

---

Title:

RC8000  
Memory Testpackage

---

 **AS REGNECENTRALEN**

RC SYSTEM LIBRARY: FALKONERALLE 1 DK-2000 COPENHAGEN F

---

RCSL No: 30-M198

Edition: 79.02.08

Author: Flemming Hansen

Flemming Kam

---

Keywords:

RC8000, Testprogram, Core Memory Test, MEM805.

---

Abstract:

This paper describes the Memory Testpackage.

<u>Content</u>	<u>Page</u>
1. Introduction.....	1
2. Initiation of Programs.....	1
3. Address Selection Test.....	6
4. Hit Selection Test.....	6
5. Worst Case Test.....	7
6. Worst Complement Test.....	8
7. X-Y Driver Load Test.....	8
8. General Reliability Test.....	10
9. MEM805 Test.....	10
9.1 Error Correction/Detection Test.....	10
9.2 Ram Chip Test.....	11
10. Examples.....	12
11. Operator Messages.....	18
 <u>Documents:</u>	
RC8000 Testprogram System, Users Manual	RCSL: 30-M216
RC8005 Testprogram List (Auto, Testadm, MEM, CPU)	RCSL: 30-M235
RC8100 Memory Test, Binary Paper Tape	RCSL: 30-M231
RC8000 Test Base Systems, Binary:	
Mag. Tape 800 bpi	RCSL: 30-M224
Mag. Tape 1600 bpi	RCSL: 30-M225
Disc Kit (for RC3652)	RCSL: 30-M226



## 1. Introduction.

1.

The RC8000 memory testpackage is logically divided into 3 parts:

- 1/ General Memory Tests.
- 2/ Special Core Memory Tests (RC8100).
- 3/ Special Semiconductor Memory Tests (MEM805).

### 1. General Memory Tests.

- 1.1 Address Selection Test
- 1.2 Bit Selection Test
- 1.3 General Reliability Test.

### 2. Core Memory Tests.

- 2.1 Worst Case Pattern Test.
- 2.2 Worst Case Complement Pattern Test.
- 2.3 X\_Y Driver Load Test.

### 3. MEM805 (RC8xxx) Tests.

- 3.1 Error Correction and Detection Test.
- 3.2 Ram Chip Test.

## 2. Initiation of Programs.

2.

The testprogram is loaded by the RC8000 OPCOM program.

The program uses the following parameters:

I Select testprogram: <SELNO>

<SELNO>::=A↑B↑C↑D↑E↑F↑G↑H

A: Address Selection Test  
 B: Bit Selection Test  
 C: Worst Case Selection Test  
 D: Worst Case Complement Selection Test  
 E: X-Y Driver Load Test  
 F: General Reliability Test  
 G: MEM805 Error Correction/Detection Test  
 H: MEM805 Ram Chip Test.

Default value: A.

II No of runs: <NO>

<NO>::=1↑2↑3↑.....↑2\*\*24-1

Default value: 1000.

III Error Messages: <MESS>

<MESS>::=Y↑N

Type Y (yes) and the program prints test information  
 on current output device else  
 Type N (no).

Default value: YES.

IV Test area: <AREA SPECIFICATION>

<AREA SPECIFICATION>::=<KNUMBER>-<KNUMBER>↑  
 <KNUMBER>-<KNUMBER>,<KNUMBER>-<KNUMBER>

<KNUMBER>::=<POSITIVE NUMBER>K<POSITIVE NUMBER>

Default value: 3K779-95K1023

Example: KNUMBER: 2K15 denotes  $2 \cdot 1024 + 15 = 2063$   
 words (byte numbers 4126 and 4127).  
 Area specification: 4K1023-16K0, 32K-103K1023.

V Parameters for MEM805 Tests.

Word address of MEM805 modul starts in K-words:

<ADD>

<ADD>::=0 1 2... 4096

Default value: 0.

Number of MEM805 moduls of 64 Kwords: <NO>

<NO>::=1 2...

Default value: 1.

Testno.: <TNO>

<TNO>::=<INTEGER>, see page

If <TNO> <=0 THEN perform the testloops in  
sequence  
ELSE loop in the selected text;

Default value: -1.

Terminate if error: <TERR>

<TERR>::=YES NO

Default value: YES.

When the start command is given, a run administration procedure is called. The flow-chart p. 5 describes how the program is initialized (run no. = 0):

The program examines "error messages" and "test area" for syntactical errors. If a syntactical error is found the program prints:

"SYNTAX IN ERROR MESSAGES"

or

"SYNTAX IN TEST AREA"

and then terminates.

Otherwise a reserve memory area procedure is called. This procedure reserves a memory area as specified in the test area. If the reservation is not accepted then the program prints:

"RESERVATION OF AREA (1 or 2) NOT ACCEPTED"

and then the reason

"FIRST ADDRESS TOO SMALL"

or

"SIZE TOO BIG".

The testarea is set equal to the reserved area and the program prints:

"RESERVED AREA: <AREA>"

If the reservation is accepted the testarea is unchanged.

If the selected testprogram is a worstcase test, a worstcase pattern is generated (p.

Now the runadministration procedure is called, and the selected testprogram executed.





3. Address Selection Test.

3.

## Purpose:

This program tests that every word in the test areas of the core store can be selected. In other words the test guarantees that two different addresses will not select the same word.

## Test:

The program works by loading into each word the number in the word, i.e. core store (N):=N. Having done so for each word, the program checks whether the core store contents are correct or not.

## Test messages:

An error causes the program to issue the following message:

```
ADDRESS    <KNUMBER>
RECEIVED   <RECEIVED DATA>
EXPECTED   <EXPECTED DATA>.
```

4. Hit Selection Test.

4.

## Purpose:

This program tests that every bit in the test areas of the core store can be set and reset.

## Test:

The program works by loading into each word the following bitpatterns consisting of 24 bits:

```
000 ... 001
000 ... 010

100 ... 000
000 ... 000
```

When a bitpattern is stored by core store, it is read out again to be checked against the original bitpattern.

Test messages:

An error causes the program to issue the following message:

```

ADDRESS      <KNUMBER>
RECEIVED     <RECEIVED DATA>
EXPECTED     <EXPECTED DATA>.

```

#### 5. Worst Case Test.

5.

Purpose:

This program checks that the contents of the test areas of the core store are not changed due to noise introduced by the worst case pattern.

Test:

The program starts by loading into each word the worst case word, belonging to the worst case pattern; this is done only in run no. 0. Then it continues to read those words repeatedly.

The worst case pattern is an array of worst case words and the content of these words are chosen so that maximum resultant noise will be produced at the output of the sense windings. The content of all locations that have address bit 10 and 22 equal are all ones. The contents of all other locations are all zero's.

```

CONTENTS:= ALL ONES FOR ADDRESS(10) EXOR ADDRESS(22)=0
CONTENTS:= ALL ZEROS FOR ADDRESS(10) EXOR ADDRESS(22)=1.

```

Test messages:

An error causes the program to issue the following message:

```

ADDRESS    <KNUMBER>
RECEIVED   <RECEIVED DATA>
EXPECTED   <0 OR 1>

```

where <0 OR 1> ::= 0↑1

0 stands for all zeroes and 1 for all ones.

#### 6. Worst Complement Test.

6.

Purpose:

This program checks that the contents of the test areas of the core store are not changed due to noise introduced by the worst complement pattern.

Test:

The program works as the worst case test program, the only exception being that the contents of the words under test are complemented, i.e.

CONTENTS: =ALL ONES FOR ADDRESS(10) EXOR ADDRESS(22)=1

CONTENTS: =ALL ZEROS FOR ADDRESS(10) EXOR ADDRESS(22)=0

Test messages:

The error messages are identical to those of the worst case test.

#### 7. X-Y Driver Load Test.

7.

Purpose:

This program checks the 16 source \* 16 sink X drivers, the 16 source \* 8 sink Y drivers, and the address selection diodes in the DR-103 ferrite core memory system.

**Test:**

16 driveraddresses are so selected that for each driver address a new source and a new sink drive transistor are activated. 8 driveraddresses are enough to do this, because different transistors are used in reading and writing. However, 16 driveraddresses are necessary if all address selection diodes are to be tested.

The program loads into each reserved driver address the instruction <JL.0>. This instruction is executed and then interrupted after 25,6 Msek.. This is repeated continuously with the time interval doubled each time.

**Operator messages:**

The program informs the operator with the number of 25,6 Msek. intervals between the interrupts by printing:

```
RUN NO 1
NO OF 25,6 MSEK DELAYS: 1

RUN NO 2
NO OF 25,6 MSEK DELAYS: 2

...

RUN NO N
NO OF 25,6 MSEK DELAYS: 2** (N-1)
```

If the driveraddresses are outside the reserved test-area the program prints:

```
DRIVERADDRESSES ARE OUTSIDE TESTAREA
DRIVER TEST AREA MODULO 32K:<AREA SIZE>
```

and then terminates.

8. General Reliability Test.

8.

The test is included in order to make a general purpose memory test available for long time test.

The execution time for 32 Kwords is app. 21 min. and proportional to  $N \cdot \log_2 N$ , where N is the memory size.

A description of the test is found in RCSL 30-M167.

9. MEM805 Test.

9.

9.1 Error Correction/Detection Test.

9.1

The test consists of 4 loops:

TESTNO 1

In this test the function of the light emitting diodes and partly of the check/syndrome bit generators is checked.

TESTNO 2

The error correction hardware's ability to correct single errors is tested. (Both data possibilities are used).

TESTNO 3

The function of the check/syndrome bit S1-S5, generators, is checked with a minimum testpattern. The test will catch all stuck-at and bridge faults.

TESTNO 4

The function of the check/syndrome bit S6 generator is checked with a minimum test pattern. In the test is

included simulated double errors, i.e. the bus-nack signal is also checked.

NB! The operator has to be careful when enabling/disabling the check bit generator.

## 9.2 Ram Chip Test.

9.2

The test consists of 7 loops:

### TESTNO 1

A zero (one) in a field of ones (zeros).

### TESTNO 2 \*)

A moving diagonal of zeros (ones) in a field of ones (zeros).

### TESTNO 3

Still refresh test.

### TESTNO 4

Dynamic refresh test.

### TESTNO 5

Test of chip array row-select.

### TESTNO 6 \*)

Test of extended 1 (0).

(The extent of a memory cell is the selected row and column).

### TESTNO 7 \*)

Test for API-faults. (API: Adjacent Pattern Interference faults).

The execution time for the test is app. 120 minutes/  
64 Kwords.

\*) This testloop checks only the free chips, i.e. the  
last 3 \* 16 Kwords.

10. Examples.

10

>S

INT. SYSS

>OPCOM

RC8000 TEST - OPERATOR COMMUNICATION PROGRAM (VERS.  
78.03.07).

AUTOLOAD OK

AUTOSEGM. OK

TESTADM. OK

TESTADM. VERSION: FEB. 78.

CORE SIZE = 131072 WORDS

OUTPUT DEVICE = LPT

SELECT FUNCTION: HELP

FUNCTIONS:

NEW: Positions to a new testpackage and initial-  
izes current parametersegment.

START: Executes break function, loads testprog.  
package if following new, transmits the cur-  
rent param.segm. and starts the test.

REPEAT: Executes break function and starts the test  
with the previously transmitted parameterseg-  
ment.



BREAK: Terminates the running testprogram.  
CLOSE: Closes the outputdriver and asks for new outputdevice.  
LIST: Lists the current parametersegment and the last defined values.  
PARAM: Same function as LIST, but now changing of values is possible.  
POXX: Same function as PARAM, but only the parameter no. XX is affected.  
SAVE: Saves a copy of the current parametersegment.  
LOAD: Makes the current parametersegment = the last saved one.  
SWAP: Saves the cur. paramsegm. and loads the previously saved one.  
DABS: Dumps a part of RC8000-memory. The areaspecification is absolute.  
DBREL: Same as DABS, but now the areaspecification is baserelative.  
SDLUX: Reads scedule-file (X = fileident. 0-9, P for PTR or C for CDR) and executes the command-strings.  
SDULXL: Reads schedule-file and lists the content.  
INIT: Initializes the communication-line between RC8000 and RC3600.  
AUTO: Initializes program, and re-autoloads the RC8000.  
WAIT: Execution of the following function (S) will be delayed until the current run is terminated.

SELECT FUNCTION:

SELECT FUNCTION: NEW

SELECT INPUT-FILE (MEM/CPU/DISC/FPA/PTR/CDR): MEM  
RC8000 MEMORY TEST. FEB. 78

SELECT FUNCTION: LIST

RC8000 MEMORY TEST

FEB. 78

000 SELECT TESTPROGRAM: A  
001 NUMBER OF RUNS = 1000  
002 ERRORMESSAGES? YES  
003 TEST AREA = 3K779-95K1023

SELECT FUNCTION: P003

003 TEST AREA = 3K779-95K1023/3K779-128K0

SELECT FUNCTION: START

SELECT FUNCTION:

RESERVATION OF AREA 1 NOT ACCEPTED

SIZE TOO BIG

RESERVED AREA: 3K779-127K1023

RUN NO. 1

BREAK

\*\*\*TEST TERMINATED

SELECT FUNCTION: P000

000 SELECT TESTPROGRAM: A/B

SELECT FUNCTION: P001

001 NUMBER OF RUNS = 1000/10

SELECT FUNCTION: P003

003 TEST AREA = 3K779-128K0/4K0-35K9

SELECT FUNCTION: START

SELECT FUNCTION:

RUN NO. 1

RUN NO. 2

RUN NO. 3 BREAK

\*\*\*TEST TERMINATED

SELECT FUNCTION: P002  
002 ERRORMESSAGES? YES/JA

SELECT FUNCTION: START

SELECT FUNCTION:  
SYNTAX IN ERROR MESSAGES  
\*\*\*TEST TERMINATED

SELECT FUNCTION: P002  
002 ERRORMESSAGES? JA/Y

SELECT FUNCTION: P003  
003 TEST AREA = 4K0-35K9/4L0-12K3

SELECT FUNCTION: START

SELECT FUNCTION:  
SYNTAX IN MEMORY AREA  
\*\*\*TEST TERMINATED

SELECT FUNCTION: P003  
003 TEST AREA = 4L0-12K3/4K0-12K0

SELECT FUNCTION: P000/E START

SELECT FUNCTION:

RUN NO.	1	
NO OF 25,6 MSEK DELAYS:		1
RUN NO.	2	
NO OF 25,6 MSEK DELAYS:		2
RUN NO.	3	
NO OF 25,6 MSEK DELAYS:		4
RUN NO.	4	
NO OF 25,6 MSEK DELAYS:		8
RUN NO.	5	
NO OF 25,6 MSEK DELAYS:		16
RUN NO.	6	
NO OF 25,6 MSEK DELAYS:		32

RUN NO. 7  
NO OF 25,6 MSEK DELAYS: 64  
RUN NO. 8  
NO OF 25,6 MSEK DELAYS: 128  
RUN NO. 9  
NO OF 25,6 MSEK DELAYS: 256  
RUN NO. 10  
NO OF 25,6 MSEK DELAYS: 512

\*\*\*TEST TERMINATED

SELECT FUNCTION: P003  
003 TEST AREA = 4K0-12K0/4K-8K  
003 TEST AREA = 4k-8K  
003 TEST AREA = ?ko-8KO

SELECT FUNCTION: START

SELECT FUNCTION:  
RUN NO. 1  
DRIVER ADDRESSES ARE OUTSIDE TESTAREA  
DRIVER TEST AREA MODULO 32K: 12K0-19K1023  
\*\*\*TEST TERMINATED

SELECT FUNCTION: P000  
000 SELECT TESTPROGRAM: E/A

SELECT FUNCTION: P003  
003 TEST AREA = 4K0-8K0/0K0-256K

SELECT FUNCTION: START

SELECT FUNCTION:  
RESERVATION OF AREA 1 NOT ACCEPTED  
FIRST ADDRESS TOO SMALL  
SIZE TOO BIG  
RESERVED AREA: 3K779-127K1023

RUN NO. 1  
RUN NO. 11  
RUN NO. 21 BREAK  
\*\*\*TEST TERMINATED

Lineprinter message due to provoked error:

RC8000 MEMORY TEST

FEB. 78

000 SELECT TESTPROGRAM: A  
 001 NUMBER OF RUNS = 100  
 002 ERRORMESSAGES? Y  
 003 TEST AREA = 0KO-256K

ADDRESS            48K            160  
 RECEIVED.....1 1.....  
 EXPECTED.....1 1.....1 .1.....  
 \*\*\*TEST TERMINATED

SELECT FUNCTION: P003

003 TEST AREA = 0KO-256K/2K-5K, 7K-37K

SELECT FUNCTION: START

SELECT FUNCTION:

RESERVATION OF AREA 1 NOT ACCEPTED

FIRST ADDRESS TOO SMALL

RESERVED AREA: 3K779-6K779

RUN NO.    1  
 RUN NO.   11  
 RUN NO.   21  
 RUN NO.   31 BREAK

\*\*\*TEST TERMINATED

SELECT FUNCTION: P003

003 TEST AREA = 2K-5K, 7K-37K/2K-8K, 8K100-147K0

SELECT FUNCTION: START

SELECT FUNCTION:

RESERVATION OF AREA 1 NOT ACCEPTED

FIRST ADDRESS TOO SMALL

RESERVED AREA: 3K779-9K779

RESERVATION OF AREA 2 NOT ACCEPTED

FIRST ADDRESS TOO SMALL

SIZE TOO BIG

RESERVED AREA: 9K780-127K1023

RUN NO. 1

RUN NO. 11

RUN NO. 21

RUN NO. 31

RUN NO. 41 BREAK

\*\*\*TEST TERMINATED

SELECT FUNCTION:

11. Operator Messages.

11.

1. Syntax in error messages.

A syntax error is found in the "error message" parameter. The program terminates.

2. Syntax in test area.

A syntax error is found in the "testarea" parameter. The program terminates.

3. Reservation of area 1 (2) not accepted.

The testarea is not included in the free area, because

A. first address too small

or

B. size too big

Instead the following area is used as testarea.

C. reserved area: <AREA SIZE>

The program proceeds.

4. Driveraddresses are outside testarea

Driver testarea modulo 32K: 12KO-19K1023

The driveraddresses are outside the reserved testarea modulo 32K. The testprogram terminates.

5. No of 25,6 Msek delays: <NO>

After each run no in testprogram E the program prints no of 25,6 Msek delays: = 2\*\*(RUN NO-1).

Testmessages.

1. ADDRESS	<KNUMBER>
RECEIVED	<RECEIVED DATA>
EXPECTED	<EXPECTED DATA>

An error is found in the specified address.

The received and expected content of this location is printed.

2. MEM805 TEST

From this test the messages are delivered as an immediately understandable text.

