Service
Service
Service
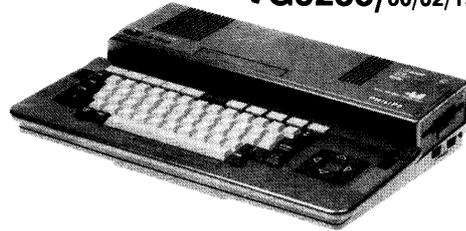
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Repair Method

Scanned, ocr'ed and converted to PDF by HansO, 2002

PART 1: REPAIR METHOD VG8230/00

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1. INTRODUCTION

During start-up of the test cartridge the memory map is displayed on the screen. The BASIC ROM (slot 0, pages 0 and 1) and the expansion ROM (slot 30, page 0) are not detected when they are in the service mode.
The test programme starts with the execution of a brief video RAM test and a brief users RAM test.
In the brief video RAM test the first 16k (of the total 128k) is being tested. Possible errors in this area are indicated by a colour indication. The other 112k video RAM can be tested with the pattern test.
With the keyboard test, the I/O test and the I/O test in the joystick test measurable pins are available on the MSX controller (U14).
Chapter 2 (repair method VG8230) refers to a possible error message or test.
In case of an error message various pins of ICs have to be checked.

Example:

● ERR 211

– Check 5–U10 ($\overline{\text{CAS2/E}}$), 10–U5, 46–U9 ┬ Check 4–U12 ($\overline{\text{RFSH}}$), 35–U9, 2–3–U26, 28–U38.
└ Check 27–U1 ($\overline{\text{M1}}$), 34–U9, 12–13–U26, 27–U38.
– Check 16–U44 ($\overline{\text{CAS1}}$), 16–U46, 8–9–10–U41.

Pin 5–U10 ($\overline{\text{CAS2/E}}$) should first be checked.
If this signal is good, pin 16–U44 should be checked.
If 5–U10 ($\overline{\text{CAS2/E}}$) is not correct, the error may be due to 5–U10, 10–U5 or 46–U9. An erroneous CAS2/E signal may also be due to the $\overline{\text{RFSH}}$ signal (4–U12 and pins 35–U9, 2–3–U26, 28–U38 connected with it) or to the $\overline{\text{M1}}$ signal (27–U1 and pins 34–U9, 12–13–U26, 27–U38 connected with it).

2. REPAIR METHOD VG8230

● Remove external cartridge(s).
● Connect a TV or monitor.
● Switch on computer.
- Power LED on.

├─ No ─────────────────────────────── ┬ Check power supply.
│   └ Check power on LED.
│
Yes
│
● Switch off computer.
● Place the service test cartridge (4822 397 30138).
● Switch computer into Service mode with jumpers ST1 and ST2
  (in position 2-3).
● Switch on set.
- Screen colour
│
├─ Black
│
├─ Yes ─────────────────────────── ┬ Check the primary conditions of the CPU (U15):
│   │ clock, supply voltage, data and address bus and
No   │ control bus (both before and after buffers U17, U18,
│   │ U19, U20, U21).
│   └ Check video signal at 22-23-23-U28, PAL encoder,
│   modulator and SCART connector.
│
├─ Blue
│
├─ Yes ─── ┬ Error message on screen.
│   │
│   ├─ Yes ──────────────────── Go to indicated error message.
│   │
│   No
│   │
│   ● Memory map on screen.
No   ● Depress <CR>.
│   ● Select a test corresponding most with customer
│   complaint.
│   ─ Error message on screen.
│   ├─ No ───────────────────── Select another test.
│   └─ Yes ──────────────────── Go to indicated error message.
│
└─ Green ─ After a short while the colour changes to:
           │
           ├─ Dark blue (video data line error, D0–D3).
           │
           ├─ Yes ─────────────────── ┬ Check 2-3-15-17-U30, 2-3-15-17-U32,
           │   │ 41-42-43-44-U28.
           No   └ Check 5-U41, (MREQ), 2-U41, 9-U39, 36-U14,
           │   4-5-U17, 19-U15.
           │
           ├─ Pale blue (video data line error, D4–D7)
           │
           ├─ Yes ─────────────────── Check 2-3-15-17-U29, 2-3-15-17-U31,
           │   45-46-47-48-U28.
           │
           No
           │
           ├─ Red (video address bus error)
           │
           ├─ Yes ─────────────────── Check 49-50-51-52-53-54-55-56-U28,
           │   6-7-8-10-11-12-13-U29,6-7-8-10-11-12-13-U30,
           No   6-7-8-10-11-12-13-U31,6-7-8-10-11-12-13-U32.
           │
           └─ Yellow (video check bus error, RAS, CAS, R/W)
              - Check 57-61-62-U28, 4-5-16-U29,
                4-5-16-U30,4-5-U31, 4-5-U32.
              - Check 60-U28, 16-U31, 16-U32.
              - Check 2-3-15-17-U29.
              - Check 2-3-15-17-U30.
              - Check 4-U41 (WR), 13-U45, 39-U14,
                13-14-U17, 22-U15.

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3. KEYBOARD TEST <TAB>

With the option <CTRL> + <F1> (repeat option) no error
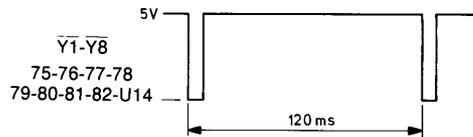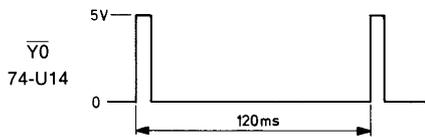message occurs with a continuously closed key.
If during start–up of the test cartridge an error is
detected in the keyboard, the programme goes directly to
the keyboard test; within 10 seconds the service mode
(ST1 only) should be switched off.
Depressing of keys: CODE, F1, F2, F3, F4, F5, TAB, INS,
DEL and ESC successively results in figures 0 through 9
on the screen.
Depressing of keys: CTRL, CAPS, GRAPH, SPACE, the
cursor keys, RETURN, BS, SELECT, CLR/HOME and
STOP results in an * on the screen.
To obtain pulses on pins
74–75–76–77–78–79–80–81–82–U14 a key from rows
Y0 or Y1 – Y8 has to be depressed (repeat option
switched on!).

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3.1 ERR 001. Several keys activated simultaneously

With ERR 001 the number of simultaneously activated
keys is indicated.

● ERR 001
– Characters appear on the screen without a key
  having been depressed.

├─Yes ————————————————————————— Check 66–67–68–69–70–71–72–73–U14.

No

└
– Depressing one key from one row results in several
  characters on the screen.
– Other keys from other rows function normally.
– Check this row
  (74–75–76–77–78–79–80–81–82–U14).

3.2 ERR 002. Continuously closed keys

● ERR 002
– One key remains closed. Replace keyboard.

3.3 Other keyboard errors

● One key does not function. Replace keyboard.
● One entire row or column does not function.

├─ Column ——————————————————————— Check related column.
│   (66–67–68–69–70–71–72–73–U14)
└─ Row ———————————————————————————— Check related row.
                                             (74–75–76–77–78–79–80–81–82–U14).

3. KEYBOARD TEST <TAB>

With the option <CTRL> + <F1> (repeat option) no error
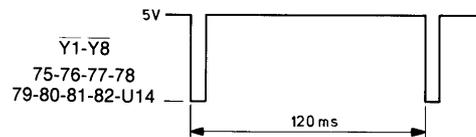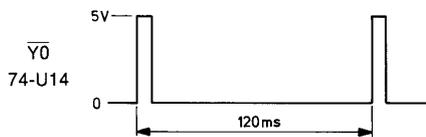message occurs with a continuously closed key.
If during start–up of the test cartridge an error is
detected in the keyboard, the programme goes directly to
the keyboard test; within 10 seconds the service mode
(ST1 only) should be switched off.
Depressing of keys: CODE, F1, F2, F3, F4, F5, TAB, INS,
DEL and ESC successively results in figures 0 through 9
on the screen.
Depressing of keys: CTRL, CAPS, GRAPH, SPACE, the
cursor keys, RETURN, BS, SELECT, CLR/HOME and
STOP results in an * on the screen.
To obtain pulses on pins
74–75–76–77–78–79–80–81–82–U14 a key from rows
Y0 or Y1 – Y8 has to be depressed (repeat option
switched on!).

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3.1 ERR 001. Several keys activated simultaneously

With ERR 001 the number of simultaneously activated
keys is indicated.

● ERR 001
– Characters appear on the screen without a key
having been depressed.

├─ Yes ————————————————————— Check 66–67–68–69–70–71–72–73–U14.

No

└─ Depressing one key from one row results in several
characters on the screen.
– Other keys from other rows function normally.
– Check this row
(74–75–76–77–78–79–80–81–82–U14).

3.2 ERR 002. Continuously closed keys

● ERR 002
– One key remains closed. Replace keyboard.

3.3 Other keyboard errors

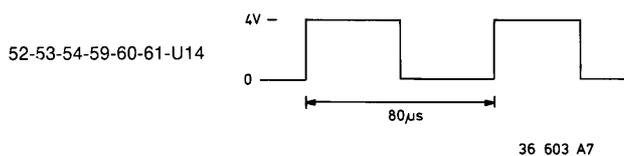● One key does not function. Replace keyboard.
● One entire row or column does not function.

├─ Column ——————————————————— Check related column.
│ (66–67–68–69–70–71–72–73–U14)
└─ Row ——————————————————— Check related row.
(74–75–76–77–78–79–80–81–82–U14).

4. JOYSTICK TEST <F1>

Operation of the joystick results in a corresponding
change of direction of the cursor on the screen. In this
way it is possible to detect an incorrect contact or a wire
rupture in the joystick. Depressing of the action key
results in a repeating cursor ($\approx$ 100 times/min.).
Depressing of a second action key (if present) results in
a repating cursor of 140 times/min.
During the I/O test pulses are generated at pins TRGA1,
TRGB1, STB1, TRGA2, TRGB2, STB2
(52–53–54–59–60–61–U14).

52-53-54-59-60-61-U14

```
4V ─      ┌───┐   ┌───┐   ┌───┐
          │   │   │   │   │   │
0   ──────┘   └───┘   └───┘   └────
          |←────── 80µs ──────→|
```
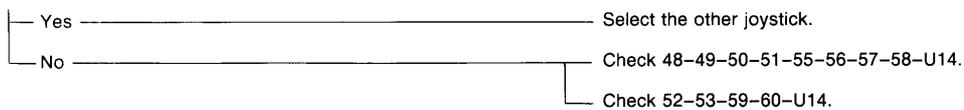
36 603 A7

4.1 ERR 101. Incorrect direction

● ERR 101
– Check if a switch in the joystick remains closed.
– Check 48–49–50–51–55–56–57–58–U14.

4.2 ERR 102. 2 Actions on the same joystick

● ERR 102
– Check if two action switches remain closed.
– Check Q6, 52–U14, 53–U14 (for joystick 1).
– Check Q5, 59–U14, 60–U14 (for joystick 2).

4.3 ERR 103. Another joystick activated

● ERR 103
– With joystick connected

├─ Yes ─────────────────────────────── Select the other joystick.
│
└─ No ───────────────────────────┬─ Check 48–49–50–51–55–56–57–58–U14.
                                 │
                                 └─ Check 52–53–59–60–U14.

4.4 Other joystick errors

● Joystick does not function.
– Check earth connection of joystick (pin 8).

● Action key does not function.
– Check for wire rupture.
– Action switch defective.

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5. RAM TEST <F2>

During start–up of the test programme a brief RAM test is performed. If an error is detected in this test, the complete RAM test is performed. The RAM test has two modes: one–time tests and continuous tests.

5.1 ERR 211. RAM not present from C000 till FFFF.

During ERR 211 the contents of the accumulator is continuously written to memory location C000. In that case the various signal forms are:


39805A12
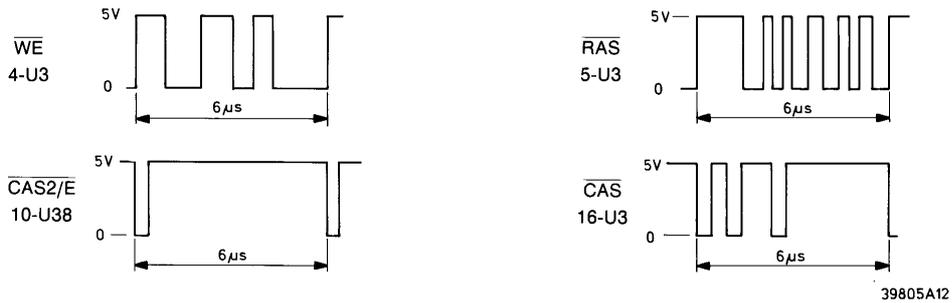
During ERR 211 RSEL (8–U16) is high.

● ERR 211
– Check 10–U38 (CAS2/E), 46–U14 ———————————— Check 10–U39 (RFSH), 9–10–U17, 28–U15.
                                                                      ├── Check 9–U36 (M1), 34–U15, 6–7–U17, 27–U15.
                                                                      └── Check 8–U16 (RSEL), 9–U14.

– Check 16–U3 (CAS), 16–U4, 8–9–10–U38, 8–U39.
– Check 4–U3 (WE), 4–U4, 47–U14.
– Check 5–U3 (RAS), 5–U4, 43–U14.

5.2 ERR 215. Incorrect address selection

During ERR 215 the programme continuously writes the value of the accumulator to memory location C000.
In that case the various signal forms are:
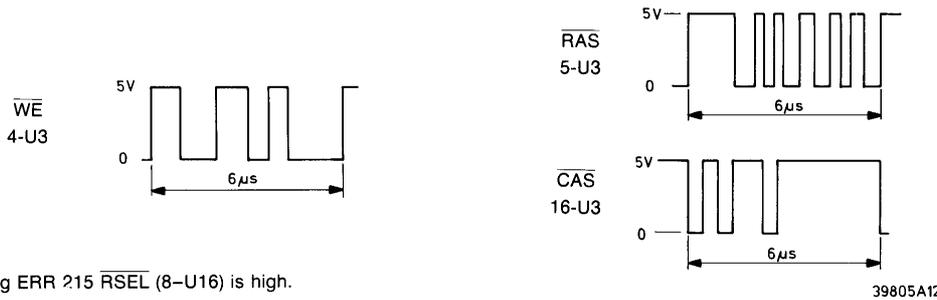
During ERR 215 RSEL (8–U16) is high.

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● ERR 215
– Check 4–U3 (WE).
– Check 5–U3 (RAS).
– Check 16–U3 (CAS).
– Check 4–U4 (WE).
– Check 5–U4 (RAS).
– Check 16–U5 (CAS).
– Check 2–3–15–17–U3.
– Check 2–3–15–17–U4.

5.3 ERR 221. Open data line(s)

During ERR 221 the programme continuously writes the contents of the accumulator to memory location C000 (see ERR 211 for possible signal forms to be checked).

n = incorrect data line(s)

● ERR 221 : Dn

– Check the indicated data line(s) on U3 (for D0–D3) or U4 (for D4–D7).

### 5.4 ERR 241. Incorrect slot selection

During ERR 241 00 and FF are written to port A8 (slot selection register).

● ERR 241
– Check 8–U16, 9–U14.
– Check 10–U14 (A15).
– Check 11–U14 (A14).

5.5 ERR 261. Incorrect RAM CHIP

It is being tried to make all 8 bits of a byte (for the total 64k) high. If this is not possible, error message 261 is given with the incorrect data bit(s).
During ERR 261 the contents of the accumulator is continuously written to memory location C000. In this case the signal form is (see ERR 211 for possible other signal forms to be checked):

39809A12
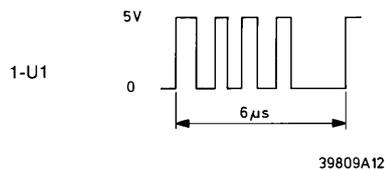
n = incorrect data bit(s)

● ERR 261: D 6 5 4 3 2 1

├─ Yes ── Check 1–U1, 1–U2, 44–U14.
│
No

● ERR 261: Dn (other possibilities)

– Check 9–U17, 10–U17, 28–U15.

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5.6 ERR 271. Incorrect address line(s)

ERR 271 is given with an open or short-circuited address line (address lines A0 through A7 only).
During ERR 271 the contents of the accumulator is written to memory locations C000 and FFFF.

n = incorrect address line

- ERR 271 : A 7 6 5 4 3 2 1 0

  ├─ Yes ──────────────────────────────── Check 44-U14 (MUX), 1-U1, 1-U2.
  │
  No

- ERR 271 : A 7 6 5 4

  ├─ Yes ──────────────────────────────── check 1-U2.
  │
  No

- ERR 271 : A 3 2 1 0

  ├─ Yes ──────────────────────────────── Check 1-U1.
  │
  No

- ERR 271 : An (other possibilities)
- Check the indicated address line(s) on U3, U4, U2 and U1.

5.7 ERR 281. Refresh error

ERR 281 occurs in case of a refresh error and when one of the higher address lines (A8-A15) are open on U1 and U2.
During ERR 281 the following instructions are executed continuously: - Write 55H to 8000.
 - Read 8000.

- ERR 281
- Check 9-U38, 8-9-10-U39.
- Check 3-U1 (A8 open).
- Check 6-U1 (A9 open).
- Check 10-U1 (A10 open).
- Check 13-U1 (A11 open).
- Check 3-U2 (A12 open).
- Check 6-U2 (A13 open).
- Check 10-U2 (A14 open).
- Check 13-U2 (A15 open).
- U3 defective.
- U4 defective.

6. CASSETTE TEST <F3>

With the cassette test the cassette interface and the recorder can be tested.
The possibilities are:

1. Writing a byte (55 hex)

First a header is sent out (for about 10 seconds).
Hereafter 256 (FF hex) bytes are sent out or the bytes are sent out continuously.
While bytes are being sent out to the recorder it is possible to trace the signal path from the computer to the recorder (from 2–U14 to 4–CN14).

2. Writing the header

The header is sent out continuously. It is possible to trace the signal path from the computer to the recorder (from 2–U14 to 4–CN14).

3. Reading tape

While reading bytes it is possible to trace the signal path from the recorder to the computer (5–CN14 to 1–U14).
The header has the following form:
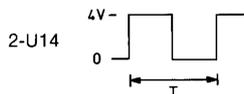
1200 baud: T = 0.4 ms
2400 baud: T = 0.2 ms.

A byte which is sent out to the recorder begins with a start bit (logical 0) and ends with two stop bits (logical 1).

Then the byte (55 hex = 01010101 bin) has the following form:
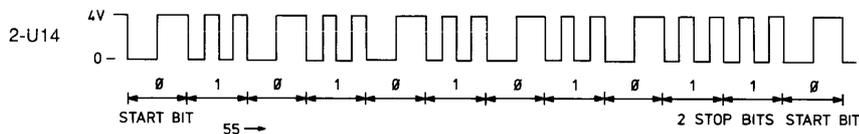
1200 baud: 0 = 1200 Hz
          1 = 2400 Hz
2400 baud: 0 = 2400 Hz
          1 = 4800 Hz

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The following error messages may occur:

● ERR 301: Header not read correctly (no time–out but too many errors).

● ERR 311: Data cannot be read.

● ERR 312: Data not read correctly: first byte is not correct.

7. SOUND TEST <F4>

The registers in the sound generator (integrated in the
S-3527) are tested by the sound test.
The screen displays which sound signal is generated at
that moment.
The various noises are:

Channel A	– increasing amplitude on channel A.
Channel B	– decreasing amplitude on channel B.
Channel C	– increasing amplitude on channel C.
Channels A,B,C	– successive increase of the amplitudes of channels A, B and C. After that the amplitudes remain high.
Noise A	– increasing amplitude on channel A.
Noise B	– constant amplitude on channel B.
Noise C	– constant amplitude on channel C.
Envelope 1	– enveloping signal form on channel A.
Envelope 2	– enveloping signal form on channel A having a higher frequency than envelope 1.

7.1 ERR 400. Incorrect reading

ERR 400 occurs when the registers of the sound
generator in the S-3527 (U14) are defective.

### 7.2 Other sound problems

● Check if the sound of the sound test corresponds
with the message on the screen.
– Absolutely no sound.

├─ Yes ──────────────────────────────── Check 5–U14, Q7 and Q14, Q15 for SCART

└─ No ──────────────────────────────── Limited sound – U14 defective.

8. I/O TEST <F5>

This test can be used to check parts of U14 for correct functioning.

During the I/O test pulses are generated on CMO, REM, PPISND, CAPS (2-3-4-64-U14), CS2 (85-U14) and ROMCS, CS1, CS12, SLTSL1, SLTSL2 (42-84-86-87-88-U14).

2-3-4-64-U14

85-U14

42-87-88-U14

84-86-U14

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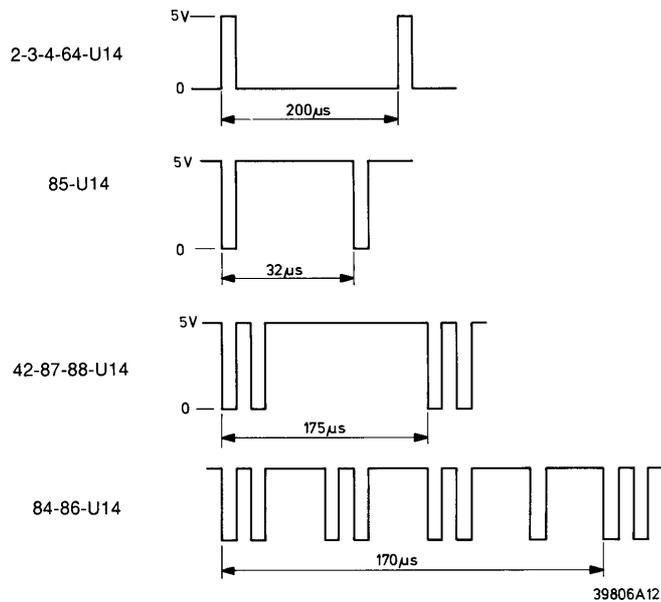
9. PATTERN TEST <INS>

With the pattern test the various functions of the video
processor can be checked, such as:
- Character set in 40 character mode.
- Character set in 80 character mode.
- Colour possibilities in high resolution mode (mode 7).
- Bar pattern.
- Sprite test.
It is also possible to check the video RAM with the
pattern test.

9.1 Character set mode 40 <F1>

The character set is represented in the 40 characters/line
mode. From some characters from the first three lines
some pixels are missing at the right–hand side of the
character (the first three lines contain the special
graphical characters).
Display of the characters can be used for a visual check
of the 40 character mode.

9.2 Character mode 80 <F2>

The character set is represented in the 80 characters/line
mode.
From some characters from the first three lines some
pixels are missing at the right–hand side of the character
(the first two lines contain the special graphical
characters).
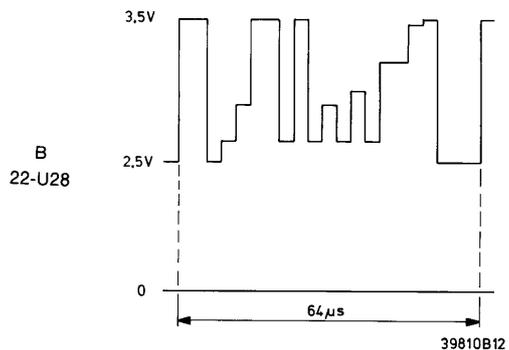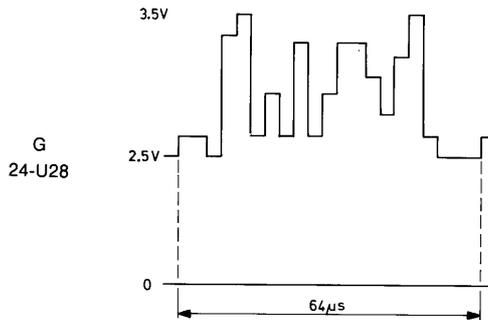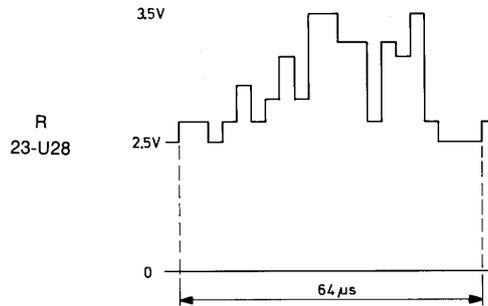Display of the character set can be used for a visual
check of the 80 character mode.

9.3 Colour stripes <F3>

The 256 colours that are possible in screen mode 7, are
represented here.

9.4 Bar pattern <F4>

A bar pattern of 15 colours is generated. With the signal
forms of the RGB output of the VDP (23–22–24–U28) the
analog circuit can be checked.

R
23-U28

G
24-U28

B
22-U28

39810B12

9.5 Sprite test <F5>

The sprite test produces 9 sprites on the screen (figures 0 – 8).
The sprites are tested for collision and the possibility to represent 8 sprites in a row.
With sprite errors the colour of the screen border changes.

- Green border : The 9 sprites are placed obliquely above each other. The coincidence flag may not be set now; if this is the case, the screen will turn green.
- Red border : The sprites placed obliquely above each other are slid together. If the coincidence flag has not been set now, the screen will turn red.
- Yellow border : The 9 sprites are placed next to each other (the 9th sprite is not visible now). If the 9th sprite flag has not been set now, the screen will turn yellow.
- Purple border : The screen turns purple when the 9th sprite flag has been set while there are not less than nine sprites in one row.

In all these cases the VDP will be defective (U28).

9.6 Video RAM test (one–time <TAB> or continuous <ESC>)

The video memory of the VG8230 consists of 128k RAM (subdivided into two banks of 64k).
During start–up of the test programme the first 16k from bank 1 are tested. Errors in the first 16k are indicated by means of a colour indication. Errors in the other 112k are indicated by means of an error message. Because of the test method applied the test colour pattern appears on the screen during the video RAM.

9.6.1 ERR 615. Incorrect address selection

● ERR 615 (Bank 2)

- Check 4–U31 ($\overline{WE}$).
- Check 4–U32 ($\overline{WE}$).
- Check 5–U31 ($\overline{RAS}$).
- Check 5–U32 ($\overline{RAS}$).
- Check 16–U31 ($\overline{CAS}$).
- Check 16–U32 ($\overline{CAS}$).

9.6.2 ERR 621. Open data line(s) (Bank 2)

n = incorrect data line(s)

● ERR 621 : Dn
- Check incorrect data line(s) on U31 and U32.

9.6.3 ERR 671. Incorrect address lines (Bank 2)

n = incorrect address lines

● ERR 671 : An
- Check address lines on U31 and U32.

9.6.4 ERR 681. Refresh error

● ERR 681 (Bank 1)
- Check U29 and U30.

● ERR 681 (Bank 2)
- Check U31 and U32.

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10. SUM CHECK TEST <DEL>

The ROMs applied in the VG8230 and the test ROM can
be checked with the sum check test.
The result of the sum check (addition of bytes) is placed
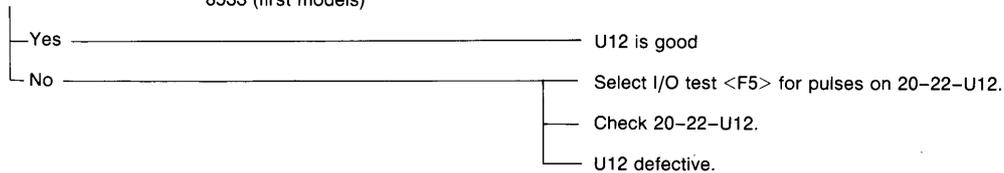behind the name of the ROM to be checked on the screen.

10.1 Sum check test ROM <F1>

– Sum check result is D70E

  Yes ———————————————————————— test ROM is good.

  No ———————————————————————— test ROM is defective.
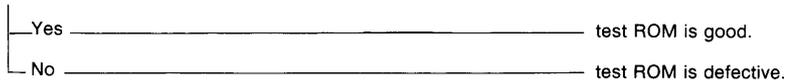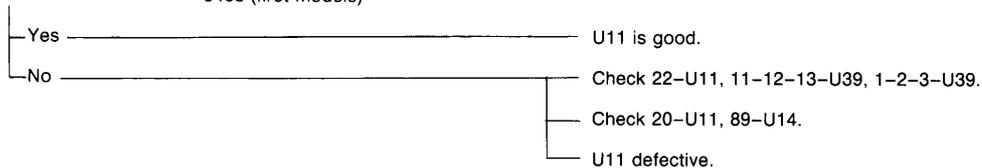
10.2 Sum check BASIC ROM <F2>

Before the sum check test is determined, the BASIC
ROM (U12) has to be switched on with service jumper
ST1.

– Sum check result is: 8249 (version 2.00)
        8533 (first models)

  Yes ——————————————————————— U12 is good

  No ———————————————————————— Select I/O test <F5> for pulses on 20–22–U12.

                    Check 20–22–U12.

                    U12 defective.

10.3 Sum check expansion ROM <F3>

Before the sum check is determined, the expansion ROM
has to be switched on with service jumper ST2.

– Sum check result is: 560F (version 2.00)
        5463 (first models)

  Yes ——————————————————————— U11 is good.

  No ———————————————————————— Check 22–U11, 11–12–13–U39, 1–2–3–U39.

                    Check 20–U11, 89–U14.

                    U11 defective.

10.4 Sum check disk ROM <F4>

– Sum check result is: 5B1E (version 1.00)

  Yes ——————————————————————— U13 is good.

  No ———————————————————————— Check 20–U13, 8–9–10–U41, 84–U14,
                    11–12–13–U44, 12–U41, U5, U27.

                    Check 22–U13, 27–U9.
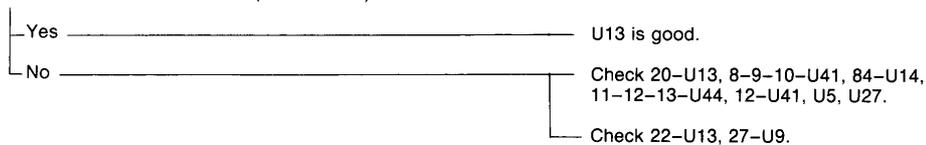
11. RTC TEST <CODE>

The RTC (Real Time Clock) has apart from a date and
time function also a memory function (26x4 bit RAM).
With the RTC test these functions are tested.
If during start-up of the test programme an RTC error is
detected, the RTC test is selected automatically. (The
period time of the signal forms in case of an error will
then be 30us instead of 58us).
In case of an RTC error the following instructions are
executed continuously:
- Write 00 to port address B4.
- Write 00 to port address B5.
- Read port address B5.
- Write FF to port address B4.
- Write FF to port address B5.
- Read port address B5.
In this case the signal forms are:

I
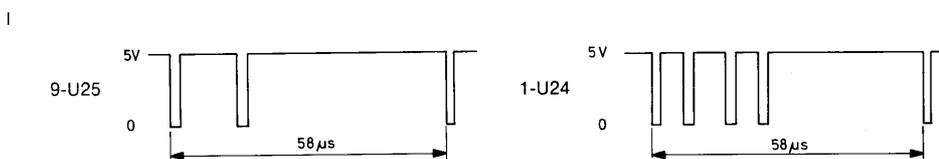
39808A12

11.1 ERR 711. RTC RAM not available

● ERR 711

- Check 1-U24 ($\overline{CS}$), 1-2-3-U37, 5-U37, U23,
  3-4-U36, 1-2-U36, 10-11-U36, 5-6-U36.
- Check 10-U24 ($\overline{WR}$-RTC), 11-12-13-U45,
  11-12-13-U37, 8-9-U36, 5-U45, 10-U45.
- Check 8-U24 ($\overline{RD}$-RTC), 8-9-10-U45.
- Check 9-U25 (CK) 4-5-6-U45, 1-2-3-U45,
  4-5-6-U37.

11.2 ERR 715. Incorrect mode selection

● ERR 715

- Check 10-U24, 11-12-13-U45.

11.3 ERR 721. Incorrect data line(s)

n = incorrect data line(s)

● ERR 721 : Dn

- Check incorrect data line(s) on U24.
- Check 9-U25.

11.4 ERR 771. Incorrect address line(s)

n = incorrect address line(s)

● ERR 771 : A 3 2 1 0

├─ Yes ─────────────────────────────┬──── Check 5-U24, 7-U25, 5-U25.
│   └──── Check 9-U25, 4-5-6-U45.
│
No
│
● ERR 771 : An

- Check indicated RTC address line(s) on U24 and U25.

11.5 ERR 799. Incorrect time function

● ERR 799

- Check 16-17-U24, X2.

12. PRINTER TEST <ESC>

The printer asks for a character. If this character is not
printed within 5 seconds, an error message is displayed.
If the character is printed, the programme asks for that
character.
If the printed character does not correspond with the
character given, the wrong bit lines are indicated.
By entering the characters * (shift 8) and U (shift u) all bit
lines except bit line 7 are tested. The printer test uses
the character table from the BASIC ROM (U12). The
BASIC ROM is switched on with ST1.

n = incorrect line(s)

12.1 ERR 801. Bit(s) n

● ERR 801

– Check indicated bit line(s) on U14, U22.
– Check the connection between computer and printer.
– Defect in printer.

12.2 ERR 810. No communication computer–printer

● ERR 810
– Check if the printer is connected.
– Check 13–14–U20, 100–U14.
– Check 11–12–U20, 91–U14.

13. ERR 990. INCORRECT INTERRUPT SIGNAL

This error message is given when the duration of the
interrupt signal deviates from 20 ± 2 ms.

● ERR 990

- Check 16–U15, 11–12–13–U38, 25–U38.
- Check 24–U15, 41–U14.
- Check 7–U17.

14. ERR 999. NO INTERRUPT SIGNAL FROM VDP

This error message occurs when the interrupt signal is continuously low.

● ERR 999

– Check 16–U15, 11–12–13–U38, 25–U38.

15. FLOPPY DISK DRIVE INTERFACE TEST

This test cartridge does not provide the tests of the floppy disk drive interface, this requires the FDD test cartridge (floppy disk drive).
This cartridge with associated description is available under service code number 4822 397 30135.
The error messages mentioned in this chapter have occurred in the floppy disk drive interface section.
The same error message may also be caused by an error in the floppy disk drive. First it should thus be determined if the error occurs in the floppy disk drive or in the floppy disk drive interface (by exchaging the floppy disk drive).
If the error occurs in the floppy disk drive, reference is made to service manual supplement VY0010/0011.
Below follows an enumeration of the error messages that may occur and with the possible causes.

- ERR 001. Disk off line

- Check 27-U7 ($\overline{\text{RAW READ}}$), 2-3-U35, 26-U7, U9, 1-2-U43.
- Check 34-U7 ($\overline{\text{TR00}}$), 1-2-3-U44, 3-4-U43.
- Check 8-9-10-U42 ($\overline{\text{STEP}}$), 15-U7.
- Check 1-2-3-U42 ($\overline{\text{DIR}}$), 16-U7.
- Check 11-12-13-U42 ($\overline{\text{MOTOR ON}}$), U6, 4-5-6-U40, 4-5-6-U41, U5.

- ERR 101. Track 00 error 1

- Check 34-U7, 1-2-3-U44, 3-4-U43.

- ERR 104. Track error

- Check U7

- ERR 106. Write protect error 1

- Check write protect slide on the disk (should be open).
- Check 36-U7, 8-9-10-U44, 12-13-U43.

- ERR 110. Track 00 error 2

- Check 34-U7, 1-2-3-U44, 3-4-U43.

- ERR 111. Track 00 error 3

- Check 34-U7, 1-2-3-U44, 3-4-U43.

- ERR 201. Track 00 error 1

- Check 34-U7, 1-2-3-U44, 3-4-U43

- ERR 204. Track error

- Check U7.

- ERR 206. Write protect error 2

- Check write protect slide (should be closed).
- Check 36-U7, 8-9-10-U44, 12-13-U43.

- ERR 210. Track 00 error 2

- Check 34-U7, 1-2-3-U44, 3-4-U43.

- ERR 211. Track 00 error 3

- Check 34-U7, 1-2-3-U44, 3-4-U43.

- ERR 300. Busy error

- Check U7.

- ERR 301. index error

- Check 35-U7, 4-5-6-U44, 12-13-U43.

- ERR 303. CRC error

- Check U7.

- ERR 304. Seek error
- Check U7.

- ERR 305. Write error
- Check 39–U7, 13–14–15–U35.
- Check 38–U7, 11–12–15–U35.
- Check 11–12–13–U34 (WG), 30-U7.
- Check 4–5–6–U42 (WD), 31–U7.

- ERR 306. Write protect error 3
- Check 36–U7, 8–9–10–U44, 12–13–U43.

- ERR 307. Disk not ready.
- Check 32–U7, 8–9–U43.

- ERR 308. Wrong side
- Check 4–5–6–U34, U10–2, 8–9–10–U40, U5.

- ERR 400. FDC Busy error
- Check U7.

- ERR 401. Data request error
- Check 38–U7, 11–12–15–U35, 15–U35, 1–2–3–U40, U5.

- ERR 402. Lost data
- Check 38–U7, 11–12–15–U35, 15–U35, 1–2–3–U40, U5.

- ERR 403. CRC error 2
- Check U7.

- ERR 404. Record not found
- Check 4–5–6–U42, 31–U7.

- ERR 405. Record type error
- Check U7.

- ERR 407. FDC not ready.
- Check U7.

- ERR 500. Media type error
- Check U7.

- ERR 501. Sector error
- Check U7.

- ERR 503. Drive data error
- Check U7.

- ERR 504. Track data error
- Check U7.

- ERR 505. Sector data error
- Check U7.

- ERR 506. Wrong data error
- Check U7.