Automatic RMS Multimeter
PM2528

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Repair by
Signature Analysis

</div>

Instruction Manual

ST 3215

PHILIPS

CONTENTS

REPAIR BY SIGNATURE ANALYSIS

1. GENERAL

For repair by signature analysis a testrom has been developed.
This testrom enables the user to test the digital part of the PM2528 by means of signature analysis.
It also enables trouble-shooting at component level in the circuit under test, by comparing the actual signature to the correct one. So the trouble-shooter can trace back the faulty node.
In total there are 13 tests. In the testrom 12 tests have been implemented and one test is made with the help of the free run facility of the PM2528.

2. WHY USE A SIGNATURE ANALYSER?

Thanks to the microcomputer in the digital part of the PM2528 the instrument can be very small.
Due to this the bus structure is very complex. Data flow on the bus becomes complex and cannot be analysed with an oscilloscope and voltmeter any longer. Therefore the need to test and service the digital part is acute.
The trouble-shooting involves the detection of circuit failure and the localization of faults at the source.
Finding the fault source in a bus system, such as the bus in the PM2528, with complex feedbacks can be difficult. But opening the feedback paths and using the signature analyser makes fault-finding easy.

3. CHECK WITH A SIGNATURE ANALYSER

The signature analyser checks the digital part of the PM2528 by detecting the bit stream at various circuits nodes, and displaying them as hexadecimal signatures.
To do this the PM2528 supplies the signature analyser with three gating signals, or in some cases four:
START, STOP, CLOCK and QUALIFIER.
START signals the beginning of a measurement and prepares the signature analyser to receive information from the data probe. STOP closes does this measurement. In cases of measuring signatures with RC delays, a QUALIFIER has to be used to stop the incoming information for a short period of time. The CLOCK is the system clock of the PM2528 under test to accept the data synchronously.

NOTE: The active edge of each of these gating signals must be selectable.

4. TYPE OF SIGNATURE ANALYSER TO BE USED?

The signature analyser to be used in combination with the PM2528 should have the following capabilities:
  — Selectable edges of; START, STOP, CLOCK and QUALIFIER.
  — Signatures in the following sequence:

DIGIT	DISPLAY	DIGIT	DISPLAY
0000	0	1000	8
0001	1	1001	9
0010	2	1010	A
0011	3	1011	C
0100	4	1100	F
0101	5	1101	H
0110	6	1110	P
0111	7	1111	U

5. **BRIEF DESCRIPTION OF THE TESTS**

FREE RUN TEST

With this test it is possible to measure signatures on the address latches and the data bus of the microcomputer. This is necessary to check if the data can be taken from the tastrom.

TEST 0 (Ram and I/O test of the μp)

This test checks the internal RAM of the microcomputer. When the RAM is correct, it will also test the I/O parts of the microcomputer. Only then can signatures be measured on the I/O parts databus and ROM.

TEST 1 (Visual display/keyboard leds test)

This test fills the display leds and keyboard leds with a certain pattern. In this way a quick display/keyboard test can be made.

TEST 2 (Display/keyboard leds test)

This test sends signatures to the display and keyboard.
The decoding, the 7-segment leds and the key-leds are tested.

TEST 3 (Key test)

This test sends signatures to the keys and reads them back.

TEST 4 (Analog control test)

This test activates the I/O expanders and the relays in the analog section.

TEST 5 (Synchronous mains/adc start circuit test, no S.A.)

This test checks the following signals:

     — Synchronous mains/adc start circuit
     — Watchdog
     — ADC test switch

The μp reads these signals and if correct an indication will be displayed.

TEST 6 (Interrupt controller test no S.A.)

This test checks the following signals:

     — Watchdog interrupt
     — Interrupt from keyboard
     — External start interrupt

The μp reads these signals and if correct an indication will be displayed.

TEST 7 (Galvanic separation test)

This test sends signatures to the galvanic separation.
Before the interfaces are tested this unit should be tested first.

TEST 8 (BCD output PM9292, start $\overline{DVM}$ test, no S.A.)

This test checks the start $\overline{DVM}$ (digital voltmeter) signal.
The μp will read this signal and if correct an indication will be displayed.

TEST 9 (BCD output PM9292 test)

    This test checks the complete BCD output.

TEST 10 (Analog output PM9254 test)

    This test checks the complete analog output.

TEST 11 (IEC-BUS PM9292 test)

    This test checks the complete IEC-BUS interface.

6.   HOW TO USE THE DOCUMENTATION AND THE TESTROM

This service manual should be used in combination with the service manual of the PM2528. The user of the fault-finding procedure in the PM2528 service manual will be directed to a certain part of the PM2528. If the fault-finding procedure does not solve the problem, then select a signature analysis test which is associated with the part of the PM2528. Begin always with the microcomputer, or with the inputs of the integrated circuits, and try to find the faulty node. Bear in mind that when the faulty node has been found, more than one circuit can cause the faulty signature.

7.   FAULT-FINDING HINTS

The first thing to do is to get an analysis of what is wrong. If this is not possible get the PM2528 in the free run mode by breaking the bus system between the microcomputer and the ROMs. This is done by removing the ROMs, and using the FREE-RUN simulator.
The microcomputer is now forcing—in some instruction that will cause a repeated increment of the address lines. So at this point the microcomputer is scanning the whole address field.
With START and STOP lines from the signature analyser, both connected to the most significant address bit and triggering on different edges, a measurement will be defined. Connecting the CLOCK line of the signature analyser to the $\overline{\text{ALE}}$ signal of the microcomputer and selecting the edge at which the address is valid, the input probe will get a signature at every address line.

By touching the probe in every test to a logic 1 level, a characteristic signature is obtained. This is the result of shifting ones (logic 1) in for every cycle that occurs while the gate is open. So the characteristic signature can be used to diagnose this condition elsewhere. The logic 0 is always a signature of "0000". Assume there are no bad signatures in the free-run test, then the TESTROM can be placed in the D1810 socket and it is possible to start measuring with test 0.
If an incorrect part can be located with the fault-finding procedure it is recommended to start with the test which is responsible for that fixed part of the PM2528. To do this a special switch has to be used. (Refer to chapter 11.1. at this service manual).
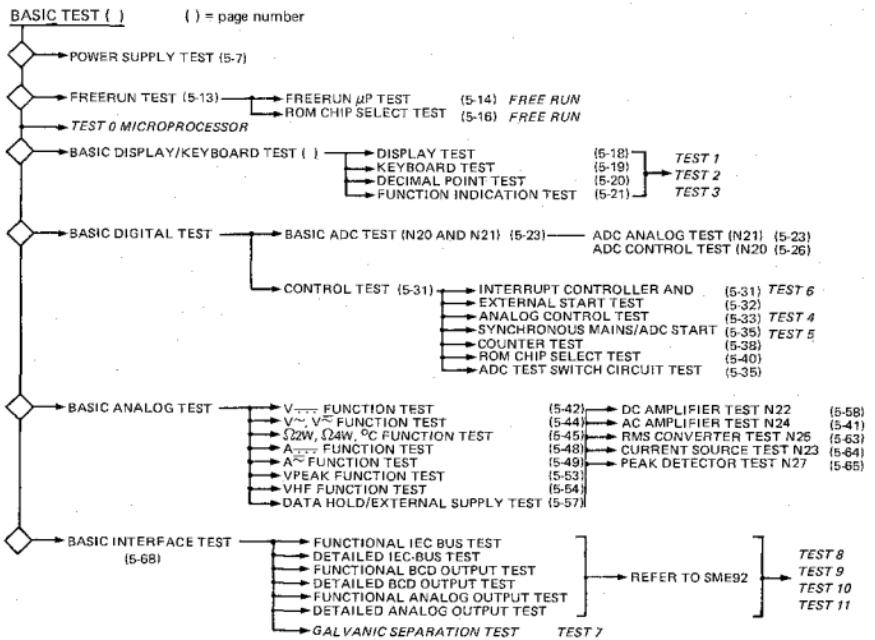
8.   HOW TO ORDER THE SIGNATURE ANALYSIS TESTROM AND THE DOCUMENTATION

Under ordering number 5322 694 54015 the testrom and the documentation can be ordered from Concern Service.

9.   ADDITIONAL EQUIPMENT TO BE USED

1. Free run simulator   (refer to chapter 5.4. of the PM2528 service manual)
    (Free run)

2. Test switch   (refer to chapter 11.1. of this manual)
    (test 0 → 11)

3. Test ROM   (ordering number 5322 694 54015)
    (test 0 → 11)

4. Two extender printed circuit boards (ordering number 4822 263 70117)

10. FAULT-FINDING FLOW CHART (refer to page 5.4. of the PM2528 service manual)

BASIC TEST ( )   ( ) = page number

◇── POWER SUPPLY TEST (5-7)

◇── FREERUN TEST (5-13) ────┬── FREERUN μP TEST   (5-14) *FREE RUN*
                                 └── ROM CHIP SELECT TEST   (5-16) *FREE RUN*
    TEST 0 MICROPROCESSOR

◇── BASIC DISPLAY/KEYBOARD TEST ( ) ──┬── DISPLAY TEST   (5-18) *TEST 1*
                                          ├── KEYBOARD TEST   (5-19) *TEST 2*
   ├── DECIMAL POINT TEST   (5-20)
                                          └── FUNCTION INDICATION TEST   (5-21) *TEST 3*

◇── BASIC DIGITAL TEST ──┬── BASIC ADC TEST (N20 AND N21) (5-23) ──── ADC ANALOG TEST (N21) (5-23)
                                                        ADC CONTROL TEST (N20 (5-26)
                              └── CONTROL TEST (5-31) ──┬── INTERRUPT CONTROLLER AND   (5-31) *TEST 6*
                                                    ├── EXTERNAL START TEST   (5-32)
                                                    ├── ANALOG CONTROL TEST   (5-33) *TEST 4*
                                                      ├── SYNCHRONOUS MAINS/ADC START   (5-35) *TEST 5*
                                                    ├── COUNTER TEST   (5-38)
                                                    ├── ROM CHIP SELECT TEST   (5-40)
                                                      └── ADC TEST SWITCH CIRCUIT TEST   (5-35)

◇── BASIC ANALOG TEST ──┬── V⎓ FUNCTION TEST   (5-42) ──┬─→ DC AMPLIFIER TEST N22   (5-58)
                                      ├── V~, V≃ FUNCTION TEST   (5-44) ──┼─→ AC AMPLIFIER TEST N24   (5-41)
                                      ├── Ω2W, Ω4W, °C FUNCTION TEST   (5-45) ──┼─→ RMS CONVERTER TEST N26   (5-63)
                                      ├── A⎓ FUNCTION TEST   (5-48) ──┼─→ CURRENT SOURCE TEST N23   (5-64)
                                      ├── A≃ FUNCTION TEST   (5-49) ──┴─→ PEAK DETECTOR TEST N27   (5-65)
                                      ├── VPEAK FUNCTION TEST   (5-53)
                                      ├── VHF FUNCTION TEST   (5-54)
                                      └── DATA HOLD/EXTERNAL SUPPLY TEST   (5-57)

◇── BASIC INTERFACE TEST ──┬── FUNCTIONAL IEC BUS TEST
       (5-68)   ├── DETAILED IEC-BUS TEST
                               ├── FUNCTIONAL BCD OUTPUT TEST   ┐   *TEST 8*
                               ├── DETAILED BCD OUTPUT TEST   ├─→ REFER TO SME92 ─┤   *TEST 9*
                               ├── FUNCTIONAL ANALOG OUTPUT TEST   │   *TEST 10*
                               ├── DETAILED ANALOG OUTPUT TEST   ┘   *TEST 11*
                               └──→ *GALVANIC SEPARATION TEST   TEST 7*

NOTE: THE TEST WRITTEN IN ITALICS ARE ADDITIONAL WHICH CAN BE CALLED WHEN USING THE SPECIAL TEST ROM

11. TESTING THE PM2528

11.1. Test switch

To switch from one test to another signal XC20 of the microcomputer has to be connected to logic zero (−5V) every time. However the XC20 input of the μp has no pull-up resistor.
To ensure correct switching a pull-up simulator with e.g. pulse switch should be used.
This may be done in the following way:

PARTS NEEDED;
− EXPERIMENT P.C. BOARD 3 x 5 cm
− 3 WIRES INCLUDING CROCODILE CLIPS (øf 20cm)
− 3 SOLDERING PINS
− 1 RESISTOR MR 25 1% 51k1, 5322 116 50672
− 1 PULSE SWITCH 5322 276 14338

ST 3803

Before switching on the tests, connect the test switch to the PM2528.

XC20 to test pin XC20
0V to test pin 0V (logic 1)
−5V to test pin −5V (logic 0)

Switch on the PM2528 and select the desired test by pushing the pulse switch. Initial the PM2528 will jump to test 0.
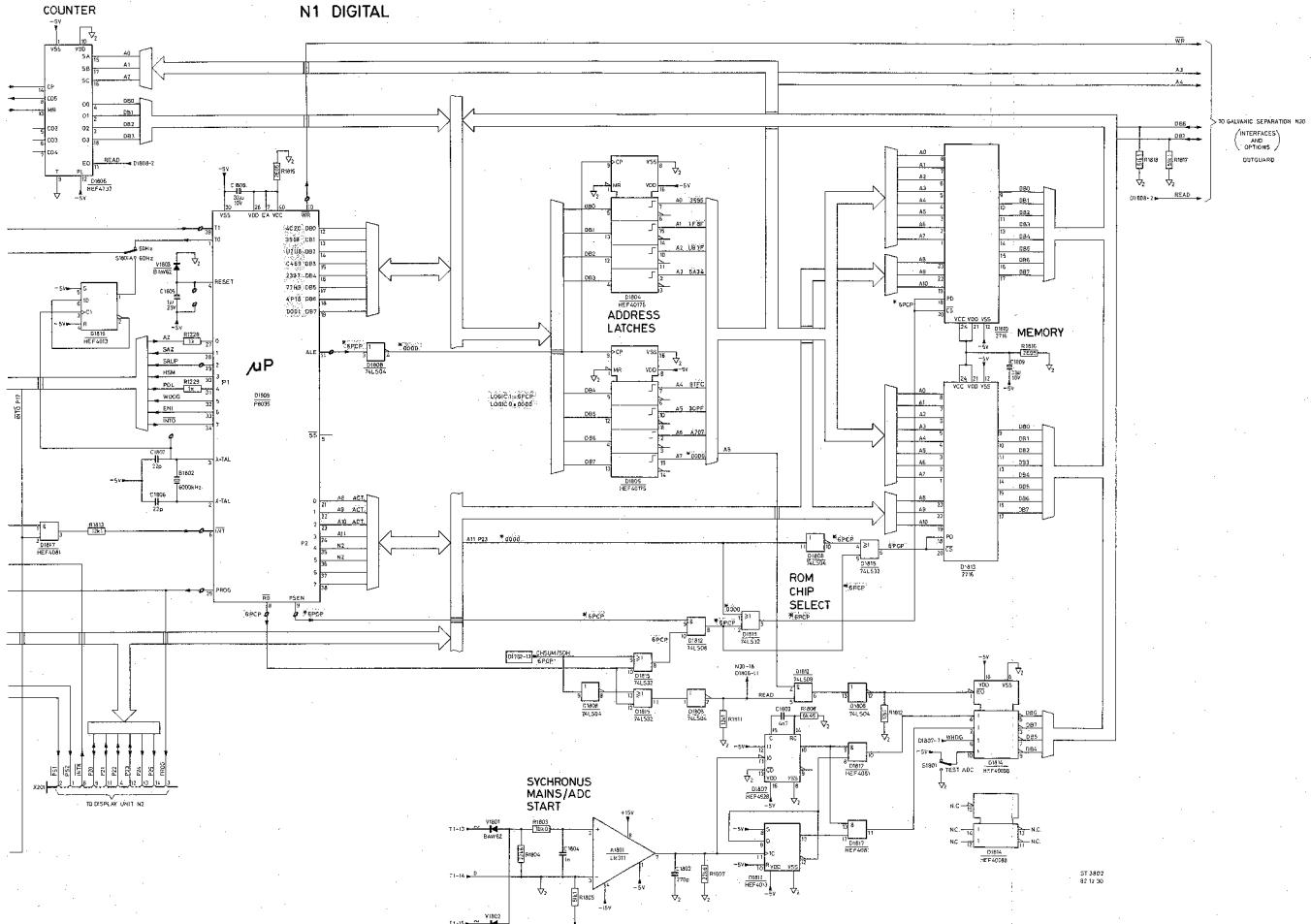
11.2. Free run

Settings signature analyser

Setting	Edge	Test pin	Signal name
START	⌐_	D1810/1	ROM / A7
STOP	_⌐	D1810/1	ROM /A7
CLOCK	⌐_	TP ALE	μp/ALE
QUAL	→		
GROUND	—	TP −5V	Logic 0

Preparations

- PM2528
  - Free run simulator placed in D1810 socket (Both ROMs removed). Refer to 5.4. of the PM2528 service manual.
  - Analog control p.c.b. N20 removed.
  - Galvanic separation p.c.b. and interfaces (ANALOG, BCD, IEC) removed.

- Connect the signature analyser as given in the settings table.

- Switch on the PM2528.

COUNTER

N1 DIGITAL

μP

ADDRESS
LATCHES

MEMORY

ROM
CHIP
SELECT

SYCHRONUS
MAINS/ADC
START

TO DISPLAY UNIT N2

TO GALVANIC SEPARATION N20
(INTERFACES
AND
OPTIONS)
OUTGUARD

8

ST 3802
82 12 30
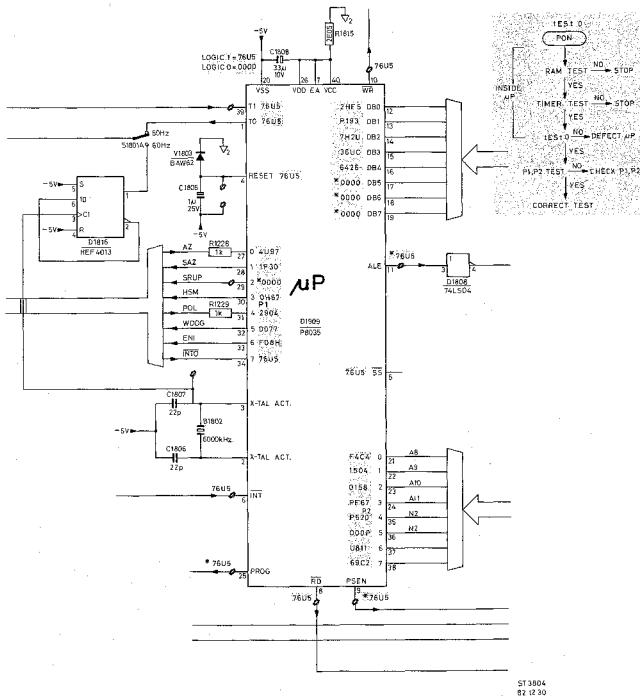
11.3.   *TEST 0* **Micro processor**

Settings signature analyser

Setting	Edge	Test pin	Signal name
START	⌐_	TP RUP	µp/P12 (SRUP)
STOP	_⌐	TP RUP	µp/P12 (SRUP)
CLOCK	⌐_	TP ALE	µp/ALE
QUAL	−	−	−
GROUND	−	TP −5V	Logic 0

Preparations

- PM2528
  - Testrom placed in D1810 socket (both ROMs removed).
  - Analog control p.c.b. N20 removed.
  - Galvanic separation p.c.b. and interfaces (ANALOG, BCD, IEC) removed.

- Connect the test switch to the PM2528 (refer to 11.1.).
- Connect the signature analyser as given in the settings table.
- Switch on the PM2528 *TEST 0* will appear on the display if a part of the µp is correct. Refer to the flow-chart in the circuit diagram.
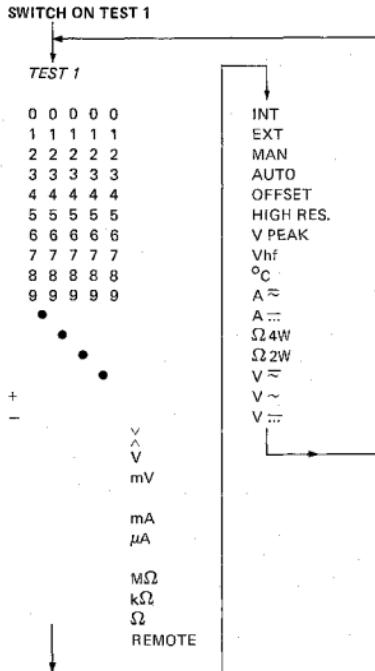
ST 3804
82 12 30

11.4. *TEST 1* **Visual display/keyboard (No S.A.)**

Preparations

- PM2528   — Testrom placed in D1810 socket (Both ROMs removed).
                        — Analog control p.c.b. removed.
                        — Galvanic separation p.c.b. and interface (ANALOG, BCD, IEC) removed.
- Connect the test switch to the PM2528 (refer to 11.1).
- Switch on the PM2528 and select *TEST 1*.

INDICATION

SWITCH ON TEST 1

TEST 1

0 0 0 0 0	INT
1 1 1 1 1	EXT
2 2 2 2 2	MAN
3 3 3 3 3	AUTO
4 4 4 4 4	OFFSET
5 5 5 5 5	HIGH RES.
6 6 6 6 6	V PEAK
7 7 7 7 7	Vhf
8 8 8 8 8	°C
9 9 9 9 9	A ≈
	A ⃨
	Ω 4W
	Ω 2W
+	V ⁼
−	V ~
	V ⃨

∨
∧
V
mV

mA
µA

MΩ
kΩ
Ω
REMOTE
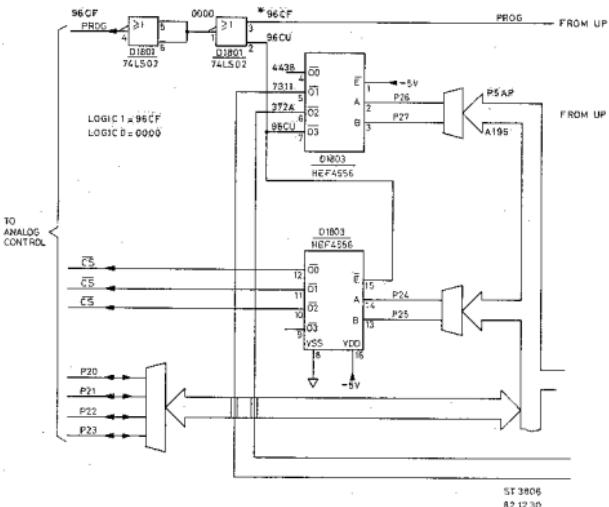
11.5. *TEST 2* Display/keyboard leds test (+ QUALIFIER)

Setting signature analyser

Setting	Edge	Test pin	Signal name
START	⌐⌐	TP RUP	µp/P12 (SRUP)
STOP	⌐⌐	TP RUP	µp/P12 (SRUP)
CLOCK	⌐⌐	TP ALE	µp/ALE
QUAL	⌐⌐	N20/12	SAZ
GROUND	—	TP −5V	Logic 0
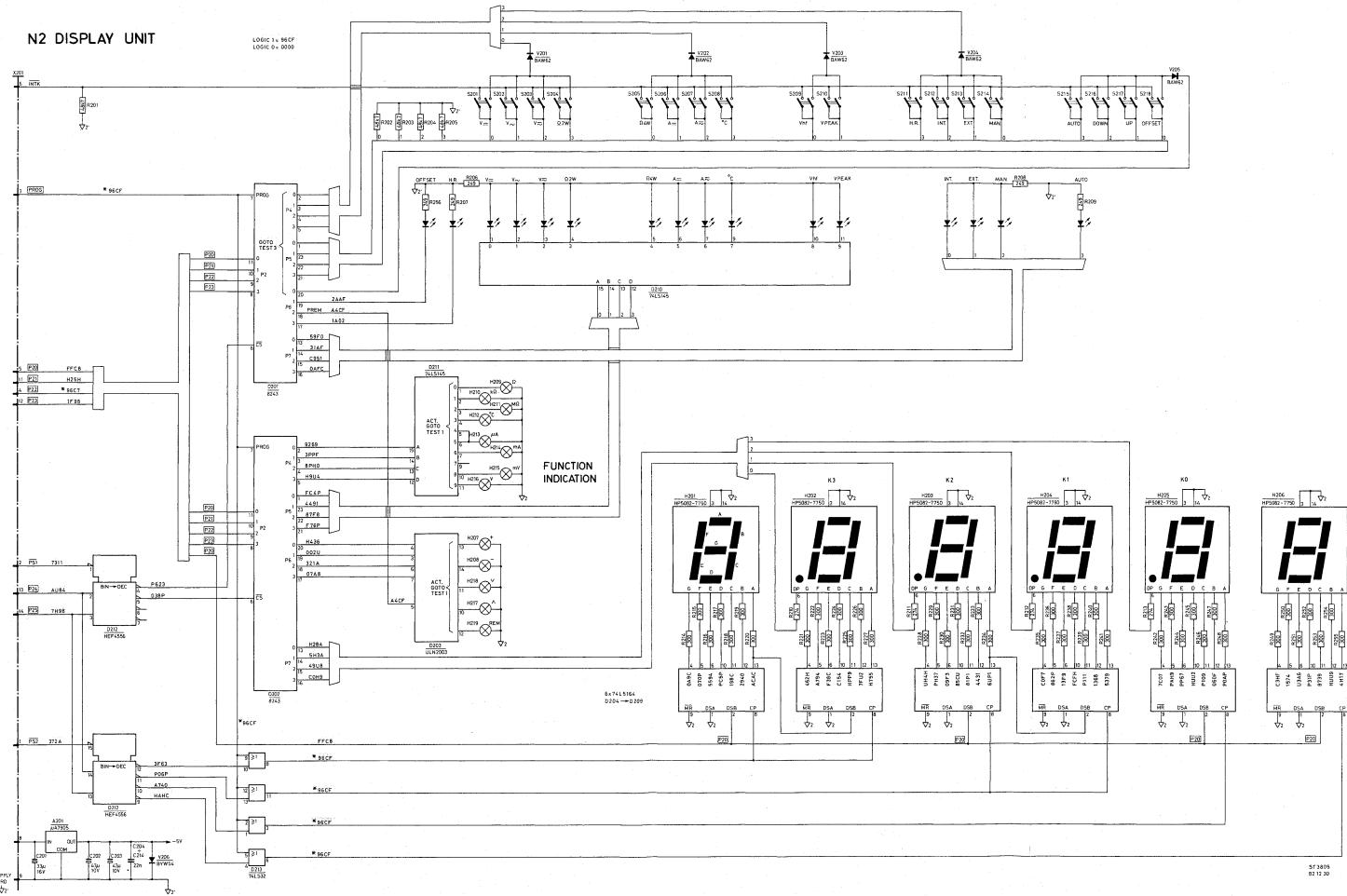
Preparations

● PM2528
  - Testrom placed in D1810 socket (both ROMs removed).
  - Analog control p.c.b. removed and replaced by extender p.c.b.
  - Galvanic separation p.c.b. and interfaces (ANALOG, BCD, IEC) removed.
  - All analog units may be removed, it is not necessary.

● Connect the test switch to the PM2528 (refer to 11.1.).

● Connect the signature analyser as given in the settings table.

● Switch on the PM2528 and select *TEST 2*.

ST 3806
82 12 30

N2 DISPLAY UNIT

11.6.   *TEST 3*   Keys
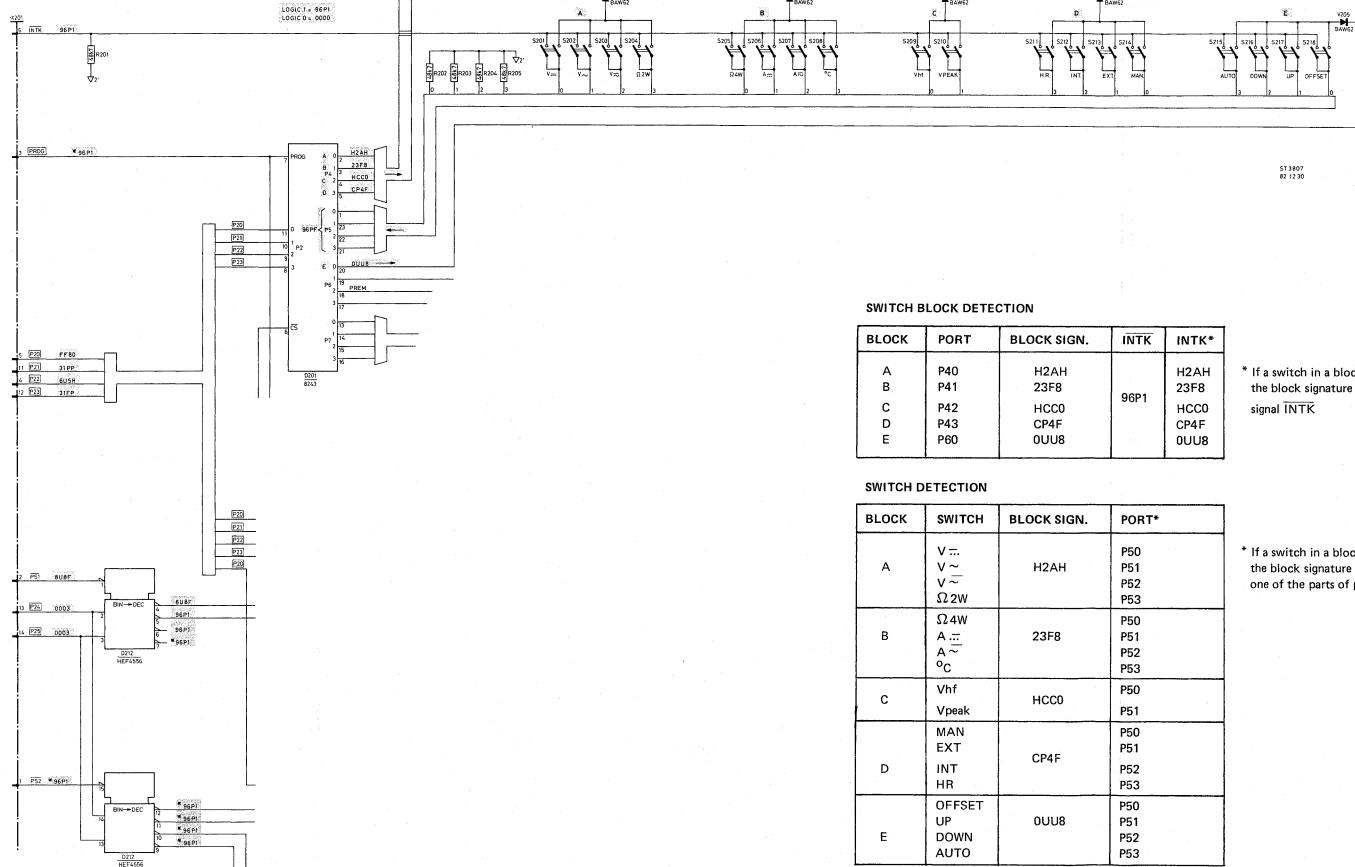
Settings signature alayser

Settings	Edge	Test pin	Signal name
START	⌐_	TP RUP	μp/P12 (SRUP)
STOP	_⌐	TP RUP	μp/P12 (SRUP)
CLOCK	⌐_	TP ALE	μp/ALE
QUAL	—	—	—
GROUND	—	TP −5V	Logic 0

Preparations

● PM2528   — Testrom placed in D1810 socket (both ROMs removed).
                       — Analog control p.c.b. N20 removed.
                       — Galvanic separation p.c.b. and interfaces (ANALOG, BCD, IEC) removed.

● Connect the test switch to the PM2528 (refer to 11.1.)

● Connect the signature analyser as given in the settings table.

● Switch on the PM2528 and select *TEST 3* .

N2 DISPLAY UNIT

ST 3407
82 12 30

SWITCH BLOCK DETECTION

BLOCK	PORT	BLOCK SIGN.	INTK	INTK*
A	P40	H2AH		H2AH
B	P41	23F8	96P1	23F8
C	P42	HCC0		HCC0
D	P43	CP4F		CP4F
E	P60	0UU8		0UU8

* If a switch in a block is depressed the block signature will appear on signal INTK

SWITCH DETECTION

BLOCK	SWITCH	BLOCK SIGN.	PORT*
A	V ⎓	H2AH	P50
	V ~		P51
	V ⎓~		P52
	Ω 2W		P53
B	Ω 4W	23F8	P50
	A ⎓		P51
	A ~		P52
	°C		P53
C	Vhf	HCC0	P50
	Vpeak		P51
D	MAN	CP4F	P50
	EXT		P51
	INT		P52
	HR		P53
E	OFFSET	0UU8	P50
	UP		P51
	DOWN		P52
	AUTO		P53

* If a switch in a block is depressed the block signature will appear on one of the parts of port 5.

11.7. *TEST 4* **Analog control (+ QUALIFIER)**
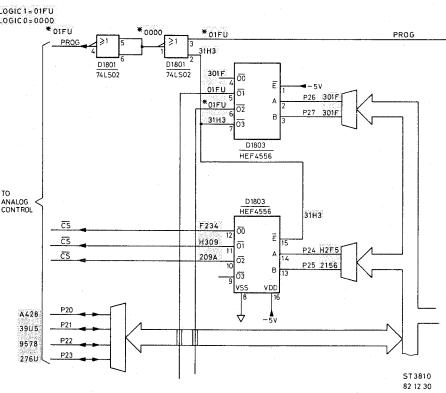
Settings signature analyser

| Setting	Edge	Test pin	Signal name
START	⌐_	TP RUP	µp/P12 (SRUP)
STOP	_⌐_	TP RUP	µp/P12 (SRUP)
CLOCK	⌐_	TP ALE	µp/ALE
QUAL.	⌐_	N20/12	SAZ
GROUND	–	–5V	Logic 0

Preparations
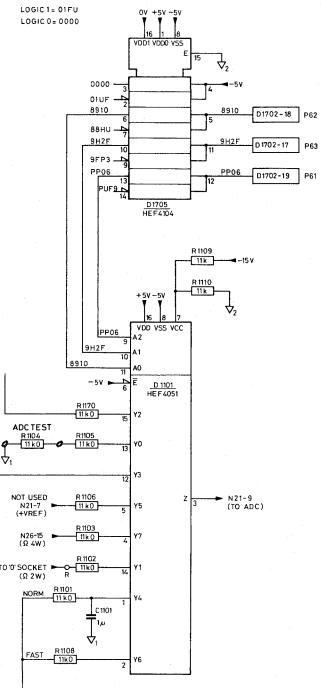
● PM2528
  - Testrom in D1810 socket (both ROMs removed).
  - Analog control p.c.b. N20 removed and replaced by extender p.c.b.
  - Galvanic separation p.c.b. and interfaces (ANALOG, BCD, IEC) removed.
  - Remove all plug-in units.

● Connect the test switch to the PM2528 (refer to 11.1.).

● Connect the signature analyser as given in the settings table.

● Switch on the PM2528 and select *TEST 4*.

● If test 4 is correct, place the current source N23, DC amplifier N22 HF voltage unit N26, RMS convertor N25 and peak detector N27 in the PM2528 again and trace back the signals on the units.

NOTE: Peak detector N27 (PM9259) and HF voltage unit (PM9258) are options.
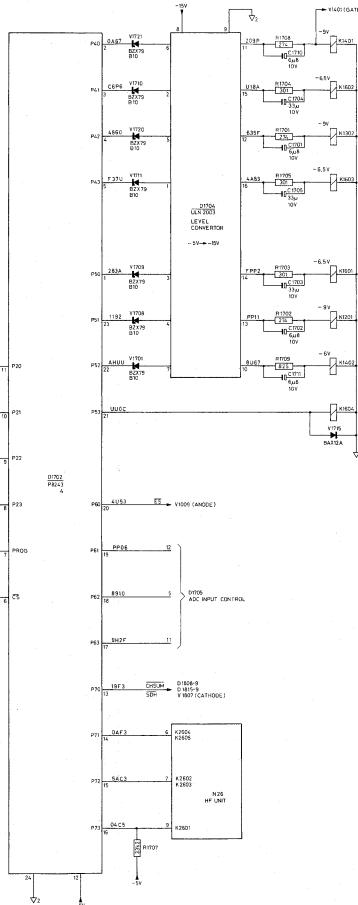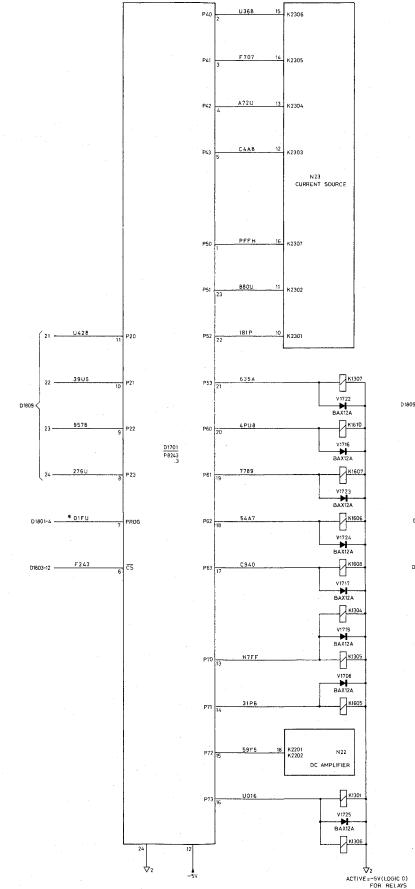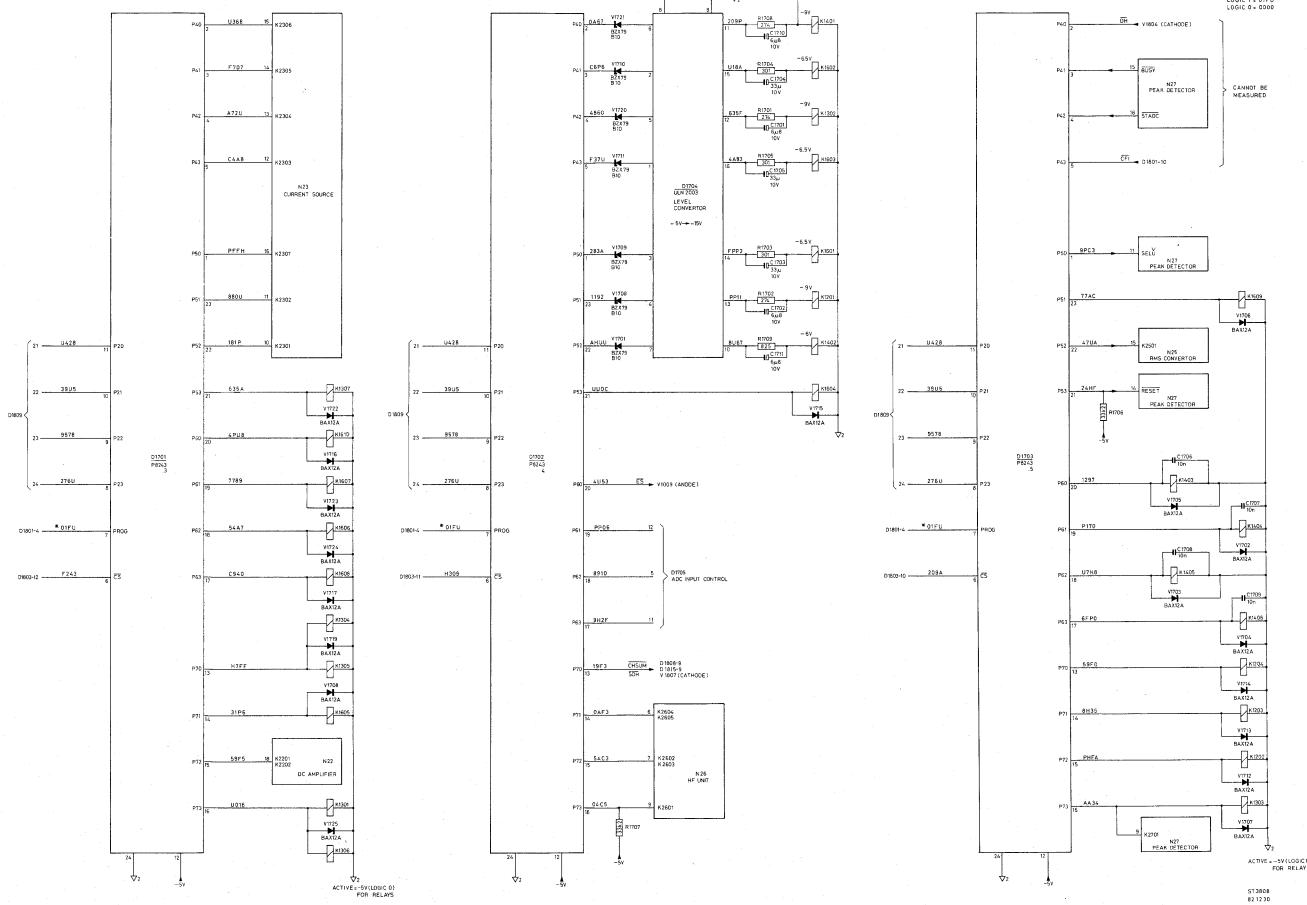
ST 3810
82 12 30
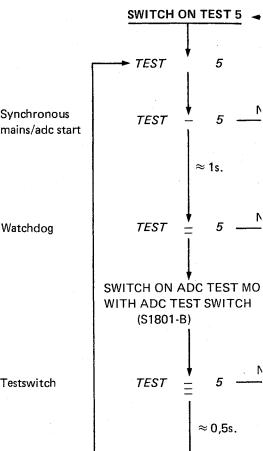
N1 ANALOG CONTROL

N1 ANALOG CONTROL

11.8. *TEST 5*   Synchronous mains/ADC start circui
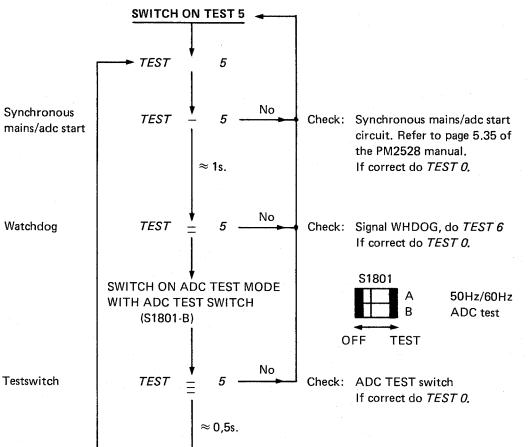
Preparations

● PM2528
  — Testrom placed in soc
  — Analog control p.c.b.
  — Galvanic separation p

● Connect the test switch to the PM2528 (refer

● Switch on the PM2528 and select *TEST 5*.

● Use a data probe or oscilloscope to measure t
  Logic 1 = 0V, logic 0 = −5V.

<div align="center">

SWITCH ON TEST 5 ◄

TEST   5

</div>

Synchronous   *TEST* — 5 —— N
mains/adc start

≈ 1s.

Watchdog   *TEST* = 5 —— N

SWITCH ON ADC TEST MO
WITH ADC TEST SWITCH
(S1801-B)

Testswitch   *TEST* = 5 —— N

≈ 0,5s.
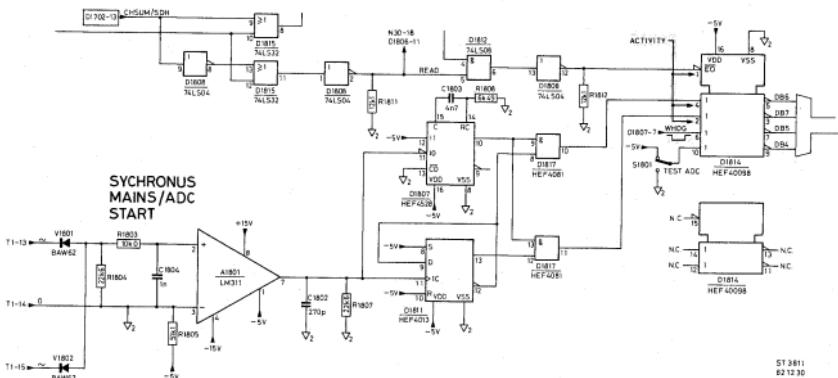
11.8.   *TEST 5*   Synchronous mains/ADC start circuit (No S.A.)

Preparations

- PM2528
  - Testrom placed in socket D1810 (both ROMs removed).
  - Analog control p.c.b. N20 removed.
  - Galvanic separation p.c.b. and interfaces (BCD, ANALOG, IEC) removed.
- Connect the test switch to the PM2528 (refer to 11.1.).
- Switch on the PM2528 and select *TEST 5*.
- Use a data probe or oscilloscope to measure the state of the signals.
  Logic 1 = 0V, logic 0 = −5V.

SWITCH ON TEST 5

TEST   5

Synchronous
mains/adc start

TEST − 5   No   Check: Synchronous mains/adc start
                                      circuit. Refer to page 5.35 of
                                      the PM2528 manual.
≈ 1s.   If correct do *TEST 0*.

Watchdog

TEST ≡ 5   No   Check: Signal WHDOG, do *TEST 6*
                                      If correct do *TEST 0*.

SWITCH ON ADC TEST MODE
WITH ADC TEST SWITCH
(S1801-B)

S1801
A   50Hz/60Hz
B   ADC test

OFF   TEST

Testswitch

TEST ≡ 5   No   Check: ADC TEST switch
                                      If correct do *TEST 0*.

≈ 0,5s.

DI 702-13 CHSUM/50H

D1808
74LS04

D1815
74LS32

D1815
74LS32

D1808
74LS32

N30-18
D1806-11

READ

R1811

-5V

D1812
74LS08

C1803
4n7

RC

R1806

VDD   VSS

D1807
HEF4528

VDD   VSS

-5V

D1806
74LS04

R1812

ACTIVITY

-5V

VDD   VSS

WHDG

D1807-7

SI801   TEST ADC

-5V

D1814
HEF40098

DB8
DB7
DB6
DB5
DB4

D1817
HEF4081

D1811
HEF4002

D1807
HEF4528

VDD   VSS

-5V

D1817
HEF4081

-5V

N.C.   N.C.

N.C.   N.C.

D1814
HEF40098

**SYCHRONUS
MAINS/ADC
START**

T1-13   V1801
BAW62

R1803
10k Ω

R1804

C1804

+15V

A1801
LM311

T1-14

-15V

C1802
270p

R1807

R1805

T1-15   V1802
BAW62

-5V

ST 3811
82 12 30

11.9. *TEST 6* **Interrupt controller (No S.A.)**

Preparations

- PM2528 — Testrom placed in D1810 socket (both ROMs removed).
  — Analog control p.c.b. N20 removed.
  — Galvanic separation p.c.b. and interfaces (BCD, ANALOG, IEC) removed.

- Connect the test switch to the PM2528 (refer to 11.1.).
- Switch on the PM2528 and select *TEST 6*.
- Use a data probe or oscilloscope to measure the state of the signals.
 Logic 1 = 0V, logic 0 = −5V.

INDICATION

SWITCH ON TEST 6

TEST 6

≈ 5s

Watchdog — int 1 — No — Check: Signals WDOG, ENI
WHDOG and $\overline{INT}$ on activity.

Yes

Incorrect:
WDOG, do *TEST 0*
ENI, do *TEST 0*
WHDOG, do *TEST 5*
$\overline{INT}$, check D1811, D1817.

WHDOG is also connected to D1814/6

DEPRESS KEY

Interrupt keyboard — int 2 — No — Check: Signals $\overline{INTK}$, ENI and
$\overline{INT}$ on activity.

Yes

Incorrect:
$\overline{INTK}$, do *TEST 2*
ENI, do *TEST 0*
$\overline{INT}$, check D1811, D1817.

MAKE EXT. START

External interrupt — int 3 — No — Check: Signals EXT START, ENI
$\overline{INTO}$ and $\overline{INT}$ on activity.

Yes

Incorrect:
EXT START, check EXT
start circuit
ENI, do *TEST 0*
$\overline{INTO}$, do *TEST 0*
$\overline{INT}$, check D1811, D1817

μP

AZ R1228 1k 27 0
SAZ 28 1
SRUP 29 2
HSM 30 3
POL R1229 1k 31 4
WDOG 32 5
ENI 33 6
INT0 34 7

P1

D1909
P8035

WDOG P15
ENI P16
INT0 P17

≈ 5s
int 1

INTERRUPT
CONTROLLER

≈ 5s
int 1

C1807
22p

B1802
6000kHz.

X-TAL

-5V

C1806
22p

X-TAL

C1804
22μ
10V

R1809
562k

C
RC

R
DC1

1D

1
&
2

R1813
12k1

INT

D1807
HEF4528

WHDOG
D1814-6

D1811
HEF4013

D1817
HEF4081

int 1
AFTER ≈ 5s

D1814
HEF40098

int 2

int 3

PROG

+5V
OUTGUARD

R1902 R1903

V1902
BAX12A

V1903
BC549B

EXT.
START

X1003

R1901
18k7

C1903
10n

V1904

INSTRUMENT
HOUSING

EXT.
START
BCD/IEC
X1901-7

STD0

R1802

B1801
CNY47A

R1807

OUTGUARD

D1808
74LS04

R1814

-5V

D
1C

ENI

INT0

D1816
HEF4013

P51
P52
INTK
P20
P21
P22
P23
P24
P25
P800

X201

TO DISPLAY UNIT N2

ST 3812
82 12 30

11.10. *TEST 7*   Galvanic separation

Setting signature analyser

Setting	Edge	Test pin	Signal name
START	⌐_	TP RUP	μp/P12 (SRUP)
STOP	_⌐	TP RUP	μp/P12 (SRUP)
CLOCK	_⌐	TP $\overline{WR}$	$\mu p/\overline{WR}$
QUAL.	–	–	–
GROUND	–	TP –5V	Logic 0

Preparations

- PM2528   — Testrom placed in D1810 socket (both ROMs removed).
  - Analog control p.c.b. N20 removed and replaced by extender p.c.b.
  - Galvanic separation p.c.b. N30 placed on extender p.c.b.
  - Interconnect N30/12 to N30 (Galvanic separation).
- Connect the signature analyser to the PM2528 as given in the settings table.
- Connect the test switch to the PM2528 (refer to 11.1.).
- Switch on the PM2528 and select *TEST 7*.

!! NOTE: TRIGGER LOW > 1.5V !!

5V
1.5V
0

LOGIC 1 = 5386
LOGIC 0 = 0000

WR   15   *0000

A3   19   HH45

READ   18   0000

D7   16   80PF

A4   17   8PF3

D6   16   5449

D3001 HEF4049
D3002 HEF4011
D3003 HEF4013
D3004 HEF4013
D3005 HEF40097
D3007 HEF4555

80PF
8PF3

V3001 BAW62

93CC
F03H
*0000
*5386
17CA
443F
FPU5
9H79

ED4

EO2

Q6
Q5

R3008 2k05
R3002 46r
R3009 15k0

R3010 2k05
R3003 46r
R3011 15k0

R3012 2k05
R3004 46r
R3013 15k0

R3015 2k05
R3005 46r
R3015 15k0

R3006 2k05
R3007 15k0
R3016 46r

R3018
R3019 56k2
R3017

C3006 2n2
C3010 470p
C3001 33u 10V
C3002 22n
C3003 22n
C3004 22n
C3007 22n
C3008 22n
C3009 47u 10V

V3002 BAW62

D3001 CNX35
D3002 CNX35
D3003 CNX35
D3004 CNX35
D3005 CNX35

HEF4049
HEF4049

D3005 *0009

EA
BIN   DEC
A1
A2

DAD   93CC   2
CLOCK *0009
DLEN 1 A30P
DLEN 2 3P7H
DLEN 3 P732
       29F7

+5V
0V   OUTGUARD

+5V
DAI   5386   0000   CONNECT DAI
                    TO LOGIC 0

0V LOGIC 1
-5V LOGIC 0

5386
0000

ST 3813
83.01.07

11.11. *TEST 8*   BCD output PM9292, Start DVM (No S.A.)
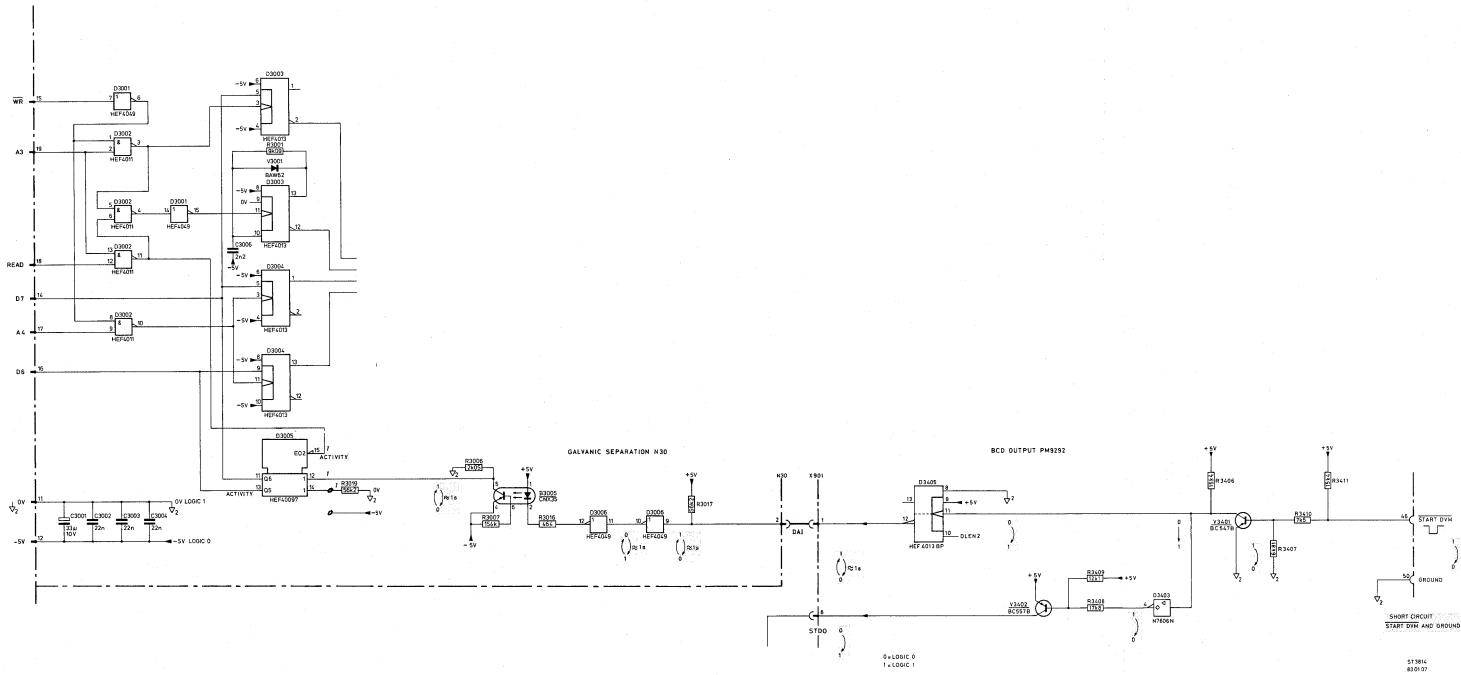
Preparations

● PM2528   — Test rom placed in D1810 socket (both ROMs removed).
                  — Analog control p.c.b. N20 removed.
                  — Galvanic separation p.c.b. N30 placed on extender p.c.b.
                  — Interconnect N30/12 to N30/8 (Galvanic separation).

● Connect the test switch to the PM2528 (refer to 11.1.).

● Switch on the PM2528 and select test 8.

● Use a data probe or oscilloscope to measure the state of the signals.
  Logic 0 = —5V, logic 1 = 0V.

Indication

● If test 8 is switched on *TEST 8* will appear on the display.

● Short circuit signal $\overline{\text{START DVM}}$ and ground, on the display a dash will appear between TEST and 8
  for about 1 second *(TEST — 8)*. This means that the μp has read the start dvm signal.
  If in-correct measure the state of the signals as given in the circuit diagram.

SWITCH ON TEST 8

TEST   8

SHORT CIRCUIT $\overline{\text{DVM}}$
TO GROUND

                ≈ 1s.
TEST — 8   No   Check: State of signals as
                                    given in the circuit
                                    diagram.

GALVANIC SEPARATION N30

BCD OUTPUT PM9292

ST3814
83.01.07
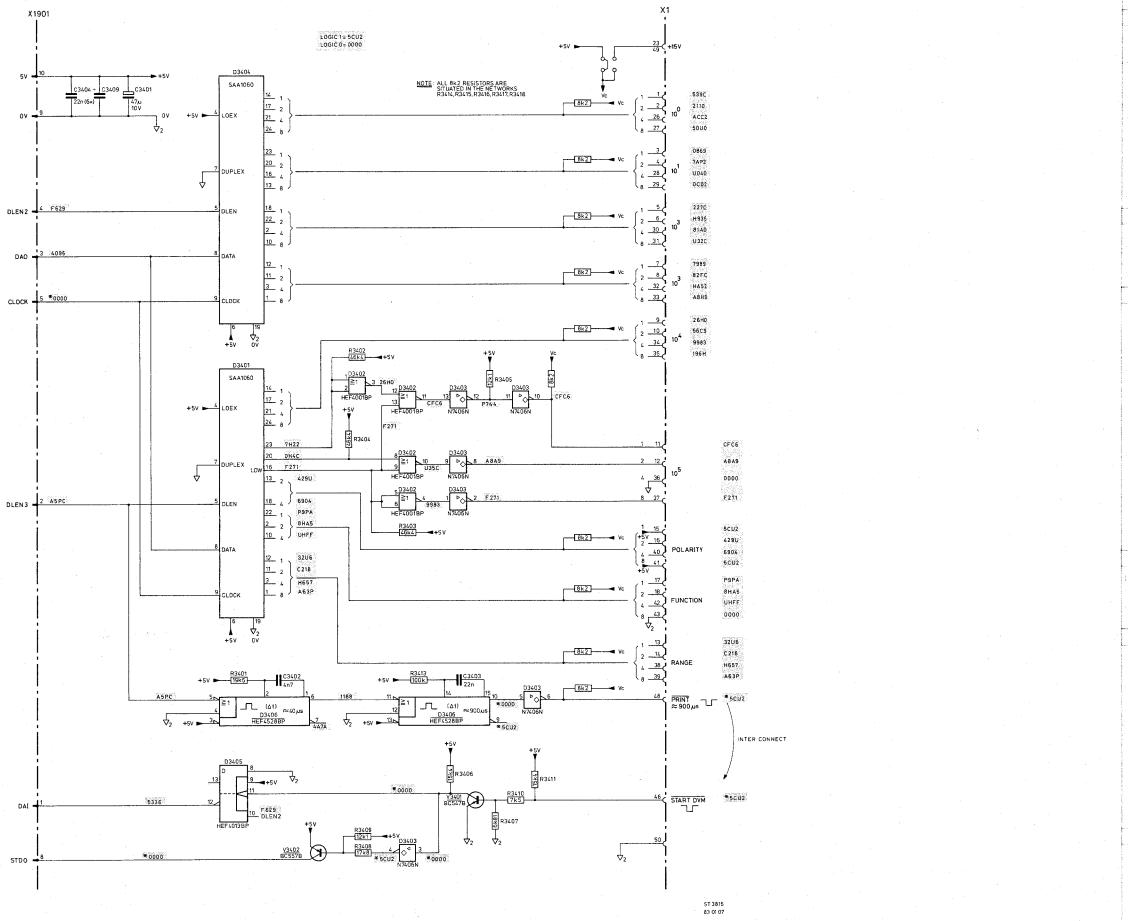
11.12. *TEST 9*   BCD output PM9292

Setting signature analyser

Setting	Edge	Test pin	Signal name
START	⌐⌐	TP RUP	μp/P12 (SRUP)
STOP	⌐	TP RUP	μp/P12 (SRUP)
CLOCK	⌐	TP $\overline{WR}$	μp/$\overline{WR}$
QUAL.	—	—	—
GROUND	—	TP −5V	Logic 0

Preparations

● PM2528   — Testrom placed in D1810 socket (both ROMs removed).
                                — Analog control p.c.b. N20 removed.
                                — Galvanic separation p.c.b. N30 placed on extender p.c.b.
                                — Interconnect N30/12 to N30/8 (Galvanic separation).

● Connect the signature analyser to the PM2528 as given in the settings table.

● Connect the test switch to the PM2528 (refer to 11.1.).

● Switch on the PM2528 and select *TEST 9.*

ST 3815
83 01 07

11.13. *TEST 10*   Analog output PM9254

TEST10-A   Input part.

Settings signature analyser

Setting	Edge	Test pin	Signal name
START	⌐_	TP RUP	μp/P12 SRUP
STOP	_⌐	TP RUP	μp/P12 SRUP
CLOCK	_⌐	TP $\overline{WR}$	μp/$\overline{WR}$
QUAL.	—	—	—
GROUND	—	TP −5V	Logic 0

Preparations

- ● PM2528   — Testrom placed in D1810 socket (both ROMs removed).
              — Analog control p.c.b. N20 removed and replaced by extender p.c.b.
              — Galvanic separation p.c.b. N30 placed on extender p.c.b.
              — Interconnect N30/12 to N30/8 (Galvanic separation).
- ● PM9254   — Set digit switch in position C (refer to rear of PM2528).
- ● Connect the signature analyser to the PM2528 as given in the settings table.
- ● Connect the test switch to the PM2528 (refer to 11.1.).
- ● Switch on the PM2528 and select *TEST 10*.
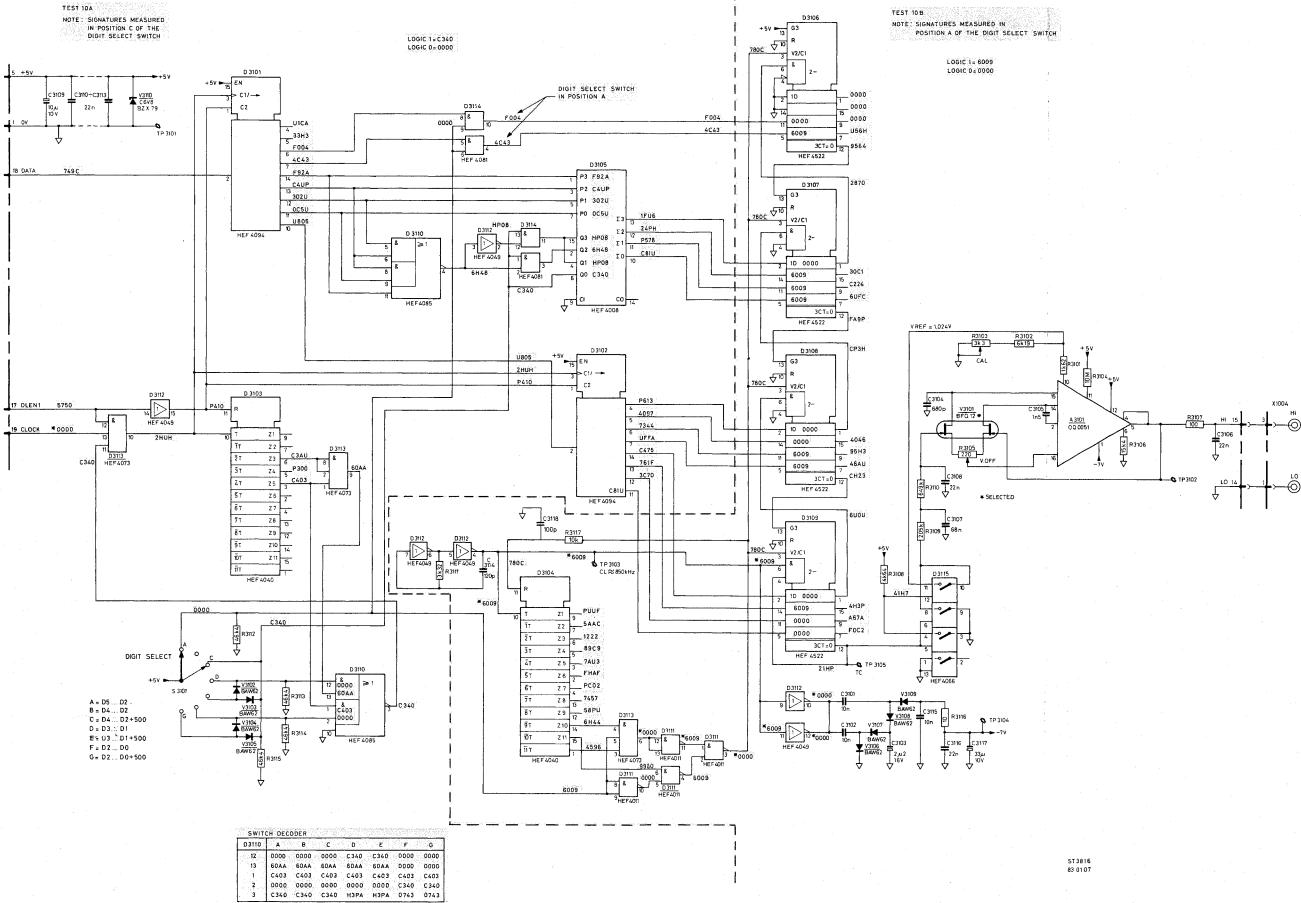
TEST 10-B   Output part (Self running, with own clock).

Settings signature analyser

Setting	Edge	Test pin	Signal name
START	⌐_	D3111/3	Load
STOP	_⌐	D3111/3	Load
CLOCK	⌐_	TP3103	Clock
QUAL.	—	—	—
GROUND	—	TP −5V	Logic 0

Preparations

- ● PM2528   — Refer to test 10A.
- ● PM9254   — Set the digit select switch in position A (refer to rear of PM2528).
- ● Connect the signature analyser to the PM2528 as given in the settings table.
- ● Connect the test switch to the PM2528 (refer to 11.1.).
- ● Switch on the PM2528 and select *TEST 10*.
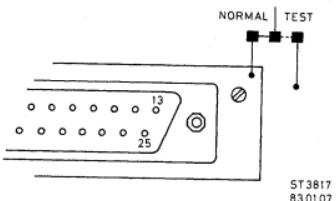
11.14. *TEST 11*   IEC-BUS PM9291 (without address decoder)

Settings signature analyser

| Setting	Edge	Test pin	Signal name
START	⌐_	TP RUP	μp/P12 (SRUP)
STOP	_⌐	TP RUP	μp/P12 (SRUP)
CLOCK	⌐_	N20/12	μp/P10 AZ
QUAL.	–	–	–
GROUND	–	TP –5V	Logic 0

Preparations

● PM2528
— Testrom placed in D1810 socket (both ROMs removed).
— Analog control p.c.b. N20 removed and replaced by extender p.c.b.
— Galvanic separation p.c.b. N30 placed on extender p.c.b.
— Inter-connect N30/12 to N30/8 (Galvanic separation).

● PM9291
— Jumper on the interface in position test

NORMAL │ TEST

ST3817
830107

— Interconnect on the IEC-BUS connector
  signal DAV with EOI,
  signal REN with ground

● Connect the signature analyser to the PM2528 as given in the settings table.
● Connect the test switch to the PM2528 (refer to 11.1.).
● Switch on the PM2528 and select *TEST 11.*

TEST ADDRESS DECODER (Self-running with own clock).

Settings signature analyser

Setting	Edge	Test pin	Signal name
START	⌐_	D3210/9	red
STOP	_⌐	D3210/9	red
CLOCK	⌐_	D3216/15	CI
QUAL.	–	–	–
GROUND	–	TP –5V	Logic 0

Preparations
Refer to test 11.

How to measure signal INSR (D3210/3)   LOGIC 1 = 0UP7

Measuring sequence

	Settings			Sequence
1	Address	22	− SRQ	0C03
2	Address	22	+ SRQ	US* (Unstable)
3	Only		− SRQ	0010
4	Only	TON	− SRQ	0050
5	Only	A1	− SRQ	0091
6	Only	A2	− SRQ	0112
7	Only	A3	− SRQ	0215
8	Only	A4	− SRQ	041A
9	Only	A5	− SRQ	0804

+SRQ = SRQ off in position off = SRQ
 SRQ = SRQ off in position on = SRQ

ST3418
830101