insufficient feeder efficiency so the banknotes are not enough separated. However the feeder has to be adjusted only if there are many banknote rejected for this reason.

Be careful when adjusting the feeder.

7.7.3 Code E3: Banknote overlapped

The banknote is too dark and may be made by an overlap of two or more of them; otherwise it may be a single soiled banknote.

7.7.4 Code E4: Banknote not aligned

The banknote is not properly aligned to the bottom side of the identification module. If the number of rejected banknotes exceed the 5% of the banknote deposited, either check the aligner mechanical setting or replace it, according to the procedure described in the service manual.

Be careful when adjusting the aligner.

7.7.5 Code E5: Unknown banknote

This the most frequent reject message: the banknote is not recognized as a banknote! It may be a sheet of paper, a unknown currency or simply a worn banknote.

If the number of this type of rejects is too high (more than 30% of the deposited banknote), check the following:

1. Clean the banknote identification module.
2. Check the transport belts through the identification module.
3. Check the encoder of this part of transport; the service application program has a function suitable for this test (dimensional check): it let to read the length of each banknote measured through the encoder by the identification module.
4. Check the banknote identification module.

7.7.6 Code E6: Wrong configuration of the identification module

The sensor identifies the banknote, but this type of currency / value is not handled by the machine. The module is not synchronized with the currency table of the machine.

After a configuration change on the machine, the module has to be synchronized; normally this is done automatically by the service application program. Also when the module itself is replaced, it need to be synchronized manually with the related command on the service application program.

If the dimensional evaluation of the banknotes is activated **(only for test)**, this error signals a banknote not identified (no synchronizing is required in such a case).

7.7.7 Code E7: Banknote not classified

The identification system has not classified the banknote, maybe due to a multiple feed of banknotes. If this error happens sometimes, it may show a low efficiency of the banknote feeder; see the code E1 for troubleshooting (this latter could be present).

If the error is frequent, maybe the machine is either not properly configured or the module (or its encoder) is defective.

7.7.8 Code E9: Bag full

The identification module has recognized the note, but slave board rejects it, due to the reaching of maximum capacity of the bag.

7.7.9 Code EA: Banknote identification module encoder failure

When the banknote passes across the module, its speed is wrong.

Check the transport, the machine configuration, the encoder or the module itself. Remark that, if the transport speed is too low, the diagnostic system should detect it before this error appears.

7.7.10 Code EB: Environmental noise

The banknote identification module is disturbed by the environmental light or by external magnetic fields.

7.7.11 Code EC: Counterfeit

The banknote is detected as counterfeit (it is a banknote but doesn't pass the genuineness test).

7.7.12 Code ED: Banknote overlapped

This is the code to reject the banknote next to a “BWIN” error.

7.7.13 Codes from 01 to DF: Simple reject

The banknote is a forgery or alike (doubtful); this is detected only if the sensor is type CasRay + pidsy; in these cases, the first two digits of data D2 holds the BCE class of the banknote:

- D2: **02**xxxxxx the banknote is a forgery
- D2: **03**xxxxxx the banknote is doubtful

For other values of D2, the banknote is good, but the destination store wasn't able to get it. This may be due to several reasons:

1) The bag is full (it has reached the maximum capacity).
2) The bag is infected, so cannot get more banknote until its emptying.

7.7.14 Code F5: Reject following an error

This banknote is rejected after a process aborted or after the bag has been infected.

7.8 Errors of the banknote identification module

The banknote module has its own diagnostic system. The following errors are given by the CDS707 diagnostic system and some of them are simply translations of the module diagnostic result.

The banknote sensor should be treated as a black box; except cleaning of the module surfaces, any problem leads to its replacement.

Any problem encountered during idle mode will arise only a warning; if this problem persists after the beginning of the process error 203 or error 209 will be thrown.

Code	Description
200	**Communication fault (blocking error)**
201	Initialization error
202	Dirty surfaces
203	**Banknote identification module defective (blocking error)**
204	Environmental interferences error
205	Missing answer error
206	Command not available
207	Selection failed error
209	**Module not ready at deposit start (blocking error)**

7.8.1 Code 200: Communication fault

The module don't respond on the serial connection. Check the connection, the module itself or the master board of the machine.

7.8.2 Code 201: Initialization error

The module initialization phase doesn't come to an end; the module is faulty.

7.8.3 Code 202: Dirty surfaces

The module has to be cleaned. It is still operating but the rejects rate may increase a lot and, in the long run, it may became defective. If the cleaning has no effect, replace the sensor.

7.8.4 Code 203: The banknote identification module is defective

This error code is linked to the sensor Cash-Ray90

The diagnostic system of the module reported an error; its code is in the first two digits of D1.

Example:

```
E 20/10/07 08:25:51 EX:A203 SRBI SN:08A0 D1:010F D2:0E000200 D3:00000004 ST:039B810D
```

In the example the error reported by the Cash Ray90 diagnostic is the code 01. Relevant codes are:

First two digits of D1 in binary mode. D1:**aa**0F	Description
aa = 00000000	No error
aa = xxxxxxx1	Module face plates too dirty

aa = xxxxxxx0	The module is defective

When replacing the module, label it with the first two digit code in the D1 field (module error code), together with the failure description.

If this failure is found not during a process, only a warning is thrown.

Please check preceding logs to find any malfunctioning of the identification module.

7.8.5 Code 204: Environmental interferences error

Shield the module from any external light and remove any external magnetic source. If the problem is still present, replace it.

7.8.6 Code 205: Missing answer error

Communication problem; check the connection between the master board and the sensor, check the master board and the module.

7.8.7 Code 206: Command not available

The module is requested to do a function which it has not installed. Check the machine configuration or the model of the module.

7.8.8 Code 207: Selection failed error

The module was not synchronized correctly; check the machine configuration and the model of the module. Remark that, some models don't allow to change configuration too often (once in 10 min for example).

7.8.9 Code 209: Module not ready at deposit start

When the deposit starts, the module was unexpectedly in a “not ready” status. If the problem is repeated, replace the module.

8 Parameters

This chapter describes a few parameters useful to the service engineers and changeable through the service application program. They are related to the machine hardware variation and to the setting of optional functions.

All the user setting, like currency and store setting, withdrawal delays and other safety settings, and so on, are not explained here but in the user manual.

8.1 "WorkMode"

Sets the hardware variants in this specific machine.

Their values have not to be worked out by the service engineers as they are supplied from the factory and should be written on a label attached to the plate (except for the default values).

These numbers have a checksum embedded on them, to protect themselves from errors or exchange.

Actually, the hardware variations and their workmode settings are:

	WORKMODE	Standard Canvas Bag (High capacity)	Self-locking plastic bag	Filling sensor	Banknotes compactor
MOT. DC (S/N: < 300)	**00006 – 00002** **00000-00000**[1]	X			
	00006 - 4000A	X		X	
	00006 - 6000E		X	X	
	00006 - C0009	X		X	X
	00006 - E000D		X	X	X
MOT. BRUSHLESS (S/N: >= 300)	10004 - 00002	X			
	10004 - 4000A	X		X	
	10004 - 6000E		X	X	
	10004 - C0009	X		X	X
	10004 - E000D		X	X	X

The bold numbers are the default ones.

A wrong setting of WorkMode leads to a non-working machine (configuration error 121).

8.2 "Opzioni" (options)

This parameter let to enable or disable several software options; it groups both user options and technical options and should be handled with care.

It is a 32 bit number (8 digits hexadecimal) and let to set up to 32 functions. All available options (for service engineers) are described here, while all other bits has to be set to 0.

[1] This value is contained on the device when it's initialized for the first time. It has the same meaning of the default value.

Default: all options are disabled (“Opzioni” = 0).

“opzioni” bit	Description
0	Reserved: leave at 0
1	Serial interface monitor: if set to 1 all serial command are logged in the log (except polling commands). Be careful, since this option increases a lot the log size, reduces its readability and reduces the history length.
2	Reserved: leave at 0
3	If 1, the machine records the transit of the banknotes through the sensors onto the log (exception messages with mnemonic “spy:”); the D1 field has the step number (see 7.1). Be careful, since this option increases a lot the log size, reduces its readability and reduces the history length.
4 ... 5	Reserved: leave at 0
6	If 1, the motor power supply (48V) is never turned off. Normally, when idle, the machine turns off the motor power supply to reduce waste of energy and to keep the machine itself cool. Set this only for testing purposes, unless explicitly required.
7	If 1, the banknotes are identified only by their dimensions (height and length); all other tests are disabled, including overlaps, skew, genuineness and fitness. The banknotes sensor acts only like a dumb length measure tool. This setting is useful to test the machine without having genuine banknotes (it is possible to use any piece of paper of the same size); however **it has to be not set** when the machine is operated by an user, since no good detection on the banknotes is done. To test the machine with sample of banknotes it is better to check the option “dimensional deposit” near the deposit button, since this doesn't affect the behavior for the user.
8 ... 10	Reserved: leave at 0
11	If 1 it enables the “pidsy” function on the Cash-Ray 90 (if applicable); this function let the sensor to detect counterfeit banknotes (while not retrieving them). It works only if the sensor has the “pidsy” function licensed on it.
12 ... 28	Reserved: leave at 0
29	If 1, the machine cannot work if powered with the door open (requires specific hardware).
30 ... 31	Reserved: leave at 0

8.3 “Diagnosi” (diagnostic options)

This parameter enables the various branches of the diagnostic system. It is useful in order to disable some diagnostic function during the troubleshooting. Remark that this should done only for troubleshooting, since removing any test function leads to a machine prone to mistakes. A working machine must have all diagnostic functions enabled. Actually this refers to all bits except 13.

It is a 32 bit number (8 digits hexadecimal) and let to set up to 32 functions. All available options (for service engineers) are described here, while all other bits has to be set to 0.

A working machine must have all diagnostic functions enabled

By default, this parameter has all the diagnostic functions enabled (actually except bit 13). The

corresponding code id **80004FFFL**.

Bit of "diagnosi"	Description
0	If 1, enables the pass through sensor tests (see 7.1)
1	If 1, enables the motor speed tests (see 7.3)
2	If 1, enables the banknote transport test (see 7.3)
3	If 1, enables the slave board tests (see 7.5)
4	If 1, enables the banknote "list" related tests (see 7.6)
5	If 1, enables the banknote sensor tests (see 7.8)
6	If 1, enables the actuators tests (see 7.2)
7	If 1, enables all the other tests not mentioned above.
8	If 1, let the machine be blocked by an exception thrown by a test function; this lead to an user error code 13 as command answer, and to the registration of the message "Abort process" in the log.
9	If 1, enables the self reset of the slave boards when not responding.
10	If 1, enables the power on self test (POST).
11	If 1, enables the input tray and outlet sensors test: to start a deposit the input tray has to be filled and the outlet has to be free; to start a withdrawal the outlet has to be free.
12	If 1, enables the warm-up function (short activation of motors before any operation, after the machine was idle for a long while).
13	If 1, enables the non-volatile memory data integrity test. **This function is disabled by default; don't enable it unless requested by the factory.**
31	If 1, enables the integral mode for the diagnostic system (see 3.5): every exception stops the whole machine. If 0, an exception stops only the machine areas which involves.

This parameter should be changed temporarily only for test purposes.

8.4 Other parameters

There are many other parameters to configure the machine. They belongs to one of the following two groups:

1. User parameters: they let to change the currency, the stores, the withdrawal delays and other safety settings. All these parameters are handled by application software or service application software. See the related application program manuals for their description.
2. Specific settings and adjustments: they are defined by Cima S.p.A. and should be changed only according to Cima engineers. They have to be treated as reserved so they are not described here.