NMD 050

Communication & Command Reference Manual 2019-02 Code

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1 INTRODUCTION

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1.1 Purpose

This document describes the application, session, data link and physical layer of the communication protocol implemented in the NMD.
The protocol is an emulation of the MDDM SD300 01-65 firmware.
The document is intended as a reference for system analysts and developers involved in the task of integrating NMD into dispensing automation products.

1.2 Overview

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1.3 Versions

This document is valid from the following firmware configuration.

CMC	2019-02.07
NFC	2006-03.16 or 2006-04.01
NCC	2007-02.08

1.4 Definitions and Conventions

1.4.1 Firmware version code

The six digit Firmware Version code, XXXX-YY.ZZ, is explained and changed as follows:

XXXX = Program Type. The two last digits indicate the module, hardware compatibility and functionality of the firmware.
XXXX= 2019 for NMD Central Machine Controller firmware NMD 50.

YY = Version Number. This number changes when new features or major functional changes have been made
For example:
New format of Command or Reply.
Limited function of Command.
Not compatible with old hardware or if the program is not compatible because of other major changes.

ZZ = Revision Number Changed when the program has been updated or corrected. The release is fully compatible with previous revisions

1.4.2 Conventions in this Manual:

Throughout this manual we will refer to standard ASCII characters enclosing them within brackets, meanwhile their internal hexadecimal value will be represented between inverted commas preceded by letter X.

Example:
The character combination 0A (zero and a letter A)

Hex. Value.....X’30’X’41’

1.4.3 Vocabulary

ATM	Automatic Teller Machine
CAN	Controller Area Network, a local area network
CCA	Cassette Communication Adapter
CMC	Central Machine Controller
DE	Denomination Extension
FR	Frame
FW	Firmware
I/F	Interface
MDDM	Multi Denomination Dispense Mechanism
NC	Note Cassette
NCC	Note Cassette Controller
ND	Note Diverter
Network	The external device where the application for the NMD is executed. The "network" could be a Host, a Terminal controller or a Personal Computer
NFC	Note Feeder Controller + FW included/
NF	Note Feeder
NMD	Notes and Media Dispenser
Note	“Note” also refers to other documents besides banknotes. With "note" is, besides banknote, also referred to other documents as value document etc. that is handled by the modules within the NMD.
NQ	Note Qualifier
PS	Power Supply
RV	Reject Vault

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2 PHYSICAL DESCRIPTION

2.1 System Structure

The standard NMD 050-configuration consists of a Controller with Firmware (CMC & FW), a Frame (FR), a Note Qualifier (NQ), a Note Transport (NT), a Reject Vault (RV) and a Note Cassette (NC).
The machine can easily be upgraded from 1 up to 4 denominations, by adding one Note Feeder (NF), one Note Feeder Controller (NFC), one Frame (FR) and one Note Cassette (NC) for each feeding position.

Required
• CMC 101
• FW 2019
• FR 100
• NQ 100
• NT 100
• NC XXX
• RV 150 or PS 126
• RV 150 or RT 100
Optional
• NF 101
• NFC 100
• FR 100
• TE 038
• TE 070

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3 LOGICAL DESCRIPTION

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3.1 Dialogue procedures

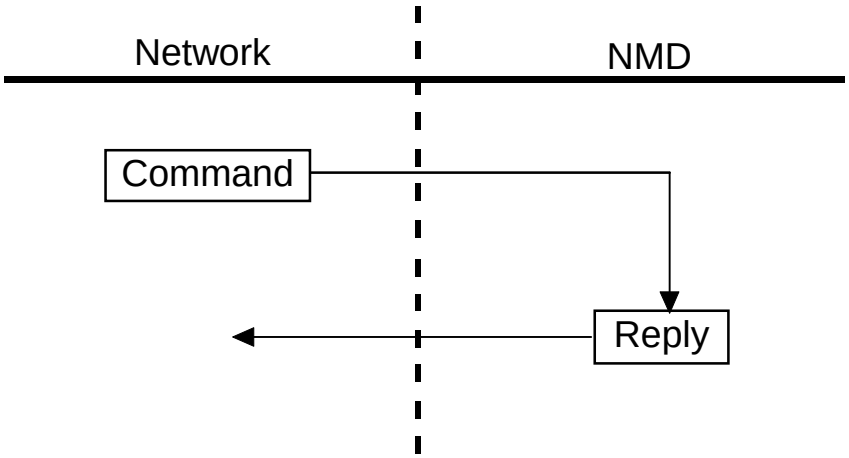
The NMD Controller is designed to be controlled by an external device. We will refer to this device as the NETWORK.
From the logical point of view, the NMD Controller cannot perform any operation without receiving a COMMAND from the Network.

After receiving a COMMAND, the NMD Controller will try to execute it, sending back to the network the adequate STATUS REPLY, regardless of whether the operation has been successfully executed or not.

On the other hand, the NMD will never send any message to the Network, unless it had been previously activated by a command.

The dialogue procedure between the NMD and the Network is always established in PAIRS OF MESSAGES, which must be initiated always from the Network.

Figure 3.1: Dialogue procedure



3.2 Commands overview

Possible commands available to handle the system are listed below. However, not all of them are strictly required for common operation at the user site. Each one of the commands is identified by an operation code, 1 byte long, in Hex code.

For everyday normal operation, only 5 commands are strictly required. These are:

X’32’ ……. MOVE FORWARD
X’35’ ..... READ CASSETTE-ID.
X’37’ ..... CLOSE CASSETTE
X’38’ ..... OPEN CASSETTE

Any Application Program to drive the NMD should always begin the “Start-of-day” procedure by sending to the system an "Activation Routine", which basically consists of two commands: the X’38’, OPEN CASSETTE, to put the Cassettes in operating position, and then the X’35’, READ CASSETTE-ID, to read the Cassette numbers.

X’38’ ..... OPEN CASSETTE
X’35’ ..... READ CASSETTE-ID

Each subsequent transaction should send an order to dispense the notes and deliver them to the exit (not teller) by issuing the X”32” MOVE FORWARD command.

For the end-of-day procedure, a X’37’ CLOSE CASSETTE, command must be sent, in order to unload the Cassettes

3.3 Status reply overview

As stated in paragraph 3.1, the dialogue procedure between the NMD and the network, is established in pairs of messages. That means that each one of the commands issued to the system will send its own REPLY STATUS MESSAGE back to the network.

In general terms, each reply message contains three different types of information:

- *General status code*
- *Hopper status code*
- *Relevant information data*

The *General status code* tells the network what the final result of the transaction has been. It is a 1 byte ASCII character, at the beginning of the reply message.

The *Hopper status code* gives information about the particular situation of each one of the different hoppers. It is also a 1 byte ASCII character, with the same coding as the General Status, to make its interpretation easy. Depending on the replying message, the *hopper status*es are located in different positions.

The *information data*, when necessary, gives detailed information as required by the corresponding command, like Cassette *ID-numbers*, number of notes dispensed from each hopper, and so on.

The *status codes* itself, both General and Hopper ones, provide the user with several kinds of information:

- Successful operation.
- Hardware problems.
- Software problems.
- Operation mistakes
- Communication problems.
- Cassette situation.

A detailed analysis of the different *status codes* will be done later on in this manual.

Some status codes can only appear when some of the special options for the NMD are installed. As far as the NMD is concerned, we will analyse each one of the different statuses in Section 5 of this document

3.4 Coding of Note Cassette

Each Feed Cassette is identified by a unique ID-number.

The first time a cassette is used, it must be programmed with its own ID-NUMBER, as explained below. This is normally done at manufacturing.

Throughout this manual we will be making references to the cassettes ID-NUMBERs and also to the Hopper numbers. It's extremely important to clearly understand both concepts. The ID-NUMBER has a 5-digit code.

Because of their electronic identification capability, the note cassettes can be loaded in any Feed Module. As we will see in detail later on, the notes dispense commands refer to the different Feed Modules. Therefore, it will always be necessary to set up a correspondence between each Feeder and the cassette it contains. This is what the Hopper Number is used for.

Each one of the different modules installed in the system is defined as a Hopper. Each Hopper will be internally identified by a one-digit code, which will be the Hopper Number. The first Module in the System is The Note Transport holding the Reject Vault (Tray). It will be reported as Hopper Number 0. The first Feeder connected will be reported as Hopper Number 1, the second Feeder as Hopper Number 2, and so on. Hopper 0 will always hold the Reject Vault or Reject Tray.

Coding cassettes in the NMD

Insert a Cassette in the Frame. Do not open the Cassette. The NMD mechanism will automatically latch the cassette to the Note Feeder at the first command changing the cassette coding. When cassette coding has been finished a command X'37' Close Cassette has to be issued to unlock the cassette. The cassette MUST BE REMOVED AND RE-INSERTED before it can be used for normal operation.

Currency/denomination cassette ID and Note size parameters

These parameters can either be set or changed with the CCA 100 or as described here in the NMD-machine with machine level commands Read/Write Data, WD/9H27, WD/9H28 respectively 9H29. For more details see Read Data and Write Data in chapter 4.
H shows the location, Note Feeder NF1=1, NF2=2 … NF4=4.
H=0 addresses the Reject Vault. '/' is the parameter delimiter.

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4 COMMAND AND REPLY STRUCTURE

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4.1 Data transmission

Communication between the NMD and the external network is performed through a standard V.24 port.

As we already have stated, the dialogue procedure is always performed in the same simple way: pairs of COMMAND-REPLY messages. Optionally using the standard V24 timing signals. Detailed information about ASCII character set and signal timing see section 6.

4.1.1 *Message format*

Commands format

The commands sent from the network to the NMD must conform to the following format:

C DDD...LL E

Where:

C	=	OPERATION CODE	1 Byte
D	=	DATA	0-250 Bytes
L	=	LRC	2 Bytes
E	=	EOM	1 Byte

The Operation Code can be any of the codes we already described in paragraph 3.2. Its length is always one byte.

The DATA Field is only required when using Commands:

X'32'	MOVE FORWARD
X'47'	SEND SELF TEST DATA
X'52' X'44'	READ DATA
X'57' X'44'	WRITE DATA

The LRC Field, Longitudinal Redundancy Check, is always two bytes long. It is used internally to test the accuracy of the received data. How to calculate it, is explained in paragraph 6.5.

The EOM Field is the End of Message indicator, and ASCII <CR>, hexadecimal X'0D' will be used.

Status reply format

The status reply messages sent back to the network from the NMD, will always conform with the following standard format:

S DDD...LL E

Where:

S	=	STATUS	1 Byte.
D	=	DATA	0-250 Bytes
L	=	LRC	2 Bytes
E	=	EOM	1 Byte.

The Status Code is 1 Byte ASCII character, which tells the network what the result of the executed transaction has been. This field is the General Status Code described in paragraph 3.3. The Particular Status of each hopper comes, when relevant, as part of the DATA Field.

The LRC and EOM Fields have the same values, lengths and meanings of those already explained in the preceding paragraph.

More detailed information about the status codes will be given in Section 5 of this manual.

Longitudinal Redundancy Check

In order to verify the accuracy of all transmitted data, all messages sent to the line, both COMMANDS and STATUS REPLY MESSAGES, must include, before the EOM character, the LRC bytes. These two characters are automatically calculated and included by the Controller in the Status Reply Message sent to the network. It is the responsibility of the network to include them in the commands sent to the NMD.

The LRC is a logical algorithm is explained in section 6.5

4.2 Commands overview.

Possible commands available to handle the system are listed below. Each one of the commands is identified by an operation code, 1 byte long, in Hex code. Below follow a list with a full set of commands available and recommended time outs in application program:

OP. CODE	MNEMONIC	COMMENTS	TIME TO EXECUTE
X'30'	RESET	Resets some internal registers on the Controller Board, and performs a reject sequence to clear the system	180 sec
X'32'	MOVE FORWARD	Picks up the requested number of notes, moves forward into the Stacker and waits for a new command.	180 sec
X'35'	READ CASS-ID.	Establish which denominations have been loaded in the NMD.	20 sec
X'36'	CHECK DISPENSED NOTES	Check the number of notes that has been delivered to the customer in the latest transaction	5 sec
X'37'	CLOSE CASSETTE	Cassettes are closed and can be taken out.	180 sec
X'38'	OPEN CASSETTE	Cassettes are opened to operating position so that the notes can be picked.	180 sec
X'39'	READ REJECT TRACE	Sends to the network the Trace Area buffer, in which the system holds the last 15 reject reasons.	5 sec
X'3A'	CHECK THROAT	Tests if there are any notes left in the Delivery Throat.	5 sec
X'41'	READ PROG-ID.	Reads the Program Identification Numbers of the software versions installed in the NMD.	5 sec
X'47'	SEND SELF TEST DATA	Performs and reports the result of internal self-test.	20 sec
X'4B'	RESEND LAST MESSAGE	Resend last reply message.	5 sec
X'51'	CHECK NMD STATUS	Check the status of the entire NMD	20 sec
X'52'	CLEAR NOTE TRANSPORT	Clears the note transport. Works as the Reset command when item 236 is set.	180 sec
X'52' X'44'	READ DATA	Read Data Item	20 sec
X'57' X'44'	WRITE DATA	Write Data Item	20 sec

4.3 Commands and replies description

Under this heading, it will be described in full detail, each one of the different commands available for the NMD, as well as the different reply messages, which can be sent to the network from the system.

A reference will be made of the different status codes, which can appear in each one of the commands; however, full description of those statuses will be given in Section 5 of this Reference Manual.

In this section there will be references to the following two groups of commands:

Movement Commands:

X’30’	RESET
X’32’	MOVE FORWARD
X’37’	CLOSE CASSETTE
X’38’	OPEN CASSETTE

Non-Movement Commands:

X’35’	READ Cassette-ID
X’39’	READ REJECT TRACE
X’41’	READ PROG-ID
X’47’	SEND SELF TEST DATA
X’4B’	RESEND LAST MESSAGE
X’51’	CHECK NMD STATUS
X’52’ X’44’	READ DATA
X’57’ X’44’	WRITE DATA

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Command *X'30'* *RESET*

Command Message String:

C LL E

Where: C = Command Code, X'30'.
L = LRC
E = EOM Character.

Reply Message String:

S HFNNN HFGGGGG ..... LL E ***or*** S LL E

Where: S = General Status Code.
H = Hopper Number.
F = Hopper Status Code.
N = Number of notes rejected during the reset sequence.
G = Cassette ID-Number.
L = LRC
E = EOM Character.

Notes: The field HFGGGGG is repeated for each Cassette loaded in the system, except for the Reject Vault/Tray.

The data NNN for HOPPER number X'30' contains the number of notes counted by the Note Qualifier during the reset sequence. Feed Cassette will have HOPPER numbers X'31' - X'34' and the ID-number range from 00001 - 99999.

If S = X'3A' "CASSETTE NOT PROPERLY INSTALLED" or if S = X'3F' "REJECT VAULT NOT PROPERLY INSTALLED" only hoppers with status X'3A' and/or status X'3F' will be reported. The Cassette ID-Number will be set to 00000 since it is not possible to read the cassette number in this situation. Other hoppers with cassettes installed cannot be reported until the status is cleared. The second alternative message format (SLLE), will be sent if a LOCKOUT condition occurs. (Refer to Section 5). If only the Reject Vault is inserted X'3A' is not reported as return code.

When a fatal error has occurred (See Section 5), the system will only accept either the X'30' RESET, X'37' CLOSE CASSETTE or Non-Movement commands. Any other command will cause the NMD to send the same fatal status message reply.

The RESET Command is only intended for use after a note jam, lockout or any other fatal error condition. Therefore, it should be used outside of the normal daily operation, in such a way that it is not easy for the operator to issue it without special supervisor authorisation.

It is very important that the note transport path has to be cleared from notes after a jam, before sending this command. Remaining notes in the upper transport path can be delivered through the throat on this command.

If the Reset command is sent without clearing the transport path, the number of remaining notes that are delivered through the throat during a reset command, can be checked with X'36 Check Delivered Notes command.

If item 236 is set the transport speed is limited to 500mm/s. If there is a note in the transport path after the diverter the transport will stop, or not start at all. In this case the return code will be X'68' Error in note transport. To clear the transport from notes command X'52' CLEAR NOTE TRANSPORT has to be used.

Command Time out:

The recommended time out for this command is 180 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

Command X'32' MOVE FORWARD

Command Message String:

C T HDDD HDDD .... LL E

Where: C = Command Code X'32'.
T = Not used, must always be X'30'.
H = Hopper number, X'31' to X'34'
D = Number of notes to pick up from this hopper (3 digits).
L = LRC
E = EOM Character.

Reply Message String:

S HFNNN HFNNN HFNNN ..... LL E ***or*** S LL E

Where: S = General Status Code.
H = Hopper number, X'30' to X'34'.
F = Hopper Status Code.
N = Number of notes fed from this hopper, rejects included.
L = LRC
E = EOM Character.

Notes: The field HFNNN is repeated for each hopper dispensed from and / or for each hopper having some relevant information. Hopper number zero will always be the first one. For this hopper, the NNN field contains the total number of notes, which have been passed the Note Qualifier including single rejects. The second alternative message format (SLLE) will be sent if a LOCKOUT condition is present when the command is received. A LOCKOUT condition occurring during execution will report with the first alternative message. The short message format will also be sent if status code X'37' TRANSMISSION ERROR, X'38' ILLEGAL COMMAND or X'4E' COMMUNICATION TIMEOUT occurs. (Refer to Section 5).

Command Description:

This command picks up the requested number of notes from the specified feed modules and delivers them to the throat. If an error is detected, the note is diverted into the Reject Vault. If a single reject occurs the NMD will try to fulfil the requested number of notes from the actual feeder before starting to feed from the next. The number of times the NMD tries to fulfil the requested notes from each feeder is depending on the requested number, but at least five times.

The reply message includes information about the actual number of notes picked from each Cassette, as well as their particular status. Hopper number 0 data will show the total number of notes that have passed the Note Qualifier including single rejects. Long notes, doubles are counted as 2. Treble notes or more are counted as 2 notes.

If the reply from the NMD is not X'30' SUCCESSFUL COMMAND, the command X'36' Check Delivered Notes must be used to check how many notes has been delivered through the throat to the customer. A recommendation is to use the command X'36' Check Delivered Notes after every Move Forward command. See description of command X'36' Check Delivered Notes.

The command can be issued with all note feeders addressed, but with a total of zero notes requested. All feeders addressed will give a response. Addressed non-existing feeders and feeders without cassettes will answer with status X'3A' NOTE CASSETTE NOT PRESENT.

If the same command is repeated but notes are requested from at least one feeder non existing feeders and feeders without opened cassettes will answer with status X'30' SUCCESSFUL COMMAND in the hopper status position.

The default maximum number of notes in a transaction is 50.
(The maximum number of notes in a transaction can be limited with item 104). Requesting more will cause the status X'42' TOO_MANY_NOTES_REQUESTED to be sent to the network.

If Change over is used (Item 127 is set to 1) the addressed feeders as well as the feeders used to fulfil the transaction will report their status and number of notes picked from each cassette. The addressed feeders that become empty during the transaction will report X'32' EMPTY CASSETTE as hopper status, but the general status will X'30' SUCCESSFUL COMMAND or X'31' LOW LEVEL if the transaction is fulfilled successfully.

Command Time out:

The recommended time out for this command is 180 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

Command *X'35' READ CASSETTE ID*

Command Message String:

C LL E

Where: C = Command Code, X'35'.
L = LRC
E = EOM Character.

Reply Message String:

S HFGGGGG HFGGGGG ..... LL E ***or*** S LL E

Where: S = General Status Code.
H = Hopper Number, X'30' TO X'34'
F = Hopper Status Code
G = Cassette ID-Number.
L = LRC
E = EOM Character.

Notes: The field HFGGGGG is repeated for each Cassette loaded in the system.
The Reject Vault has HOPPER number X'30' and Note Cassettes will have HOPPER number X'31' - X'34' and the ID-number range is from 00001 - 99999.
If S=X'3A' "CASSETTE NOT PROPERLY INSTALLED" or if S=X'3F' "REJECT CASSETTE NOT PROPERLY INSTALLED" only hoppers with this status will be reported. The Cassette number reported will be set to 00000 since it is not possible to read the cassette numbers in this situation. Other feeders with cassettes installed cannot be reported until status is cleared. If only the Reject Vault is inserted X'3A' is not reported as return code.

The second alternative message format (SLLE), will be sent if status code X'37' TRANSMISSION ERROR, X'38' ILLEGAL COMMAND or X'4E' COMMUNICATION TIMEOUT occurs.

Command Description:

This command requests the Cassette ID-numbers of all the Cassettes inserted in the NMD, including the Reject Vault.

The Reply Message will provide the Application Program, with the identification codes of all the Cassettes loaded in the system. Cassette numbers will appear in the natural sequence of the hopper numbers, always beginning with Hopper 0, the Reject Vault. (Further information about Cassette ID-Numbers and HOPPER Numbers; can be found in paragraph 3.4)
This command must be used whenever the Cassettes HAVE been or COULD HAVE been changed.

In order to avoid any possible misunderstanding about the denomination of the notes loaded in each hopper, the NMD does not allow any dispense operation (Command X'32' MOVE FORWARD) unless this command has been issued after the X'38' OPEN CASSETTE Command.

It is not possible to see if the cassettes are opened or not. The answer string is exactly the same for opened cassettes and cassettes that are simply inserted in the NMD.

Fatal errors cannot occur on this command; only remaining fatal errors that have occurred in a previous command are reported

Command Time out:

The recommended time out for this command is 20 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

Command *X'36' CHECK DELIVERED NOTES*

Command Message String:

C LL E

Where: C = Command Code X'36.
L = LRC
E = EOM Character.

Reply Message String:

S HFNNN HFNNN HFNNN ..... LL E ***or*** S LL E

Where: S = General Status Code.
H = Hopper number, X'30' to X'34'.
F = Hopper Status Code.
N = Number of notes delivered from this hopper.
L = LRC
E = EOM Character.

Notes: The field HFNNN is repeated for each hopper dispensed from and / or for each hopper having some relevant information. Hopper number zero will always be the first one. For this hopper, the NNN field contains the total number of notes which have passed the Throat sensor and delivered to the customer The second alternative message format (SLLE), will be sent if status code X'37' TRANSMISSION ERROR, X'38' ILLEGAL COMMAND or X'4E' COMMUNICATION TIMEOUT occurs.. (Refer to Section 5).

Command Description:

This command is used to check the number of notes delivered to the customer through the throat sensor, when the answer on a MOVE FORWARD is not SUCCESSFUL COMMAND.
The command can also be used to check if any notes are delivered through the throat during a Reset command. In the case only the counter for hopper 0 will be presented.

On a power fail the counters for delivered notes are saved in a non-volatile memory.

Command Time out:

The recommended time out for this command is 5 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

The use of this command is recommended for the following replies:

MNEMONIC NAME	TYPE	HEX	ASCII
Empty Cassette.	O	X'32'	2
Diverter Failure	F	X'35'	5
Failure to Feed.	R	X'36'	6
Transmission Error.	S	X'37'	7
Jam in Note Qualifier	F	X'39'	9
Jam in Note Feeder Transport	F	X'43'	C
Cassette Data Corrupted	R	X'45'	E
Main Motor Failure.	F	X'46'	F
Note Qualifier Faulty	F	X'49'	I
Note Feeder exit sensor failure	R	X'4A'	J
Communications Time-out.	S	X'4E'	N
Reject Vault Cassette Full.	O	X'51'	Q
Error in Throat.	F	X'57'	W
Sensor Error or Sensor Covered.	R	X'5B'	[
NMD Internal Failure/Data Corrupted	F	X'60'	‘
Error in Note Transport	F	X'68'	b

Command ***X'37' CLOSE CASSETTE***

Command Message String:

C LL E

Where: C = Command Code, X'37'.
L = LRC
E = EOM Character.

or

CHT LL E

Where: C = Command Code, X'37'.
H = Hopper number, X'31' to X'34'. X'41' will close all cassettes.
T = Close Type:
X'31' Close and unlatch the Cassette,
X'32' Force close and unlatch a Cassette after close failure.

L = LRC
E = EOM Character.

Reply Message String:

S LL E

Where: S = General Status Code.
L = LRC
E = EOM Character.

Command Description:

This command can either be sent in short form equal to the MDDM SD300 or in long form using Close Type X'31' or Close Type X'32'.

When using the short form this command will close and unlatch all cassettes

When using the long form (Close type X'31') this command will close and unlatch the cassette with the addressed hopper number.

Errors that occur during the close sequence will be reported. To discover which cassette caused the failure in the close sequence it is recommended to send a Read Cassette ID X'35' command after the close command.

The long form (Close type X'31') can be used for unloading cassettes without taking the NMD out of service. Errors will be reported when using the long form (Close Type x'31').

It is still possible to feed from other feeders even if the status from close one cassette is X'61' CASSETTE LOCK FAULTY.

Close type X'32' is only allowed to release a cassette with shutter locking failure. This cassette should be sent to a qualified service organisation.

Command Time out:

The recommended time out for this command is 180 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

Command ***X'38' OPEN CASSETTE***

Command Message String:

C LL E

Where:

C = Command Code, X'38'.
L = LRC
E = EOM Character.

or

CHT LL E

Where:

C = Command Code, X'38'.
H = Hopper number, X'31' to X'34'
T = Open Type:
X'30' Latch the Cassette to the frame
X'31' Latch and Open the Cassette,
L = LRC
E = EOM Character.

Reply Message String:

S LL E

Where:

S = General Status Code.
L = LRC
E = EOM Character.

Command Description:

When using the short form this command will latch and open all cassettes

If no proper reset has been made since POWER UP, it will be performed during the X'38' OPEN CASSETTE command.

When using the Open type X'30' the cassette addressed by Hopper number will be latched to the frame. It will not be possible to feed notes from a cassette, which is latched to the frame. Hopper number X'30' is not allowed when using open type X'30'.

When using the Open type X'31' the cassette addressed by Hopper number will be latched and opened. In this case it is possible to feed notes from the cassette.
It is still to feed from other feeders even if the status from open one cassette is X'61' CASSETTE LOCK FAULTY.
This command can be used for loading cassettes without taking the NMD out of service.

After the X'38' OPEN Command, the network must send an X'35' READ Cassette-ID Command, before any dispense operation can be executed.

The NMD Controller logically sets the cassettes to a closed state after system power on; this is done regardless of the physical state of the cassettes. Therefore, this command must always be the first one in the daily operating procedure.

Command Time out:

The recommended time out for this command is 180 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

Command *X'39' READ REJECT TRACE*

Command Message String:

C LL E

Where: C = Command Code, X'39'.
L = LRC
E = EOM Character.

Reply Message String:

S RRRRRRRRRRRRRRR LL E ***or*** S LL E

Where: S = General Status Code.
R = LAST 15 REJECT REASONS:

X'30'	=	Pointer or Unused Position.
X'31'	=	Double Note.
X'32'	=	Internal Reject.
X'33'	=	Long Note sensor A.
X'34'	=	Long Note sensor B.
X'35'	=	Short Note.
X'36'	=	Incorrect Count.
X'37'	=	Thin Note.
X'38'	=	Skewed Note.
X'39'	=	Notes Too Close

L=LRC
E=EOM Character.

Notes: The second alternative message, format (SLLE) will be sent if status code X'37' TRANSMISSION ERROR, X'38' ILLEGAL COMMAND or X'4E' COMMUNICATION TIMEOUT occurs.

Command Description:

This command will request the NMD to send back to the Network the contents of the Reject Trace Buffer. This is an area in the memory of the NMD Controller, which keeps a record of the last 15 rejects, which took place, during movement commands.

The buffer holds that information coded as described in the Reply Message String, one byte per rejection. The buffer is updated in a circular way, so that it will always contain the last 15 reject causes. One additional byte,
containing X'30' is used as a buffer pointer, indicating that the immediately preceding byte corresponds to the last reject. The content of this buffer is lost when the machine is powered off, so that at the beginning of daily operations, it is always loaded with 16 zeros (X'30').

The Application Program may use this command for statistical purposes, and also by the technical service engineer to analyse system performance.

The internal reject reasons showed in item 300 and the translation to external reject reason (MDDM emulation) are in the table below.

Reject Code	NMD Reject Name	MDDM Reject Name	Description
01	LEARNING_NOTE	Internal Reject	Reject reason for the rejected notes in the learning sequence.
02	MORE_THAN_ONE_NOTE	Double Note	The note was detected as double
03	TOO_SKEWED_NOTE	Skewed Note	The note was too skewed
04	TOO_LONG_NOTE_AT_DDA	Long Note sensor A	The note was too long at double detect sensor A.
05	TOO_LONG_NOTE_AT_DDB	Long Note sensor B	The note was too long at double detect sensor B.
06	TOO_SHORT_NOTE_AT_DDA	Short Note	The note was too short at double detect sensor A.
07	TOO_SHORT_NOTE_AT_DDB	Short Note	The note was too short at double detect sensor B.
08	TOO_CLOSE_NOTE	Notes Too Close	The note was too close to previous note.
09	TRANSACTION_ABORT	Incorrect Count.	Note that is rejected on a transaction abort due to a fatal status.
10	UNEXPECTED_NOTE	Incorrect Count.	A note is seen in the double detect sensor but not by the NF Exit Sensor
11	NOTE_IS_TOO_THIN	Thin Note	The note was detected as thin.
12	DIVERTER_OP_FAILED	Incorrect Count.	It was not possible to move the diverter from reject to deliver
13	TOO_CLOSE_IN_TRP	Notes Too Close	An ok note is too close to the following note. Both notes will be rejected.

Reject Code	NMD Reject Name	MDDM Reject Name	Description
14	TOO_CLOSE_IN_DIV	Notes Too Close	An ok note is too close to the following note. Both notes will be rejected.
15	DIVERTER_OP_FAILED_STK	Incorrect Count.	It was not possible to move the diverter from deliver to reject. .
16	LEARNING_NOTE_SINGLE	Internal Reject	Reject reason for the rejected notes in the learning sequence. All notes are rejected.
17	TEST_NOTE	Incorrect Count.	Not used. Only for test purpose.
18	DELAYED_NOTE	Incorrect Count.	This internal reject reason is used when a note is too late to the Note Qualifier. The reject reason occurs when the timeout exceeds for a note in the NQ. Only used internally for logging reason.
19	REJECT_ALL_NOTE	Internal Reject	Used when a note is fed and rejected during a Close Cassettes command.
20	OVERLAPPED_A	Long Note sensor A	Used for reject reason on the second note on two overlapped notes. The note is detected as one long note on channel A, but two separate notes on channel B.
21	OVERLAPPED_B	Long Note sensor B	Used for reject reason on the second note on two overlapped notes. The note is detected as one long note on channel B, but two separate notes on channel A.
22	UNEXPECTED_IN_REJ	Incorrect Count.	A note, which has not passed the Note Qualifier, is seen in the reject sensor.
23	REJECT_NOTE_ ON_COMMAND	Internal Reject	This reject reason occurs on notes that are fed in a test Move Forward command.
24	REJECT_IN_STK	Internal Reject	Not used in NMD 50

Command Time out:

The recommended time out for this command is 5 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

Command X'3A' CHECK THROAT

Command Message String:

C LL E

Where: C = Command Code, X'3A'.
L = LRC
E = EOM Character.

Reply Message String:

S LL E

Where: S = General Status Code.
L = LRC
E = EOM Character.

Command Description:

This command can be used to check if there are notes remaining in the throat.

The Reply Message will only answer X'4D' Notes In Throat if the notes are still in the Throat sensor or X'30' Successful Command if there are no notes in the throat.

Command Time out:

The recommended time out for this command is 5 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

Command *X'41' READ PROGRAM-ID*

Command Message String:

C LL E

Where: C = Command Code, X'41'.
L = LRC
E = EOM Character.

Reply Message String:

S M NNNNNNNN LL E ***or*** S LL E

Where: S = General Status Code.
M = Unit Identifier, always X'44'
N = Program ID-Number, 8 bytes.
L = LRC
E = EOM Character.

Notes: The second alternative message format (SLLE) will be sent if status code X'37' TRANSMISSION ERROR, X'38' ILLEGAL COMMAND or X'4E' COMMUNICATION TIMEOUT occurs.

Command Description:

This command requests the NMD to send back to the network a reply containing the Software Identification Number. This will be sent in the Reply Message, in the format of 8 ASCII numeric characters, preceded by the letter D.
Program ID for all controllers in the NMD can be read with Read Data Item 100.

Command Time out:

The recommended time out for this command is 5 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

Command *X'47' SEND SELFTEST DATA*

Command Message String:

C H LL E

Where:

C = Command Code, X'47'.
H = Hopper number.
L = LRC bytes.
E = EOM character.

Reply Message String:

The reply message format depends on hopper number specified:

H = "1"-"4" S TTTTTTTTTTTUUUUVVVHHHCCCDDDDI LL E

H = "9" S TTTUU LL E

H = "A" S TUUUCCCDDDIAAAaNNNBBBbNNN.....

.....CCCDDDIAAAaNNNBBBbNNN LL E

or

S LL E

Where:

S	=	General Status Code.
A	=	Double detect sensor A offset.
a	=	Double detect sensor A gain
B	=	Double detect sensor B offset.
b	=	Double detect sensor B gain
C	=	Currency code
D	=	Denomination code
E	=	Offset calibration sensor A
F	=	Offset calibration sensor B
H	=	Horizontal size of note
I	=	Note type/Issue.
N	=	Sensor nominal note thicknes value
T	=	Sensor test data.
U	=	Sensor calibration value.
V	=	Vertical size of note.
L	=	LRC bytes.
E	=	EOM Character.

Notes: The last alternative message format will be sent if status X'37' TRANSMISSION ERROR, X'38' ILLEGAL COMMAND or X'4E' COMMUNICATION TIMEOUT occurs.

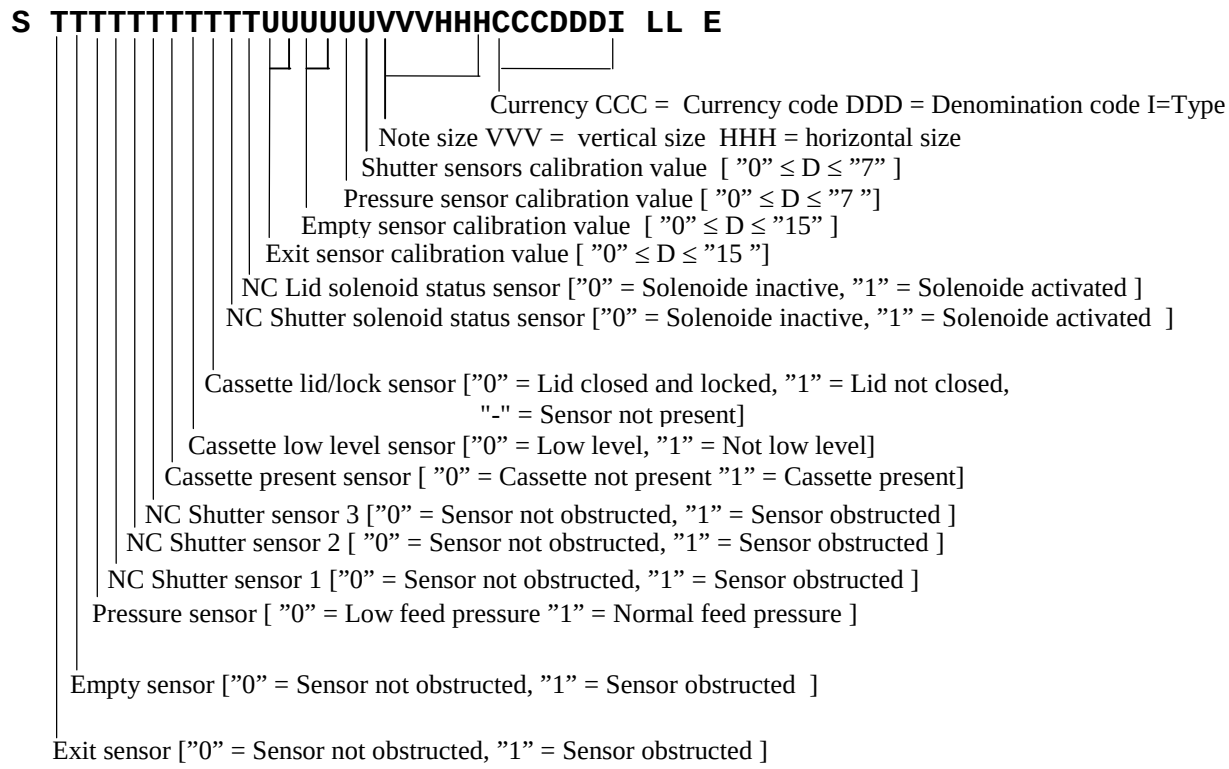
When hopper number set to 1-4 the Note Feeder and Note Cassette are addressed, the reply message will contain information of the following sensors and switches: The sensors labelled with "T" above will also report status X'5B' if an error associated to the sensor detected. When the NC is not present the positions related to the cassette will be reported as "-".
When Item 214 is set to '0' (default), the result string will have the following "old" content.

S TTTTTTTTTTTUUUUVVVHHHCCCDDDI LL E

Currency CCC = Currency code DDD = Denomination code I=Type
Note size VVV = vertical size HHH = horizontal size
Shutter sensors calibration value ["0" ≤ D ≤ "3"]
Pressure sensor calibration value ["0" ≤ D ≤ "3 "]
Empty sensor calibration value ["0" ≤ D ≤ "7"]
Exit sensor calibration value ["0" ≤ D ≤ "7 "]
NC Lid solenoid status sensor ["0" = Solenoide inactive, "1" = Solenoide activated]
NC Shutter solenoid status sensor ["0" = Solenoide inactive, "1" = Solenoide activated
"2"= Solenoide sensor error]
Cassette lid/lock sensor ["0" = Lid closed and locked, "1" = Lid not closed,
"-" = Sensor not present]
Cassette low level sensor ["0" = Low level, "1" = Not low level]
Cassette present sensor ["0" = Cassette not present "1" = Cassette present]
NC Shutter sensor 3 ["0" = Sensor not obstructed, "1" = Sensor obstructed]
NC Shutter sensor 2 ["0" = Sensor not obstructed, "1" = Sensor obstructed]
NC Shutter sensor 1 ["0" = Sensor not obstructed, "1" = Sensor obstructed]
Pressure sensor ["0" = Low feed pressure "1" = Normal feed pressure
"2" = Sensor Error "3" = Sensor Warning]
Empty sensor ["0" = Sensor not obstructed, "1" = Sensor obstructed
"2" = Sensor Error "3" = Sensor Error]
Exit sensor ["0" = Sensor not obstructed, "1" = Sensor obstructed
"2" = Sensor Error "3" = Sensor Warning]

Command *X'47' SEND SELFTEST DATA*

When Item 214 is set to '1', the result string will have the following content.
Exit Sensor and Empty sensor have two figures for calibration value. The calibration values for Pressure sensor and Shutter sensors are separated.



When hopper number set to "9" the Note Transport is addressed in the command, the reply message will contain information of the following sensors and switches:

S TTTTT LL E

Throat sensor calibration value ["0" ≤ D ≤ "7"]

Note Transport sensor calibration value ["0" ≤ D ≤ "7 "]

Reject Vault present sensor ["0" = Cassette not present "1" = Cassette present]

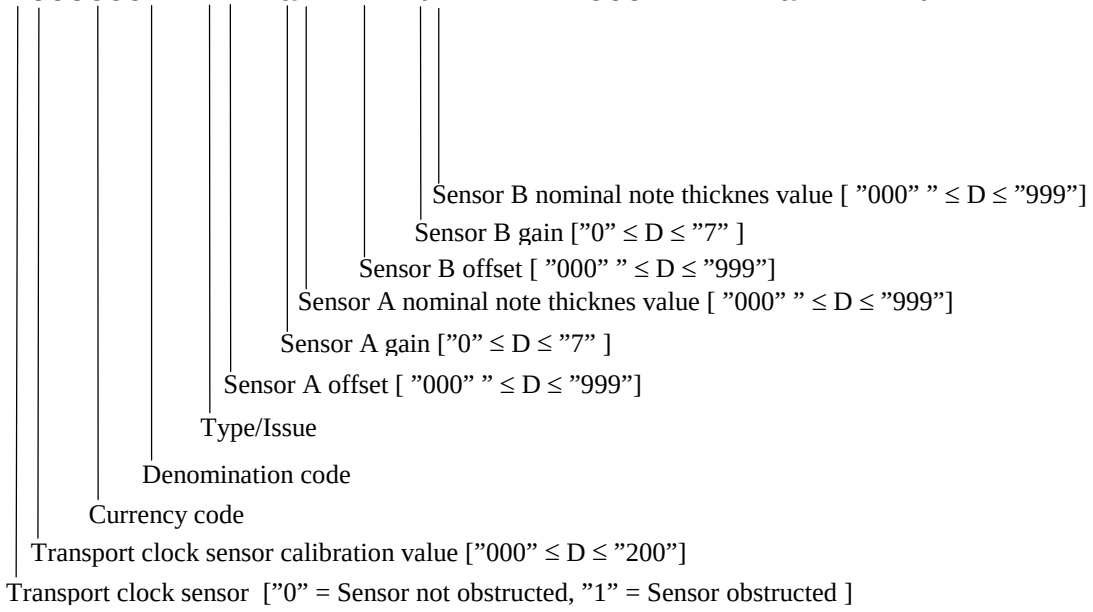
Throat sensor ["0" = Sensor not obstructed, "1" = Sensor obstructed
"2" =Sensor error "3" = Sensor warning]

Note Transport sensor ["0" = Sensor not obstructed, "1" = Sensor obstructed
"2" =Sensor error "3" = Sensor warning]

Command *X'47' SEND SELF TEST DATA*

When hopper number set to "A" the Note Qualifier Module is addressed, the reply message will contain information of the transport clock sensor and double detect sensors. The note specific data will be repeated for up to 10 latest used currencies and denominations. Unused entries will be reported as "-" (X'2D'):

S TUUUCCCDDDIAAAaNNNBBBbNNN.... CCCDDDIAAAaNNNBBBbNNN LL E



Command Time out:

The recommended time out for this command is 20 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

Command *X'4B' RESEND LAST MESSAGE*

Command Message String:

C LL E

Where: C = Command code X'4B'.
L = LRC Bytes
E = EOM character.

Reply Message String:

S M...LL E ***or*** S LL E

Where: S = General Status Code.
M = Last Response Message.
L = LRC Bytes.
E = EOM Character.

Notes: The M-parameter Last Response Message will contain an exact copy of last message sent with the exception that the LRC and EOM characters are removed.

The second alternative message format (SLLE) will be sent if an error exists at the NMD-controller or if the following status occurs.

X'37' TRANSMISSION ERROR,
X'38' ILLEGAL COMMAND,
X'4E' COMMUNICATION TIMEOUT or
X'65' NO MESSAGE TO RESEND.

Command *X'4B' RESEND LAST MESSAGE*

Command Description:

This command causes the NMD-controller to resend the last response message sent, excluding the response on this command it self.

The command is primarily intended to be used after a communication error is detected in the response message.

If there is no response message to resend, i.e. no command has been executed since power on/hardware reset, the status code X'65' NO MESSAGE TO RESEND will be sent using the second alternative reply message format.

The general status in the reply message shows the validity of the response.

Command Time out:

The recommended time out for this command is 5 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

Command *X'51' CHECK NMD STATUS*

Command Message String:

C LL E

Where: C = Command Code, X'51'.
L = LRC
E = EOM Character.

Reply Message String:

S HFArrGGGGG HFAffGGGGG ..... ttqqddssppoovvLL E

or

S LL E

Where: S = General Status Code.
H = Hopper Number, X'30' TO X'38'
F = Hopper Status Code
A = Cassette Open Close status
rr = Internal status for Reject Vault
ff = Internal status for Feeder
tt = Internal status for Main motor drive
qq= Internal status for Note Qualifier (Double Detect)
dd= Internal status for Note Diverter
ss = Internal status for Note Transport
pp=
oo= Internal status for Note Output (Throat) NMD50
vv= Internal status for Data Handler(Used for cassette items)
G = Cassette ID-Number.
L = LRC
E = EOM Character.

Notes: The field HFAffGGGGG is repeated for eight feeder positions, although the NMD 50 has only four possible feeder positions.
The Reject Vault have HOPPER number X'30' and Note Cassettes will have HOPPER number X'31' - X'38' and the ID-number range is from 00001 - 99999.

The second alternative message format (SLLE), will be sent if status code X'37' TRANSMISSION ERROR, X'38' ILLEGAL COMMAND or X'4E' COMMUNICATION TIMEOUT occurs.

Command Description:

This command requests the Cassette ID-numbers of all the Cassettes inserted in the NMD

Description of Cassette Open Close Status

A	Cassette Open Close Status	0	No Feeder at position
		1	No Cassette Inserted
		2	Cassette Inserted
		3	Cassette Inserted and Data from Cassette is read
		4	Cassette Locked to Frame
		5	Cassette opened in operation position

Description of task-number used in item 311. This is not used in this command

Task No	Task Name	Description
3	TRANSPORT CONTROL	Task that handles the main motor and note transport.
4	FEEDER CONTROL	Task that handles the Note Feeders
5	PRESENTER CONTROL	Not used in the NMD 50
6	DIVERTER CONTROL	Task that handles the Note Diverter.
7	QUALIFIER CONTROL	Task that handles the Note Qualifier (Double Detect)
8	STACKER_CONTROL_ID	Task that handles the Note Transport sensor
9	THROAT CONTROL	Task that handles the Throat sensor.
10	REJECT CONTROL	Task that handles the Reject Vault and the Note Diverter outlet sensor.
14	DATA CONTROL	Task that handles the Data Items.

Command *X'51' CHECK NMD STATUS*

The internal statuses (rr, qq, dd etc) are described below. The internal statuses are also used in item 311.

The internal failure codes for the Reject Vault:

Code	No	Name of internal Failure	Description
rr	01	REJ_CASS_ALMOST_FULL	The RV is almost full
	02	REJ_CASS_FULL	The RV is full
	03	REJ_NO_CASS_IN_MODULE	There is no RV inserted
	04	REJ_STACK_REJECT_ERROR	Not Used in the NMD 50
	05	REJ_CLOSE_ERROR	Not Used in the NMD 50
	06	REJ_SINGLE_ACCEPT_ERROR	Not Used in the NMD 50
	07	REJ_STACK_ACCEPT_ERROR	Not Used in the NMD 50
	08	REJ_CASS_DATA_ERROR	Not Used in the NMD 50
	09	REJ_JAM_IN_QUA	Not Used in the NMD 50
	10	REJ_NOTE_JAMMED	Not Used in the NMD 50
	11	REJ_NOTE_IN_STK	Not Used in the NMD 50
	12	REJ_COM_ERROR	Not Used in the NMD 50
	13	REJ_SW_FAILURE	Not Used
	14	REJ_FATAL_SW_FAILURE	Not Used

The internal failure codes for the Note Feeder Task:

Code	No	Name of internal Failure	Description
ff	01	FDR_NO_CASS_IN_MODULE	There is no cassette in the actual feeder position
	02	FDR_SERVICE_REQUEST	Service requested on the actual feeder.
	03	FDR_CASS_ALMOST_EMPTY	Low level in the cassette
	04	FDR_EMPTY_DETECTED_ NOT_LOW	Empty has been detected without having low level in the cassette
	05	FDR_EMPTY_DETECTED_ LOW	Empty has been detected with low level in the cassette
	06	FDR_EMPTY_CHANGE_OVER	Empty has been detected, but the feeding continues from another feeder
	07	FDR_CASS_EMPTY	The cassette is marked as empty.
	08	FDR_FEED_ERROR	The feeder has not been able to feed the notes.
	09	FDR_RETRY_NOTE	The feeding is interrupted due to a possible jam between the feeder and the Note Qualifier. A retry is made on this error.
	10	FDR_SENSOR_ERROR	A sensor is faulty, or a note is stuck under the exit sensor
	11	FDR_ABORT_ERROR	The feeding is aborted because the RV is full during the transaction.
	12	FDR_RETRY_TRANS	Not Used in the NMD 50
	13	FDR_CASS_LOCK_ERROR	It was not possible to open or close the cassette
	14	FDR_COM_CLOSE_ERROR	Communication error with the feeder during open or close cassette.
	15	FDR_COM_ERROR	Communication error with the feeder.
	16	FDR_SW_FAILURE	It was not possible to access the feeders from a task. Another task has the access to the feeders.
	17	FDR_FATAL_SW_FAILURE	It was not possible to create mailboxes and queues; the task will not start at all.

Command *X'51' CHECK NMD STATUS*

The internal failure codes for the main motor transport task:

Code	No	Name of internal Failure	Description
tt	01	TRP_MISSING_PULSE	Transport clock pulses are missed, probably due to dust on the transport clock sensor.
	02	TRP_MOTOR_START_ FAILURE	The main motor transport did not reach the stipulated speed within a timeout.
	03	TRP_MOTOR_SPEED_TOO_ LOW	The speed is lower than the speed tolerance, probably due to a jam in the transport path
	04	TRP_MOTOR_SPEED_TOO_ HIGH	The speed is higher than the speed tolerance.
	05	TRP_SW_FAILURE	It was not possible to access the main motor transport from a task. Another task has the access to main motor transport.
	06	TRP_FATAL_SW_FAILURE	It was not possible to create mailboxes and queues; the task will not start at all.

The internal failure codes for the Note Qualifier task (double detect):

Code	No	Name of internal Failure	Description
qq	01	QUA_CONFIG_DATA_ERROR	An error in the note data table was detected during power on. All notes have to be learned again.
	02	QUA_WRITE_E2_ERROR	An error was detected when writing the note data table to the e2prom.
	03	QUA_TOO_MANY_REJECTS	More than five rejects without any OK notes between.
	04	QUA_JAM_NOTE_ TRANSPORT	A note has left the Note Feeder exit sensor and is not seen in the Double detect sensors.
	05	QUA_CHECK_FAILURE	An error was detected, when an ongoing calibration was made on the Double detect sensors. The error is cleared if the next ongoing calibration is successful.
	06	QUA_LEARNING_FAILURE	An error was detected during learning sequence. It was not possible to adjust the gain enough. The note was either too thick for the lowest gain value or too thin for the highest gain value.
	07	QUA_CALIBRATE_FAILURE	An error was detected, when a calibration from a command was made on the Double detect sensors.
	08	QUA_LID_OPENED	The lid in the Note Qualifier is detected as opened.
	09	QUA_SW_FAILURE	It was not possible to access the qualifier a task,
	10	QUA_FATAL_SW_FAILURE	It was not possible to create mailboxes and queues; the task will not start at all.

The internal failure codes for the Note Diverter task:

Code	No	Name of internal Failure	Description
dd	01	DIV_SENSOR_ERROR	It was not possible to calibrate the Note Transport Path sensor. The sensor is located in the note path after the note diverter. The reason for this error could be a faulty sensor, or that the sensor is covered with a note.
	02	DIV_SW_FAILURE	
	03	DIV_FATAL_SW_FAILURE	Not used

The internal failure codes for the Note Stacker task, in the NMD 50 this task handles the Note Transport Sensor:

Code	No	Name of internal Failure	Description
ss	01	STK_UNEXPECTED_NOTE	Not Used in the NMD 50
	02	STK_ENABLE_ERROR	.
	03	STK_JAM_IN_QUA	A note has jammed between the Note Qualifier and the Note Transport path sensor
	04	STK_NOTE_JAMMED	Not used in the NMD 50.
	05	STK_PATH_NOTE_JAMMED	A note has jammed under the Note Transport Path sensor.
	06	STK_NOTE_IN_REJ	Not used in the NMD 50.
	07	STK_MOVEMENT_ERROR	Not used in the NMD 50.
	08	STK_SW_FAILURE	Not used
	09	STK_FATAL_SW_FAILURE	It was not possible to create mailboxes and queues; the task will not start at all.

The internal failure codes for the Throat output (oo) .

Code	No	Name of internal Failure	Description
oo	01	THR_SENSOR_ERROR	It was not possible to calibrate the Throat sensor. The reason for this error could be a broken sensor, or that the sensor is covered with a note.
	02	THR_NOTE_JAMMED	The note has jammed between the Note transport Path sensor and the Throat sensor.
	03	THR_NOTE_IN_THROAT	The note has jammed under the Throat sensor.
	04	THR_SW_FAILURE	Not Used
	05	THR_FATAL_SW_FAILURE	It was not possible to create semaphores; the task will not start at all.

The internal failure codes for the Data Handler

Code	No	Name of internal Failure	Description
vv	01	DAT_CASS_DATA_ERROR	There was a checksum error in the cassette data area.
	02	DAT_CASS_COMM_ERROR	Communication error with the cassette.
	03	DAT_SW_FAILURE	It was not possible to access the cassettes. Another task has the access to the cassettes.
	04	DAT_FATAL_SW_FAILURE	It was not possible to create semaphores; the task will not start at all.

Fatal errors can not occur on this command, only remaining fatal errors that has occurred in a previous command are reported

Command Time out:

The recommended time out for this command is 20 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

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Command *X'52'* *CLEAR NOTE TRANSPORT*

Command Message String:

C LL E

Where: C = Command Code, X'52'.
L = LRC
E = EOM Character.

Reply Message String:

S HFNNN HFGGGGG ..... LL E ***or*** S LL E

Where: S = General Status Code.
H = Hopper Number.
F = Hopper Status Code.
N = Number of notes rejected during the reset sequence.
G = Cassette ID-Number.
L = LRC
E = EOM Character.

Notes: The field HFGGGGG is repeated for each Cassette loaded in the system, except for the Reject Vault/Tray.

The data NNN for HOPPER number X'30' contains the number of notes counted by the Note Qualifier during the reset sequence. Feed Cassette will have HOPPER numbers X'31' - X'34' and the ID-number range from 00001 - 99999.

If S = X'3A' "CASSETTE NOT PROPERLY INSTALLED" or if S = X'3F' "REJECT VAULT NOT PROPERLY INSTALLED" only hoppers with status X'3A' and/or status X'3F' will be reported. The Cassette ID-Number will be set to 00000 since it is not possible to read the cassette number in this situation. Other hoppers with cassettes installed cannot be reported until the status is cleared. The second alternative message format (SLLE), will be sent if a LOCKOUT condition occurs. (Refer to Section 5). If only the Reject Vault is inserted X'3A' is not reported as return code.

Command *X'52'* *CLEAR NOTE TRANSPORT*

This command is used to clear the note transport path when item 236 is set.
The command works similar the X'30' Reset command and shall only be used as a service command. If a fatal error occurs on the first X'52' command, a second X'52' command has to be sent.

Command Time out:

The recommended time out for this command is 180 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

Command *X'52'X'44' READ DATA*

Command Message String:

CC d nnnn LL E

CC d nnnn d ccc LL E

CC d nnnn d cccmmet LL E

Where:

C	=	Command Code "RD".
d	=	Delimiter X'2F' "/".
ccc	=	Currency identifier (mandatory for some item numbers, see below)
cccmmet	=	Currency, denomination and type identifier (mandatory for some items)
nnnn	=	Item number.
L	=	LRC Bytes.
E	=	EOM Character.

Reply Message String:

S d DDD... LL E *OR* S LL E

Where:

S	=	General Status Code.
d	=	Delimiter X'2F' "/".
D	=	Data read from requested item
L	=	LRC bytes.
E	=	EOM Character.

Notes: The second alternative message formats (SLLE) will be sent if an error exists at the NMD-controller or if following status occurs.
X'37' TRANSMISSION ERROR,
X'38' ILLEGAL COMMAND,
X'4E' COMMUNICATION TIMEOUT.

Command Time out:

The recommended time out for this command is 5 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

This command is used to read data from the NMD internal data structures.
The following section contains a more detailed description of the read data items. The items supported in the NMD SD 300 emulation are:

100	Program ID block
104	Max. notes per
110	Module ID blocks
118	Currency codes
127	Change over method
201	Feed Order
202	Note sizes
207	Software lock flag
209	Throat active flag
213	Distance between Note transport path sensor and Throat sensor
214	Self Test Data option
236	Check Notes in transport
300	Internal reject table
301	Status code table
303	Total notes delivered
304	Total notes rejected
308	Total notes single rejected
311	Module error log
318	Total notes delivered (high pressure feed)
319	Total notes rejected (high pressure feed)
320	Total number of transactions
330	Total notes delivered (Life Time)
331	Total notes rejected (Life Time)
333	Total number of transactions (Life Time)
395	Enable/Disable Reject Vault
397	Module status
399	Max notes in the Reject Vault
9H27	Currency and Denomination
9H28	Cassette ID
9H29	Note size

Command *X'57'X'44' WRITE DATA*

Command Message String:

CC d nnnn LL E

CC d nnnn d ccc LL E

CC d nnnn d cccmmet LL E

Where:

C	=	Command Code "WD".
d	=	Delimiter X'2F' "/".
ccc	=	Currency identifier (mandatory for some item numbers, see below)
cccmmet	=	Currency, denomination and type identifier (mandatory for some items)
nnnn	=	Item number.
L	=	LRC Bytes.
E	=	EOM Character.

Reply Message String:

S LL E

Where:

S	=	General Status Code.
L	=	LRC bytes.
E	=	EOM Character.

Command Time out:

The recommended time out for this command is 5 seconds.

Status Codes:

Table 5-1 shows a cross-reference picture of the different status codes.

This command is used to write data to the NMD internal data structures. The following section contains a more detailed description of the write data items. The items supported in the NMD SD 300 emulation are:

104	Max. notes per bundle
110	Module ID blocks
127	Change over method
201	Feed Order
207	Software lock flag
209	Throat active flag
213	Distance between Note transport path sensor and Throat sensor
214	Self Test Data option
218	Clean NF Rollers
236	Check Notes in transport
310	Clear Note statistic counters
311	Clear Module Error Log
392	NQ Note data table initialisation
395	Enable/Disable Reject Vault
399	Max notes in the Reject Vault
9H27	Currency and Denomination
9H28	Cassette ID
9H29	Note size

READ/WRITE DATA ITEMS DESCRIPTION

100	Program ID block	R	231	Program versions. CMCxxxxyyzzSPCxxxxyyzzNF1xxxxyyzz...NF8xxxxyyzzNC1xxxxyyzz...NC8xxxxyyzzNSUxxxxyyzzRVCxxxxyyzzPARxxxxyyzz The version number after “PAR”, is the version of a parameter file, which contains special currency depending settings.
104	Max. notes per dispense	R/W	3	Maximum number of notes in one dispense Legal values: 1 - 50.
110	Module ID blocks	R/W	<208	Commands: Write ID: *WD/110/<module><id>* Read ID block: *RD/110/<block>* Where: <*module*> is one of NMD, SPU, NSU, NTU, NDU, BCU, BOU, TEU, PSU, CMC, FRn, NFn, NFCn or POSn (n = 1 to 8). <*block*> is one of four blocks: *block 0* = {NMD, SPU, NSU, NTU, NDU, BCU, BOU, TEU, PSU, CMC} *block 1* = {FR1, NF1, NFC1 … … FR4, NF4, NFC4} *block 2* = {FR5, NF5, NFC5 … … FR8, NF8, NFC8} *block 3* = {POS1 … POS8} <*id*> is the module ID number. A fix length of 14 characters is allowed. The format may be like <type> <revision> <field revision> <serial number>
118	Currency codes	R	8 * 3	Currency codes. This is a string containing the currency codes (3 characters) of the defined currencies. Undefined currencies are marked as '---'.
127	Change Over Method	R/W	1	If there are two cassettes or more containing the same denomination this item determines when to change dispensing from one cassette to another. ‘0’: No change over is made (default). ‘1’: Change over is made on empty cassette.

READ/WRITE DATA ITEMS DESCRIPTION

201	Feed Order	R/W	1	'0': Feed notes in hopper order '1': Feed notes in size order with biggest notes first. (default) '2': Feed notes in size order with smallest notes first
202	Note sizes	R	8 *13	Description of all notes sizes. Format: *"cccmmetvvvhhh"*
207	Software lock flag	R/W	1	Flag can only be set to '1'. Flag will be reset to '0' at power on reset.
209	Throat Active Flag	R/W	1	Flag that indicates that the throat sensor has been activated. Reset by writing '0' to it.
211	Status on Non Addressed Feeders	R/W	1	'0': No status on Non-addressed feeders (default). '1': Status on Non-addressed feeders or for that has some relevant information.
213	Distance between Note transport path sensor and Throat sensor	R/W	3	For make it possible to use different Throat extensions the distance between Note Transport Path sensor and the Throat sensor can be set (in mm). Default is 140mm, which is the distance for an NMD 50 without Throat extension.
214	Send Self Test Data option	R/W	1	'0': Send Self Test Data for Note Feeders(G1-G4) will answer as in FW 2019-02.02 (default). '1': Send Self Test Data for Note Feeders (G1-G4) will with more relevant information. The answer string is longer.
218	Clean NF Rollers	W	1	Used for cleaning the Note Feeder rollers. '1': NF1 (NQ Feeder) '2': NF2 etc.
223	NF Rollers Clean flag	R/W	1	'0': No automatic cleaning of NF Rollers '1': NF Rollers cleaned at every Close Cassette command
225	Cassette inserted indicator	R/W	1	'0': No indicator of Cassette properly inserted '1': Sound indicator enabled. Flipping the diverter four times makes the sound.

229	Scrub NF Rollers	W	1	Closes the cassette and scrubs the Note Feeder rollers. The cassette is then reopened. '1': NF1 (NQ Feeder) '2': NF2 etc.
236	Check Notes in Transport	R/W	1	When this item is set no notes will be delivered through the exit on a Reset command. '0' Disabled (default) '1' Enabled
300	Internal reject table	R	24*6	This table specifies the number of times each reject reason has occurred. This item contains 24 entries Format: *RRnnnRRnnn* RR: Reject Reason code Nnn: Number of occurrence of each reject reason. This item can be called with *cccmmet* parameter, to get the reject reason counters for one denomination. Reject reason counters for the last ten denominations are stored.
301	Status code table	R	40*5	This table specifies the number of times each status code has occurred. This item contains 40 entries. Status X'30' is not logged. Format: *SSnnnSSnnn* SS: Status code Nnn: Number of occurrence of the status code
303	Total notes delivered	R	10	Total number of notes delivered.
304	Total notes rejected	R	10	Total number of notes rejected. Notes or events?
308	Total notes single rejected	R	10	Total number of notes rejected with single rejects
310	Clear Note statistic counters	W	1	'0': Clear the contents of item 300, 301, 303, 304, 309, 318, 319 and 320.

READ/WRITE DATA ITEMS DESCRIPTION

311	Module Error Log	R/W	8*28	Reply Message String: TTEELLLL Where: T = Task Number E = Module Error Code L = Module Line Number The Module Error log has four levels Which make it possible to log the last 112 internal errors. To see all errors this item must be called with a parameter. '0' : The last 28 internal errors '1' : Error 29 – 56 '2' : Error 57 – 84 '3' : Error 85 – 112 No parameter gives the last 28 errors. Write data with parameter ‘0’ clear the contents of item 311.
318	Total notes delivered (high pressure feed)	R	10	Total notes delivered when notes are fed in high pressure mode
319	Total notes rejected (high pressure feed)	R	10	Total notes rejected when notes are fed in high pressure mode
320	Total number of transactions	R	10	Total number of transactions completed.
330	Total notes delivered (Life Long)	R	10	Total number of notes delivered.
331	Total notes rejected (Life Long)	R	10	Total number of notes rejected.
333	Total number of transactions bundles (Life Long)	R	10	Total number of transactions completed.

READ/WRITE DATA ITEMS DESCRIPTION

392	NQ Note data table initialisation	W	1	‘0’: Clears the NQ Note data table.
395	Enable/Disable Reject Vault	R/W	1	'0': Disable Reject Vault '1': Enable Reject Vault (Default)
397	Module Status	R	12*9	Specifies status of modules. TTT/EE/LLLL/ Where: TTT = task EE = module error code LLLL = module line number
399	Max notes in the Reject Vault	R/W	3	Specifies the maximum number of notes in the reject compartment Legal values: 1 - 200 (Default=50) **Warning**: A high value could cause jams in the Reject Vault inlet.

READ/WRITE DATA ITEMS DESCRIPTION

The cassette table consists of data related to each cassette present in the NMD

All cassette data table item numbers are written on the following format:

9H*nn*

9 specify the data table.

H specifies the position of the cassette, where 0=Reject vault, 1=Cassette in first Feeder and 4=Cassette in last Feeder.

Changing currency and denomination

use the command **WD/9H27/cccmmet**.

ccc = Currency code according to DIN 30784 and ISO 4217. When a note not included in ISO 4217 is used the currency code should be set to **?xx,** where **xx** is a De La Rue recommended code for the specific note.

mm = Is the mantissa, the mantissa should coded with as low value as possible, i.e. the exponent should be as high as possible, the most significant digit should be ”0” for all currencies not needing two digits to describe the value.

e = Is the number of trailing zeros

t = Is the Variant/Issue, **t** is a letter code where ”A” is the first Issue/Variant in circulation, ”B” the second and so on. If the variant is not needed or not used the code should be set to ”_”.

Ex. The cassette is inserted in NF1, the note to be used is a 200 French Franc of the first issue/variant. The command is:

WD/9127/FRF022A

ccc mm e t

A Dutch 25 Gelder note of issue/variant B in NF2 gives in the same way the Command:

WD/9227/NLG250B

ccc mm e t

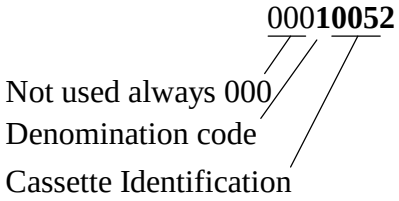
Changing the Cassette ID

Use the command WD/9H28/XXXXXXXX

XXXXXXXX The three most significant digits are recommended to be coded with 000 when used in mechanisms emulating a MDDM

XXX**XXXXX** The five least significant digits are the five-digit number reported in the response to the Reset and Read Cassette ID commands. The coding of these five digits is totally transparent to the dispensing mechanism.

Note!
If the mechanism is used with an Application program written for the MDDM/SD300 it's recommended that this eight digits is used in the following way:



Use digits 0 to 5 for denomination coding with the lowest digit for the lowest denomination. Reserve code 6 for the reject vault.

It's strongly recommended that if a new application is written that this parameter is used as pure cassette identification enabling future expansion to a full 8-digit identifier.

Changing Note size (Note width and length)

Use command **WD/9H29/vvvhhh**

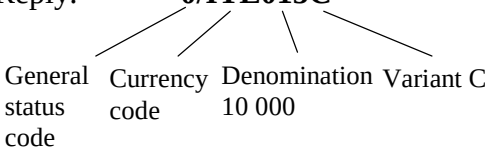
vvvhhh = Vertical size of note (width) in mm
vvv**hhh** = Horizontal size of note (length) in mm

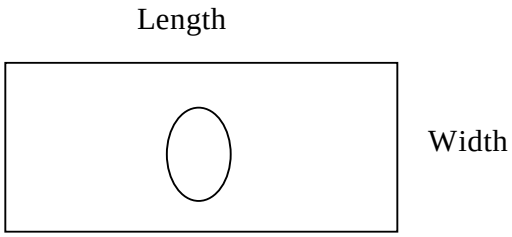
Verifying cassette coding

All coding can be read out by using command Read Data. **RD/9H27**, **RD/9H28** and **RD/9H29**. As with Write the variable H addresses the location in the mechanism. The reply string will have the format S/YYY…Y where S is the general status code and YYY…Y is the actual setting with the same format as Write Data.

Ex. Read currency and denomination in NF4 the note is a 10 000 Italian Lira of third variant/issue:

Command: **RD/9427**
Reply: **0/ITL015C**





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5 STATUS HANDLING

5

5.1 Introduction

This Section describes in detail each individual status code sent back to the network by the NMD.

Each one of the Status Codes, will be provided with following information:
Status Code.
Mnemonic name.
Status Description.
Applicable Commands.
Recommended Actions.
Recommended Operator Message.

Table 5-1 shows all the possible Status Codes, with the Mnemonic Names used throughout this Section, and their different types, which will be described in the following paragraph.

			Reset	Move Forward	Read Cassette Id.	Check Delivered Notes	Close Cassette	Opens Cassette	Read Trace	Check Throat	Read Prog Id	Send Self Test Data	Resend Message	Check NMD Status	Clear Note Transport	Read Data	Write Data
			X'30	X'32	X'35	X'36	X'37	X'38	X'39	X'3A	X'41	X'47	X'4B	X'51	X'52	X'52 X'44	X'57 X'44
			0	2	5	6	7	8	9	:	A	G	K	Q	0		
Successful Command.	**X'30'**	0	A	A	A	A	B	B	B	B	B	B	B	A	A	B	B
Low Level.	**X'31'**	1	A	A	A									A	A		
Empty Cassette.	**X'32'**	2	A	A	A									A	A		
Machine not Opened.	**X'33'**	3		B													
Rejected Notes.	**X'34'**	4		B													
Diverter Failure	**X'35'**	5	B	B	B		B	B						B	B		
Failure to Feed.	**X'36'**	6		A													
Transmission Error.	**X'37'**	7	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Illeg Com. or Com. Seq.	**X'38'**	8	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Jam in Note Qualifier	**X'39'**	9	B	B	B		B	B						B	B		
NC Not Pres or Prop Ins.	**X'3A'**	:		A	A							A				B	B
RV Not Pres or Prop Ins.	**X'3F'**	?	A	A	A		B	B						A	A		
Too Many Notes Req.	**X'42'**	B		B													
Jam in Note Feeder Transport	**X'43'**	C	B	B	B		B	B						B	B		
Reject Vault Almost Full.	**X'44'**	D	A	A	A			B						A	A		
Cassette Internal Failure	**X'45'**	E	A		A			B						A	A	B	B
Main Motor Failure.	**X'46'**	F	B	B	B		B	B						B	B		
Note Qualifier Faulty	**X'49'**	I	B	B	B		B	B						B	B		
NF exit sensor failure	**X'4A'**	J	A	A	A							A		A	A		
Notes in Delivery Throat	**X'4D'**	M		B						B							
Communications Time-out.	**X'4E'**	N	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Cassette not Identified.	**X'50'**	P		B													
Reject Vault Full.	**X'51'**	Q	B	B	B			B						B	B		
Error in Throat.	**X'57'**	W	B	B	B		B	B						B	B		
Sensor Err or Sensor Cover.	**X'5B'**	[	B	B				B				B		B	B		
NMD Internal Failure	**X'60'**	‘	B	B	B	B	B	B						B	B	B	B
Cassette Lock Faulty	**X'61'**	a			A			B						A			
Module Need Service	**X'63'**	c	A	A	A			B						A	A		
No Message To Resend.	**X'65'**	e											B				
Err in Note Transport	**x'68**	h	B	B	B		B	B							B		

Table 5-1

Notes: A = This Status can appear as General Status and as Hopper Status.
B = This Status appears only as General Status.

Table 5-1 shows all the possible Status Codes, with the Mnemonic Names used throughout this Section, and their different types, which will be described in the following paragraph.

Status codes

Table 5-2

MNEMONIC NAME	TYPE	HEX	ASCII
Successful Command	W	X'30'	0
Low Level	W	X'31'	1
Empty Cassette	O	X'32'	2
Machine not Opened	O	X'33'	3
Rejected Notes	W	X'34'	4
Diverter Failure	F	X'35'	5
Failure to Feed	R	X'36'	6
Transmission Error	S	X'37'	7
Illegal Command or Command Sequence	S	X'38'	8
Jam in Note Qualifier	F	X'39'	9
Feed Cassette Not Present or Properly Installed	O	X'3A'	:
Reject Vault Not Present or Properly Installed	O	X'3F'	?
Too Many Notes Requested	O	X'42'	B
Jam in Note Feeder Transport	F	X'43'	C
Reject Vault Almost Full	W	X'44'	D
Cassette Internal Failure	R	X'45'	E
Main Motor Failure	F	X'46'	F
Note Qualifier Faulty	F	X'49'	I
Note Feeder exit sensor failure	R	X'4A'	J
Notes in Delivery Throat	O	X'4D'	M
Communications Time-out	S	X'4E'	N
Cassette not Identified	S	X'50'	P
Reject Vault Full	O	X'51'	Q
Error in Throat	F	X'57'	W
Sensor Error or Sensor Covered	R	X'5B'	[
NMD Internal Failure	F	X'60'	‘
Cassette Lock Faulty	F	X'61'	a
Module Need Service	W	X'63'	c
No Message To Resend	W	X'65'	e
Error in Note Transport	F	X'68	h

5.2 Status types

The different Status Codes sent back to the network in the Reply Message are classified into five different groups, depending on the priority level of the reported situation.

Each one of these groups will imply a different action for the Application Program handling them. The five groups, and the status included under each one of them, are:

5.2.1 WARNING Status (Type W)

The status codes under this heading give the operator some information about the system, which does not require any immediate action. The requested command has been completed.

The statuses of type W are:

X'30' = Successful Command
X'31' = Low Level
X'34' = Rejected Notes
X'44' = Reject Vault Almost Full
X'47' = Rejected Cheque
X'63' = Module Need Service

5.2.2 SOFT RECOVERABLE Status (Type S)

All the status codes under this heading will inform the Application Program that the associated command has not been executed. However, there is not any hardware failure in the machine, so that it in most cases would be possible to send the last command again, and if the same status remains, check the Application Program and/or check the communication line.

They are:

X'37' = Transmission Error
X'38' = Illegal Command or Command Sequence
X'4E' = Communications Time-out
X'50' = Cassette not Identified

5.2.3 OPERATOR RECOVERABLE Status (Type O)

Like the status codes of the preceding group, these status codes also imply that the associated command has not been executed. There could be different reasons, but all of them could be easily solved by an operator action, like refilling an empty Cassettes or sending OPEN CASSETTE command.

The statuses included in this group are:

X'32'	=	Empty Cassette
X'33'	=	Machine not Opened
X'3A'	=	Note Cassette Not Present or Properly Installed
X'3F'	=	Reject Vault Not Present or Properly Installed
X'42'	=	Too Many Notes Requested
X'4D'	=	Notes in Delivery Throat
X'51'	=	Reject Vault Full

5.2.4 RETRIABLE FATAL Status (Type R)

The status codes included in this group will probably imply a hardware failure. The associated command is not executed at all, but could be tried again. If the status code is repeated after this second try, the system should be taken out of service.

The following statuses are included in this group:

X'36'	=	Failure to Feed
X'45'	=	Cassette Internal Failure
X'4A'	=	Feeder Sensor Fail.
X'5B'	=	Sensor Error or Sensor Covered
X'65'	=	No Message To Resend

5.2.5 FATAL Status (Type F)

The status codes defined as Fatal imply a serious problem. The associated command has not been completed and the execution was terminated at the stage where the fatal problem was detected. The NMD will respond to all movement commands with the same fatal error status until appropriate action has been taken. Please refer to special fatal status until appropriate action has been taken.

The FATAL Statuses are divided into two severity types and the action to be taken depends on which type the received status belongs to.

1) The application may send an X'30' RESET command to recover from the problem. If the Status appears again the system must be put out of service, until a Field Service Engineer has revised it.

   The Statuses of this type are:

   X'46' = Main Motor Failure
   X'49' = Note Qualifier Faulty
   X'60' = NMD Internal Failure
   X'61' = Cassette Lock Faulty

2) The NMD must be put out of service, until a Field Service Engineer has revised it.

   The Statuses of this type are:

   X'35' = Diverter Failure
   X'39' = Jam in Note Qualifier
   X'43' = Jam in Note Feeder Transport
   X'57' = Error in Throat
   X'68' = Error in Note Transport

5.2.6 Lock out conditions

Under certain circumstances, the system sets itself in the LOCK OUT condition. When this happens, all the Reply Messages of movement commands are sent in the short format, containing only the General Status byte, until the LOCK OUT condition is cleared. Meanwhile, only very few commands are accepted by the system.

There can be different reasons that put the machine into the LOCK OUT state. Each one of the LOCK OUT conditions are explained below with the ways of recovery and also the commands which are not accepted during this LOCK OUT condition.

Machine not opened

When all cassettes are closed, after a power-up or a hardware reset, the LOCK OUT condition is set. Issuing the command X ‘38’ OPEN CASSETTE clears the condition. The following commands are not accepted during the LOCK OUT condition:

X’32’ MOVE FORWARD

Cassettes not identified

When the cassettes are opened operating position, the LOCK OUT condition is set. Issuing the command X ‘35’ READ CASSETTE-ID clears the condition.

The following commands are not accepted during the LOCK OUT condition:

X’32’ MOVE FORWARD

Reject Vault full

When the limit for number of rejected notes has been exceeded for the Reject Vault, the system stays in LOCK OUT condition until the Reject Vault is removed and emptied. WITH THE POWER ON The only movement commands accepted are:

X’37’ CLOSE CASSETTE

Fatal jam

All the status codes defined as fatal will cause this LOCK OUT condition. In this situation, the only movement commands acceptable are:

X’30’ RESET
X’37’ CLOSE CASSETTE

5.3 Status description

Included in the following pages, are detailed descriptions of each one of the different status codes that can appear in the Reply Messages from the NMD Controller to the Network.

Each status can be easily identified by its mnemonic name, and also by its ASCII code. The different statuses are described in the natural sequence of their hexadecimal values.

Status Description:

This status is sent to the Network, when the command has been successfully executed.

Applicable Commands:

See table 5-1

Recommended Actions:

No action is required.

Operator Message:

There is no recommended message for this status.

LOW LEVEL STATUS ***X'31'***
TYPE W

Status Description:

This status is sent to the network when the number of notes in one or more Cassettes is below a pre set level. This means that the low-level sensor in the Note Cassette has been activated. This happens when the number of notes left in the cassette represents a note pile of less than 20-30 mm

Applicable Commands:

See table 5-1

Recommended Actions:

The Cassettes should be removed and filled using the normal procedure. The refilling could be delayed for several transaction since this status is a first warning that the cassette is becoming empty and the Cassette still contains notes for several transactions. But actions should be taken to refill the cassette as soon as possible.

This message could also indicate for the Application Program to use alternate Cassette in the following transaction.

Operator Message:

The recommended message that the Application Program should send to the operator is:

31-W LOW LEVEL IN CASSETTE NNNNN

Status Description:

This status is generated when a Cassette is empty during a dispense operation. For compatibility reasons Empty cassette is only reported when notes are requested from the cassette that is empty, Empty cassettes not requested in the Move Forward command will have their hopper status set to Low Level. On the commands Reset and Read cassette ID X'35' cassettes with empty condition will reply with X'32' EMPTY CASSETTE in the Reply Message for the cassettes that are empty.

If Change Over Method is used (item 127 set to 1), X'32' EMPTY CASSETTE will be reported as hopper status on the cassettes that become empty during the transaction, but the overall status will be X'31' LOW LEVEL or X'34' REJECTED NOTES if the transaction is successfully performed.

Applicable Commands:

See table 5-1

Recommended Actions:

The empty Cassette should be removed and refilled using the normal loading procedures. The status could also be used to trigger the Application Program to begin using alternate note Cassettes in the following transactions.

Operator Message:

The recommended message that the Application Program should send to the operator is:

32-O CASSETTE NUMBER NNNNN IS EMPTY

MACHINE NOT OPENED Status ***X'33'***

Type O

Status Description:

This status code arises when the cassettes are not opened and any movement command different from OPEN CASSETTE, RESET and CLOSE CASSETTE are sent to the system.

It is also possible that this status is sent to the network, even if the cassettes are opened. This will occur if the machine is switched off and on during normal daily operation. This is to indicate that the power has been off.

Applicable Commands:

See table 5-1

Recommended Actions:

Whatever the cause of this status, it can be easily cleared sending the commands OPEN CASSETTE and READ CASSETTE -ID.

Operator Message:

The recommended message that the Application Program should send to the operator is:

33-O MACHINE NOT OPENED

Status Description:

This status indicates that notes have been rejected during the transaction.

The Reply Message informs of the total number of notes fed from each module, including those rejected. Hopper number 0 field, will detail the total number of notes counted in the Note Qualifier, both delivered and rejected.

Rejection counters in the Application Program can be updated by subtracting the total number of notes requested from the total number of notes counted in the Note Qualifier. However, it must be kept in mind that this figure might be not exact, because rejected notes can be anything from two notes stuck together to a sheet of paper.

Applicable Commands:

See table 5-1

Recommended Actions:

Being a warning message, the only action required is to provide the Application Program with the proper subroutines to keep control of the number of rejected notes. The reject trace area should be read and the latest reject reason is stored by the application in a maintenance log file.

Operator Message:

The recommended message that the Application Program should send to the operator is:

34-W CAUTION: NOTES REJECTED

NOTE DIVERTER FAILURE Status ***X'35'***

Type F

Status Description:

This status indicates that the system has recognised a note that was intended to be rejected in the Note Transport sensor. The most likely reason is either a mechanical or an electrical failure in the Note Diverter. Therefore it is qualified as Fatal Error.

Applicable Commands:

See table 5-1

Recommended Actions:

The contents of the machine has to be verified, all transaction must be suspended, and the system must be taken out of service until checked by a Field Service Engineer. However, to empty the machine of notes a CLOSE CASSETTE command could be sent and the cassettes could be removed.

Operator Message:

The recommended message that the Application Program should send to the operator is:

35-F NOTE DIVERTER FAILURE. **CALL SERVICE ENGINEER**

Status Description:

This status appears when the system fails to dispense the requested amount of notes.

Applicable Commands:

See table 5-1

Recommended Actions:

There could be different reasons to report this status. One reason is that the Note Feeder fails to feed notes; another is that there is too many reject events in the transaction. However, it is not a Fatal Status, the Application Program could try *one* more time. If the situation still remains the same, put the hopper position out of service, continue to feed notes from remaining positions and call for a Field Service Engineer.

Operator Message:

The recommended message that the Application Program should send to the operator is:

36-R FAILURE TO FEED. **CONTINUE OPERATION FROM REMAINING FEEDER POSITIONS **

TRANSMISSION ERROR Status ***X'37'***

Type S

Status Description:

This status occurs when the message received by the NMD may be inaccurate. The reason for this status is the detection of a wrong LRC Character or a parity error. Therefore, the cause of the problem may be either some error in the Application Program Subroutines dealing with LRC calculation or a problem in the communication line.
See also chapter 6.

Applicable Commands:

See table 5-1

Recommended Actions:

The Application Program could try to send the command, again because the problem might have arisen because of a random noise in the line.

Operator Message:

The recommended message that the Application Program should send to the operator is:

37-S TRANSMISSION ERROR

ILLEGAL COMMAND OR COMMAND SEQUENCE Status ***X'38'***

Type S

Status Description:

This error can appear if an unknown command is sent to the NMD, or if a command with incorrect parameters is sent to the NMD.

Applicable Commands:

See table 5-1

Recommended Actions: Please check the application.

Operator Message:

The recommended message that the Application Program should send to the operator is:

38-S ILLEGAL COMMAND.

JAM IN NOTE QUALIFIER Status *X'39'*

Type F

Status Description:

This status indicates that a note is detected in the Note Qualifier, but not seen in the Note Transport sensor, probably due to a jam in the transport between the Note Qualifier and Note Diverter.

Applicable Commands:

See table 5-1

Recommended Actions:

The contents of the machine has to be verified, all transaction must be suspended, and the system must be taken out of service until checked by a Field Service Engineer. However, to empty the machine from notes a CLOSE CASSETTE command could be sent and the cassettes could be removed.

Operator Message:

The recommended message that the Application Program should send to the operator is:

39-F JAM IN NOTE QUALIFIER **CALL SERVICE ENGINEER**

FEED CASSETTE NOT PRESENT OR OPENED Status *X'3A'*

Type O

Status Description:

This status appears when requesting notes from a cassette, which is not present, or is not opened. It can also occur if the Command Message addresses a non-existing feed module. The status can also appear if data has been written to the cassette with item 9Hnn. This status also appears as Hopper Status.

Applicable Commands:

See table 5-1

Recommended Actions:

The operator should insert and open the cassette, read cassette numbers and resume transactions. If data has been written to the cassette it has to be removed and inserted again before it is opened.

Operator Message:

The recommended message that the Application Program should send to the operator is:

3A-O INSERT CASSETTE NNNNN AND START UP AGAIN

REJECT VAULT NOT PRESENT OR OPENED Status *X'3F'*

Type O

Status Description:

Whenever a movement command is received, the system checks that the Reject Vault is properly loaded in the machine. If not, this status code is sent, and the transaction is ignored. Only exception is the movement command CLOSE CASSETTE, which will be done without the reject cycle.

Applicable Commands:

See table 5-1

Recommended Actions:

The operator should insert the Reject Vault properly and resume daily transactions.

Operator Message:

The recommended message that the Application Program should send to the operator is:

3F-O INSERT REJECT VAULT

TOO MANY NOTES REQUESTED Status *X'42'*

Type O

Status Description:

This status appears when a transaction with too many notes is requested. Maximum number of notes is default 50, but can be redefined with item 104. The transaction is not executed, and the status code is sent back to the network.

Applicable Commands:

See table 5-1

Recommended Actions:

The operator should repeat the transaction, asking for a legal number of notes.

It is recommended that the Application program is checked, while this status indicates that the number of notes requested is higher than the maximum number of notes defined in item 104.

Operator Message:

The recommended message that the Application Program should send to the operator is:

42-O MORE THAN NNN NOTES REQUESTED

JAM IN NOTE FEEDER TRANSPORT Status *X'43'*

Type F

Status Description:

This status is sent when a note is fed from the feeder, but not reached the Note Qualifier in time. The failure could appear if a jam occurs between the feeder and the Note Qualifier, or if the note is not detected in the Note Qualifier.

Applicable Commands:

See table 5-1

Recommended Actions:

The application program should send a RESET command. If the response on the RESET command indicates successful execution, operation can be resumed from the point where the problem occurred. If the problem returns or if the RESET command was unsuccessful the system must be put out of service until checked by a Field Service Engineer.

Operator Message:

The recommended message that the Application Program should send to the operator is:

43-F JAM IN NOTE TRANSPORT. **CALL SERVICE ENGINEER**

Note: The text ****CALL SERVICE ENGINEER**** should not be reported before the recovery procedure has failed.

Status Description:

This status is sent, both as General and as Hopper status, when the internal reject counter reaches the limit for almost full.

The counter for single reject is incremented by one for each rejected note. The limit for almost full in single reject area is 37.

The limit for REJECT VAULT FULL can be set between 1 and 200 with item 399. The limit for REJECT VAULT ALMOST FULL is 75% of the limit for REJECT VAULT FULL.
Example. . If item 399 is set to 100, REJECT VAULT ALMOST FULL occurs when the counter for rejects exceeds 75.

Applicable Commands:

See table 5-1

Recommended Actions:

The Reject Vault should be emptied as soon as possible to avoid a LOCK OUT condition when the counter for rejected notes is above 50. THE REJECT VAULT MUST BE EMPTIED WITH POWER ON

Operator Message:

The recommended message that the Application Program should send to the operator is:

44-W REJECT VAULT MUST BE EMPTIED

CASSETTE INTERNAL FAILURE Status X'45'
Type R

Status Description:

This status is sent if there is a checksum error in the data stored in the Note Cassette.

Applicable Commands:

See table 5-1

Recommended Actions:

Put Cassette out of service.

Operator Message:

The recommended message that the Application Program should send to the operator is:

43-R CASSETTE INTERNAL FAILURE

Status Description:

This status occurs when main motor has not reached the normal speed in time, or if there are several missing pulses from the transport clock wheel in one transaction. As with any other fatal error, this status code generates a LOCK OUT condition, and the command is not executed.

Applicable Commands:

See table 5-1

Recommended Actions:

The application program should send a RESET command. If the response of the RESET command indicates successful execution operation can be resumed from the point where the problem occurred. If the problem returns or if the RESET command was unsuccessful the system must be put out of service until checked by a Field Service Engineer.

Operator Message:

The recommended message that the Application Program should send to the operator is:

46-F MAIN MOTOR FAILURE ** CALL SERVICE ENGINEER**

Note: The text ****CALL SERVICE ENGINEER**** should not be reported before the recovery procedure has failed.

NOTE QUALIFIER FAULTY Status X'49'
Type F

Status Description:

This status is sent back to the network from the NMD, when it is not possible to calibrate the double detects sensors in the Note Qualifier, or when it is not possible to adjust the gain value when learning a new note. Being a fatal error, the transaction is not completed, and a LOCK OUT condition is generated.

Applicable Commands:

See table 5-1

Recommended Actions:

The application program should send a RESET command. If the response on the RESET command indicates successful execution, operation can be resumed from the point where the problem occurred. If the problem returns or if the RESET command was unsuccessful the system must be put out of service until checked by a Field Service Engineer.

Operator Message:

The recommended message that the Application Program should send to the operator is:

49-F NOTE QUALIFIER FAULTY **CALL SERVICE ENGINEER**

Note: The text ****CALL SERVICE ENGINEER**** should not be reported before the recovery procedure has failed.

NOTE FEEDER SENSOR FAIL Status *X'4A'*

Type R

Status Description:

This status appears when a sensor error occurs in the Note Feeder, or when a note is stuck in the Note Feeder exit sensor. This error is qualified as Retriable because the system can still be used if no notes are going to be required from that module.

Applicable Commands:

See table 5-1

Recommended Actions:

The Application Program can make a retry with the same command as used when the problem occurred. If the problem still remains, the Application Program must internally mark the particular Hopper as faulty to avoid using it until a Field Service Engineer has resolved the problem.

Operator Message:

The recommended message that the Application Program should send to the operator is:

4A-R NOTE FEEDER SENSOR FAIL **CALL SERVICE ENGINEER**

NOTES IN DELIVERY THROAT Status ***X'4D'***

Type O

Status Description:

An attempt to feed or dispense notes when a note is still in the Throat will cause this error to be sent back as a reply and the command will not be executed.

This status is also used as a throat status in the command CHECK THROAT.

Applicable Commands:

See table 5-1

Recommended Actions:

If a note is blocking the throat, the note must be removed. Check if notes have been removed, using the command CHECK THROAT, and then repeat the original command.

Operator Message:

The recommended message that the Application Program should send to the operator is:

4D-O NOTES IN THROAT. TRANSACTION CANCELLED

Status Description:

This error status is reported when the transmission of each one of the characters in the command string, is not completed within the time restriction imposed by the electrical interface used. See also chapter 6.

Applicable Commands:

See table 5-1

Recommended Actions:

The cause of this problem may be the setting up of the electrical signals in the interface, or an error in the Application Program, which is delaying the transmission of the characters in the command string.

In both cases, the system must be put out of service, and a full revision of the installation and Application Program will be required.

Operator Message:

The recommended message that the Application Program should send to the operator is:

4E-S COMMUNICATION TIME-OUT. REVISE INSTALLATION

CASSETTES NOT IDENTIFIED Status ***X'50'***

Type S

Status Description:

This status is reported when a movement command is ordered without one preceding READ CASSETTE ID command after the cassettes have been opened.

Applicable Commands:

See table 5-1

Recommended Actions:

Either the operator or the Application Program itself should send the READ CASSETTE-ID Command to recover from the LOCK OUT condition.

Operator Message:

The recommended message that the Application Program should send to the operator is:

50-S CASSETTES NUMBERS MUST BE READ NOW

Status Description:

This status is generated when the internal counter exceeds 50. See description of REJECT VAULT ALMOST FULL.

It must be kept in mind that this status, even if it is not a fatal one, will cause a LOCK OUT condition which will not be removed until the Reject Vault has been emptied. The internal counter of rejected notes is stored non-volatile during power down and restored at power up. This means that the Reject Vault MUST BE REMOVED, EMPTIED AND RE-INSERTED WITH THE POWER ON to reset the internal reject counter to 0.

Please refer to status X'44' REJECT VAULT ALMOST FULL for information about the way the internal reject counters are updated.

Applicable Commands:

See table 5-1

Recommended Actions:

The operator must empty and reinsert the Reject Vault before normal operation can be resumed.

Operator Message:

The recommended message that the Application Program should send to the operator is:

51-O EMPTY AND REINSERT REJECT VAULT

ERROR IN THROAT Status ***X'57'***

Type F

Status Description:

This status is reported by the NMD when a note is stuck in the throat sensor during Move Forward or Reset Command.

Applicable Commands:

See table 5-1

Recommended Actions:

The contents of the machine has to be verified, all transaction must be suspended, and the system must be taken out of service until checked by a Field Service Engineer. However, to empty the machine of notes a CLOSE CASSETTE command could be sent and the cassettes could be removed.

Operator Message:

The recommended message that the Application Program should send to the operator is:

57-F ERROR IN THROAT **CALL SERVICE ENGINEER**

SENSOR ERROR OR SENSOR COVERED Status *X'5B'*

Type R

Status Description:

This status is used when a sensor in the Note Transport does not work properly during an internal self-test preceding the movement commands.

Applicable Commands:

See table 5-1

Recommended Actions:

When this status is given as reply, the application could make a retry on the command to see if the error still remains. If the error still remains the machine should be checked by a technical service engineer. The sensor may be dirty, have a loose connection or covered by a note. To check which sensor is affected command X'47' Send Self test Data can be used.

Operator Message:

The recommended message that the Application Program should send to the operator is:

5B-R ERROR IN SENSOR **CALL SERVICE ENGINEER**

NMD INTERNAL FAILURE Status *X'60'*

Type F

Status Description:

This status is reported when an internal error occurs in the NMD. The most likely reason for this is internal communication problems in the NMD.

Applicable Commands:

See table 5-1

Recommended Actions:

The application program should send a RESET command. If the response to the RESET command indicates successful execution, operation can be resumed from the point where the problem occurred. If the problem returns or if the RESET command was unsuccessful the system must be put out of service until checked by a Field Service Engineer.

Operator Message:

The recommended message that the Application Program should send to the operator is:

60-F NMD INTERNAL FAILURE **CALL SERVICE ENGINEER**

Note: The text **CALL SERVICE ENGINEER** should not be reported before the recovery procedure has failed.

Status Description:

This status is reported by the NMD at the OPEN CASSETTE command, when it fails to open the Note Cassette into the operating position. It is also reported at CLOSE CASSETTE command if the close type 1 is used. (See description of CLOSE CASSETTE). The failure can also occur when using the normal CLOSE CASSETTE command, but in that case it is not reported.

When this problem is detected status code X'61' CASSETTE LOCK FAULTY will be sent as a response.

The Note Cassette(s) causing the problem is/are located by issuing a READ CASSETTE-ID directly after the first occurrence of this status. The cassette causing the problem will have status set to X'61' CASSETTE LOCK FAULTY, this status will also be reported as main status.

Applicable Commands:

See table 5-1

Recommended Actions:

Check the notes loaded in the cassette and if necessary reload the cassette. If the problem still remains after reloading the cassette, replace the cassette and submit the faulty one for Field Service Engineer.

Operator Message:

The recommended message that the Application Program should send to the operator is:

61-F CASSETTE FAULTY OR IMPROPERLY LOADED

MODULE NEEDS SERVICE Status ***X'63'*** *Type W*

Status Description:

This status is reported by the NMD when calibration values for at least one sensor in any Note Feeder exceeds the warning level

Applicable Commands:

See table 5-1

Recommended Actions:

Check the sensor calibration values with SEND SELF TEST DATA command. If the calibration value on one or more sensors is too high maintenance should be carried out.

Operator Message:

The recommended message that the Application Program should send to the operator is:

63-W MODULE NEED SERVICE

Status Description:

This status appears at the RESEND LAST MESSAGE command when there is no command previously executed and consequently no response message to resend. This status indicates that a power loss/firmware restart has occurred at the NMD controller and no information could be retrieved.

Applicable Commands:

See table 5-1

Recommended Actions:

If the Network has sent the command MOVE FORWARD and this status occurs after receiving command RESEND LAST MESSAGE, special actions must be taken. To see if any notes have been delivered to the exit, the command CHECK DELIVERED NOTES should be used to verify if the Move Forward was completed.

Operator Message:

There is no special recommended message for this status, as the message to send to the operator depends on the command given prior to the RESEND LAST MESSAGE.

ERROR IN NOTE TRANSPORT Status *X'68'*

Type F

Status Description:

This status appears in the following situations:

1. When a note is stuck in the Note Transport sensor.
2. When a note is stuck between the Note Transport sensor and the Throat sensor.

Applicable Commands:

See table 5-1.(1).

Recommended Actions:

The content of the machine has to be verified, all transaction must be suspended, the system must be taken out of service until checked by a Field Service Engineer. However, to empty the machine of notes a CLOSE CASSETTES command could be sent and the cassettes could be removed. Before sending RESET the Note Transport has to be cleared of notes.

Operator Message:

The recommended message that the Application Program should send to the operator is:

62-F ERROR IN NOTE TRANSPORT
62-F ** CALL SERVICE ENGINEER**

6 STANDARD INTERFACE

6

The NMD Controller Board CMC is equipped with two communication ports, one for the normal application command /reply communication J5 and a second allocated for manufacturing testing J7.

6.1 Electrical and mechanical characteristics

In the following text the logical state "ON" is referred to as active and the logical state "OFF" as inactive.

All interface signals meets the electrical specification of CCITT recommendation V.24 and EIA RS-232-C in asynchronous mode, with
1 START BIT, 7 DATA BITS and 2 STOP BITS,

Signals:	Data Signals			Logical	"1" :	below -3 V
				Logical	"0" :	above +3 V
	Control Signals	"OFF"	=	logical	"0" :	below -3 V
		"ON"	=	logical	"1" :	above +3 V

Voltages are in reference to signal ground.

The ports have their connectors located on the NMD Central Machine Controller board. The connectors are 5 pin male AMP CT-type.

6.2 *Baud-rate and parity*

Communication with the NMD takes place at a fixed baud rate of 9600 with even parity.

6.3 Interface signals

The following signals are defined in the NMD application command port J5:

Circuit CCITT	Circuit EIA	PIN	IN/OUT	Signal name
103	BA	1	OUT	TxD Transmit Data
104	BB	2	IN	RxD Receive Data
105	CA	3	OUT	RTS Request to Send
106	CB	4	IN	CTS Clear to Send
102	AB	5	-	SG Signal Ground

6.4 Character coding

The NMD uses ISO 646 character coding

	0	***1***	***2***	***3***	***4***	***5***	***6***	***7***
0	NUL	DLE	SP	0	@	P	‘	p
1	SOH	DC1	!	1	A	Q	a	q
2	STX	DC2	”	2	B	R	b	r
3	ETX	DC3	#	3	C	S	c	s
4	EOT	DC4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	´	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	FS	,	<	L	\	l	|
D	CR	GS	-	=	M	]	m	}
E	SO	RS	.	>	N	^	n	~
F	SI		/	US	O	_	o	

Table 6.01.(1): Standard ASCII code set

6.5 LRC calculation

Example: If the message string, before the LRC calculation is: A B C D
Each graphic symbol being a byte of the message string. Then, the following operations should be performed:

- Calculate the "exclusive or" of all the characters in the string:
  V = (A) .XOR. (B) .XOR. (C) .XOR. (D)
- Divide the hexadecimal value calculated above by hexadecimal 10, and truncate the result:
  Y = V / X'10'
- Calculate the "logical and" between the result of the first operation and the hexadecimal (0F):
  Z = V.AND.X'0F'
- Add hexadecimal (30) to the last two values. This will give us the two LRC bytes, L_1 and L_2:
- L_1 =Y.OR.X'30'
- L_2 =Z.OR.X'30'
- The complete message string without the EOM character, will be:
  A B C D L_1 L_2 NOTE:".XOR."=LOGICAL EXCLUSIVE OR.
  ".AND.=LOGICAL AND ".OR."=LOGICAL OR
- **Example:** A Move Forward command with 5-notes from hopper 2 "202005"

Calculating the exclusive or V= X'32' .XOR. X'30' .XOR. X'32' .XOR. X'30' .XOR. X'30' .XOR. X'35' = X'05'

Divide by X'10:

Y = INT (X'05' / X'10') = X'00'

Calculate "logical and".V.AND.X'0F'

Z = X'05'.AND.X'0F' = X'05'

Add hexadecimal 30 to Y and Z

L_1 = X'30'.OR.X'00 = X'30'

L_2 = X'30'.OR.X'05' = X'35'

This will give the complete string

X'31' X'30' X'32' X'30' X'30' X'35' X'30' X'35' X'0D'
or expressed as a literal string

"20200505<CR>"

***Pseudo code;* LRC calculation**

a	Set a byte variable to zero.	SUM := 0x00
b	XOR all bytes in the command string with SUM (NOT including EOM).	FOR i := 1 to end-of-string SUM := SUM XOR CMD[i]
c	Integer divide SUM with 0x10 and OR it with 0x30 to get LRC1.	LRC1:= (SUM DIV 0x10) OR0x30
d	AND SUM with 0x0F and OR it with 0x30 to get LRC2.	LRC2 := (SUM AND 0x0F) OR 0x30

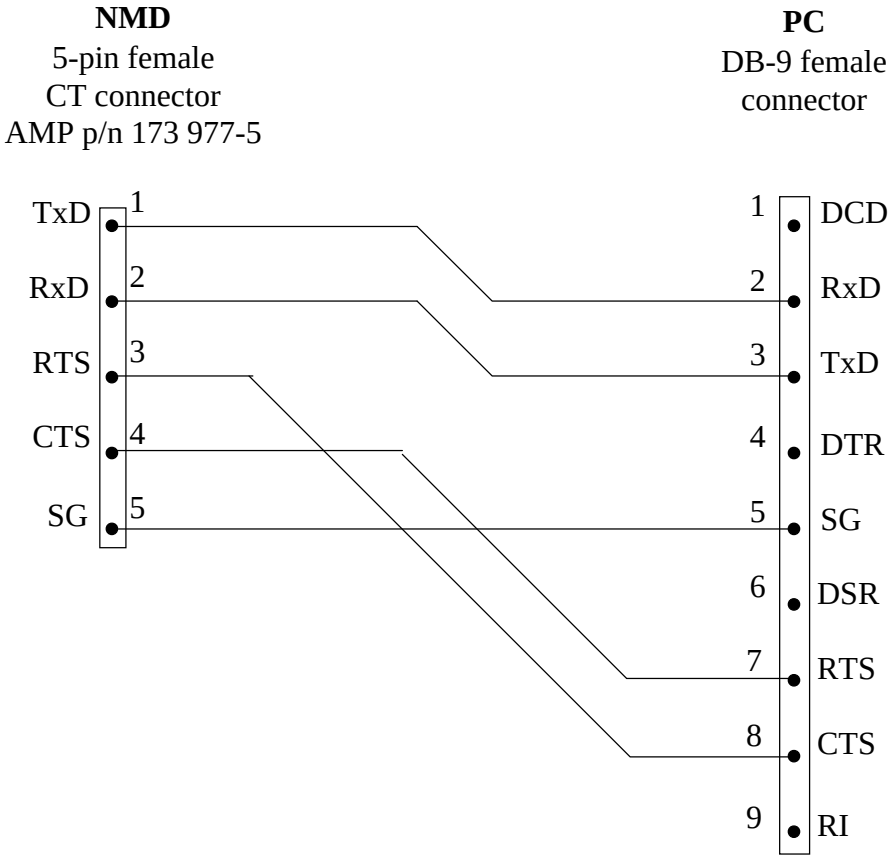
6.5.1 Control signals and cables

There are two different possibilities to communicate with the NMD, with or without "handshaking".

6.5.2 Communication with handshake

In normal situations, when handshaking is required, the control signals are used in the following way:

CTS	"ON" condition indicates that the connected device wants to communicate with the NMD. The CTS signal must be held "ON" when the command is transmitted to the NMD as well as when the NMD sends the reply string. The CTS signal can be used to delay characters in the response message up to 1 sec. The CTS must be set ”OFF” within 1 sec. after that RTS has been set ”OFF” by the NMD.
RTS	"ON" condition will be applied by the NMD as a response to detecting the CTS ”ON”. The connected device must not transmit any data to the NMD until RTS is "ON". The RTS signal will stay "ON" until the NMD has transmitted the response message.



Normal situation

In the normal situation, the Network raises the RTS line, which indicates that it wants to send a message to the NMD. In response the NMD raises the CTS line within 10 ms, indicating it is ready to receive the first character.

The Network sends the message terminated by an EOM Character; the Network may after sending the EOM Character put the RTS line "OFF". When the message is received by the NMD, it is passed onwards to the actual handler in the NMD code. When the message has been processed and the NMD is ready to send a response the RTS line must be "ON". The Network may now delay the transmission by setting the RTS line "OFF", and re-enable transmission by setting the RTS line "ON" again. The transmission must not be delayed by more than 1 second each time the RTS is turned "OFF".

The NMD will terminate the message with an EOM Character. At this point a complete exchange has been performed. The Network now has a choice of two actions.

1. It may drop RTS, which terminates the connection and causes the NMD to drop CTS and resume idle mode.
2. It may send a new message within 1 second, in which case this is treated in the same manner as the previous.

Delaying transmission

The Network may delay transmitted characters from the NMD by taking RTS to "OFF" condition. The NMD will stop transmission within
2 characters time after that the RTS is set to "OFF" condition.

Maximum delay is 1 second. If exceeded, the error handling described in paragraph 6.08.c below is carried out.

6.5.3 Error conditions

After error detection and handling has taken place as described below, the NMD will always await a new transmission (command) from the connecting device.

Receive time out of incoming data

A 1s timer is started when the NMD responses to the handshake and sets CTS signal to "ON". This timer is restarted each time a complete character is received, and is stopped upon receiving an EOM Character.
If a time out occurs, the following error handling takes place:
The NMD transmits error message X'4E' COMMUNICATION TIME OUT and then sets CTS to "OFF" condition.

If the RTS is at "OFF" condition when the NMD is ready to send the error message, the NMD will wait 1 second for RTS "ON" and then set the CTS to "OFF" condition, not sending the error message. The NMD will not support any further communication on this channel until the Network sets RTS to ”OFF”.

Input buffer overflow and receive error

If the 254 character input buffer is exceeded or a character receive error is detected, such as Parity, Framing or LRC error, the following error handling takes place:
The NMD transmits error message X'37' TRANSMISSION ERROR and then sets RTS to "OFF" condition.

If the RTS is at "OFF" condition when the NMD is ready to send the error message, the NMD will wait 1 second for RTS "ON" and then set the RTS to "OFF" condition, not sending the error message. The NMD will not support any further communication on this channel until the Network sets RTS to ”OFF”.

Transmit time out / Delay time out

When the NMD is ready to send the response message the RTS line must be "ON" within 1 second. During transmission the RTS line from the Network is used to inhibit the NMD if the Network cannot receive data in the rate it is sent to it. When the Network lowers the RTS, the NMD stops transmission within 2 characters. The RTS must be raised within 1 second or a transmission time out is triggered. Thus for each character to be sent, the RTS must be raised within 1 second, and when it is lowered, transmission is stopped.

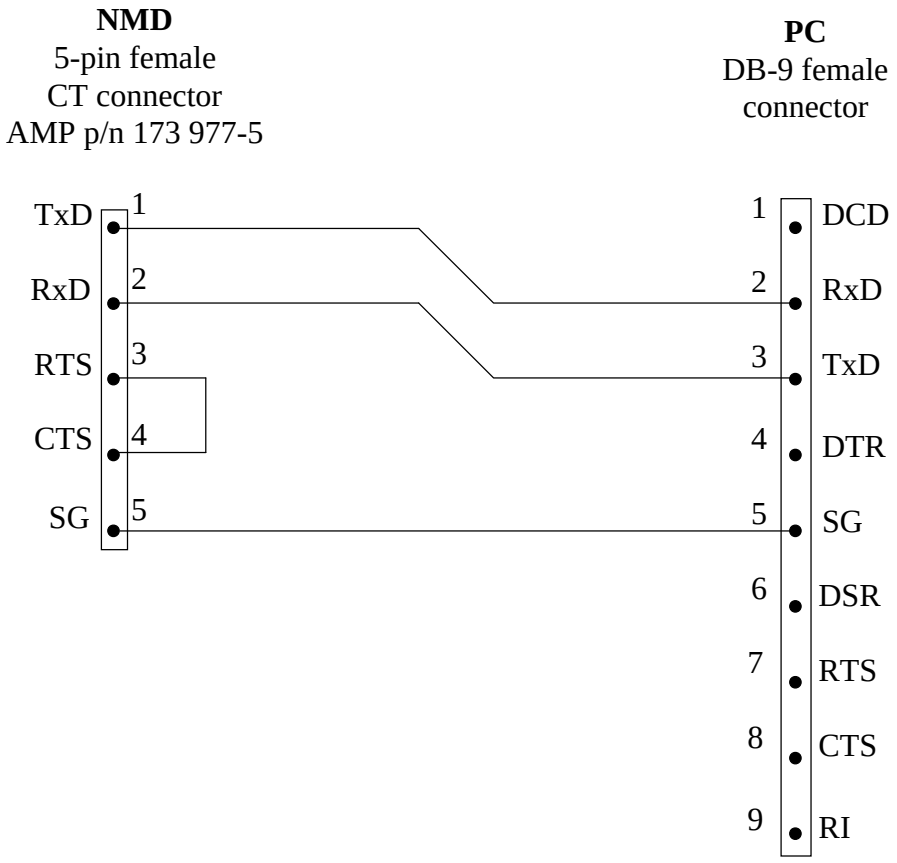
The first character of the response may not be sent before 50 ms have elapsed since reception of the command.

If a transmission time out exception is raised, this causes the NMD to lower the CTS signal. The Network must now lower the RTS line before this channel can be used again. There is no time out waiting for the Network to lower the RTS line.

6.5.4 Communication without handshake

Under special conditions, when "handshaking" is not desired, the control signals may be used in the following way:

CTS	Wired to RTS. The NMD Machine controller will at power on reset determin if this pin is connected directly to RTS to deside if communication without hanshake is requested.
RTS	Will be set permanently ”ON” after detection of it being wired to CTS



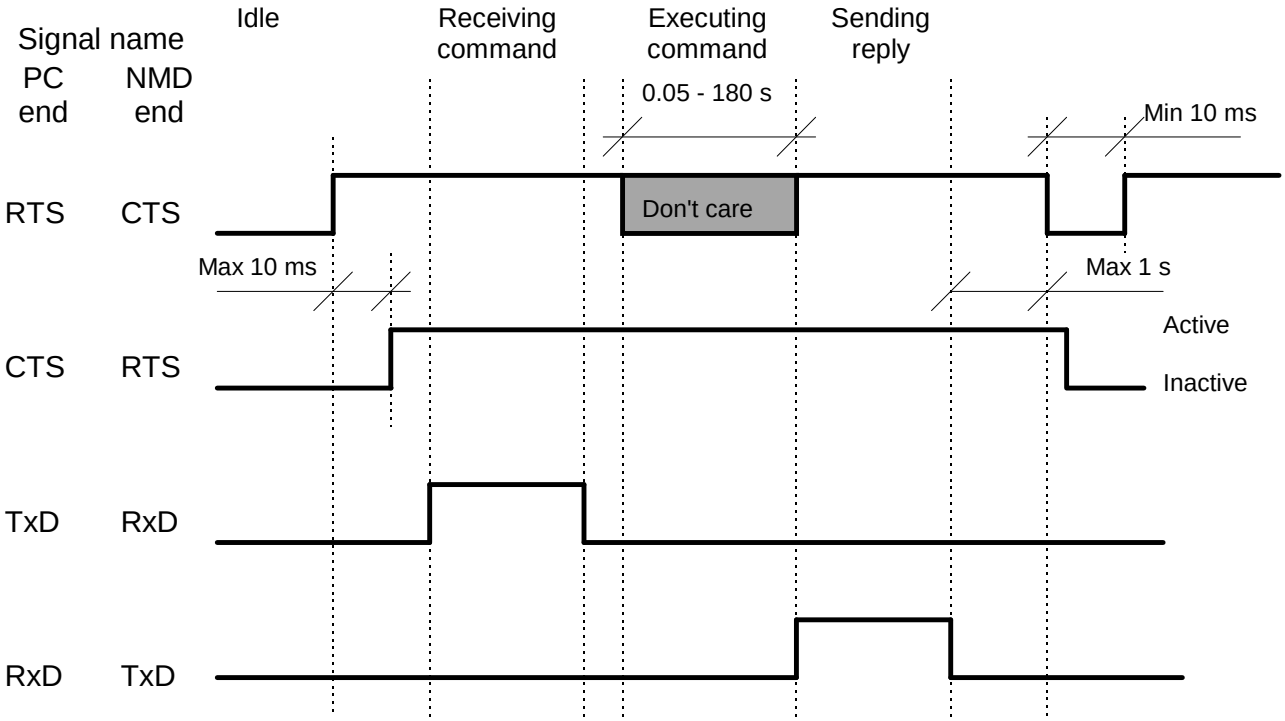
The Network sends the message terminated by an EOM. When the NMD Controller receives the message, it is passed onwards to the actual handler in the NMD code. When the message has been processed the NMD Controller send the response.

It should be notified that the NMD is not ready to receive a new message until the EOM character in the response has been transmitted from the NMD.

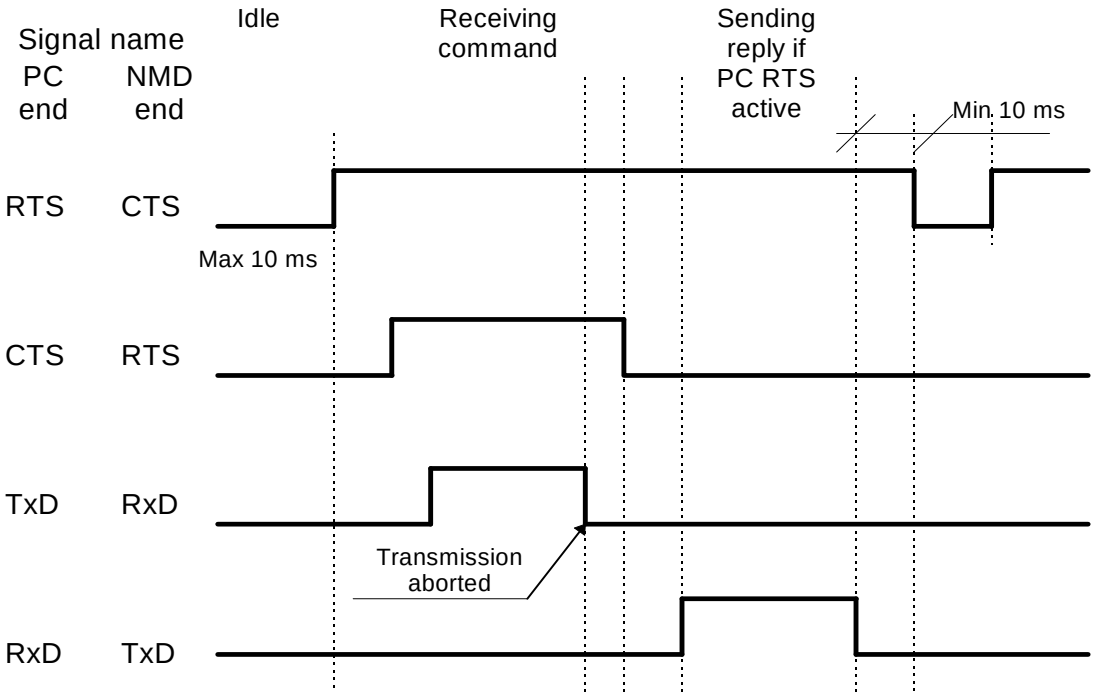
6.6 *Signal timing*

In the following pages some examples are shown of the timing of control signals in different situations.

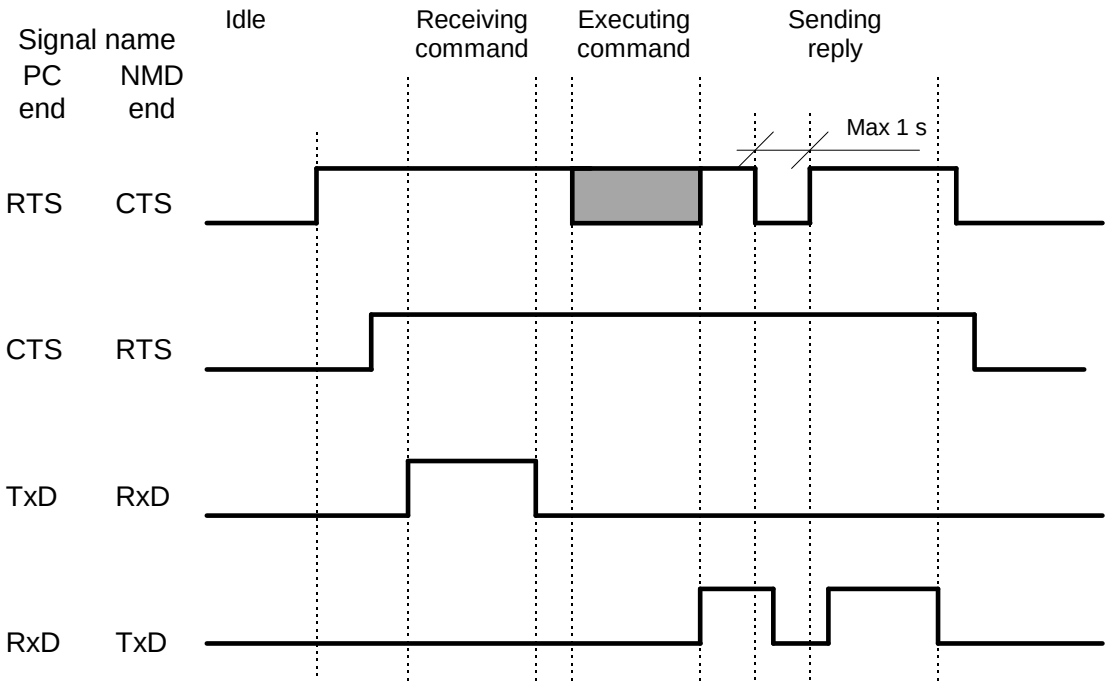
Example: Normal situation.



Example: Receive time-out or Buffer overflow.



Example: Transmission delay.



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The Talaris Commitment

Talaris are World Experts in cash management. Across the globe 2,300 personnel, with over 130 business partners deliver technology and solutions that provide security, productivity and innovation to our customers.

The company is committed to the highest ethical standards and compliance with legislation and to be a fair employer wherever we operate. As a responsible organisation we maintain a disciplined approach to our corporate governance and operate to the optimum professional standards in all aspects of our business.

Talaris will always seek to provide a safe and productive work environment where all employees can grow and be challenged. Wherever we operate our objective is to contribute actively to the community and the local environment. An intrinsic part of our business philosophy across our product and service offerings is to be consistently environmentally responsible and to continue to improve our performance across all environmental issues wherever possible.

talaris™
security | productivity | innovation

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