OX 860
100 MHz PORTABLE OSCILLOSCOPE

USER'S MANUAL

CONTENTS

Congratulations ! *You have just choosen a Metrix oscilloscope, realized to give you complete satisfaction during many years. Til the conception to the delivery it has been carefuly developed. Thanks to the advanced technologies use, like maintenance by micro-controler, cutting supply, components mounted in surface, he will stay up-to-date for a long time.*
Even, if you are already familiar with this type of instrument, please read this manual at least once to make easier your user life to benefit more from your instrument.

1. GENERAL INSTRUCTIONS

This instrument complies with the specification of IEC publication 1010-1 (BS 4743, VDE 411, NFC 42020), single insulation, concerning safety requirements for electronic measuring apparatus. In the interests of user safety and safety of the instrument, the instructions contained in this manual must be strictly observed.

In particular : *Use in external, altitude < 2000 m*
Relative humidity < 80% until 31°C
Use temperature 10 °C to 40 °C

1.1 Precautions and safety measures

1.1.1 Preliminary

- Universal mains power supply (94 V to 264 V).

☞ ***Note*** ***The replacement fuse must be the same size and rating as the fuse supplied. It is inside the instrument in a recess on the cathode ray tube mounting.***

- Earth all exposed metal parts (including the workbench).

1.1.2 During use

- Use functionally sound measuring probes.
- Select appropriate vertical and timebasesensitivity ranges for the signal being measured.
- When the instrument is connected to measuring circuits, do not touch unused terminals.

1.1.3 Symbols


See user manual


Risk of electric shock


Earth terminal

1.1.4 Safety instructions

Never open the instrument without first disconnecting from the mains power supply and any measuring circuits.

☝ ***Caution!*** ***The oscilloscope contains capacitors which may retain hazardous charges even after being isolated from the supply voltage.***

Any adjustment, maintenance or repair work carried out on the oscilloscope while it is live should be carried out only by appropriately qualified personnel.

1.2 Warranty

METRIX equipment is warranted against any defects of manufacture or materials according to the general conditions of sale. During the warranty period (2 years), defective parts will be replaced, the manufacturer reserving the right to repair or replace the product. In the event of the equipment being returned to the after sale department METRIX or to a local agency METRIX, carriage to the centre shall be payable by the customer.

The METRIX warranty does not cover the following:

1. Repairs necessitated by misuse of the equipment or use in association with incompatible equipment.
2. Modification of the equipment or any related software without the explicit authorization of METRIX technical departments.
3. Repairs necessitated by attempts to repair or maintain the product made by a person not approved by the company.
4. Adaptation to a specific application not provided for in the specifications of the equipment or the user manual.

The contents of this manual must not be reproduced in any form whatsoever without the consent of METRIX.

1.3 Maintenance

For problems concerning maintenance, spare parts, warranty, etc, please contact your local agency METRIX.

This organization will quickly process orders for spare parts and will help you for a quick repair and calibration service.

1.4 Unpacking - Repacking

This equipment has been fully checked out mechanically and electrically before shipping.

All precautions have been taken to ensure that the instrument arrives at its destination undamaged.

☝ ***Caution!*** ***Should you need to return the oscilloscope, preferably use the original packaging and indicate the reasons as clearly as possible on an accompanying note.***

☞ ***Note*** ***METRIX products are patented in FRANCE and ABROAD. All METRIX logotypes are registered.***
METRIX reserves the right to modify specifications and prices as required by technological improvements.

2. DESCRIPTION

The portable OX 860 is a two-channel oscilloscope, designed to satisfy the most demanding users.

Performance

- 2 x 100 MHz channels.
- Input range: 2 mV to 5 V/div.
- Triggering up to 180 MHz.
- Dual resynchronized timebase.
- AUTOSET.
- Bandwidth limiting (BWL).
- 0 V reference display.
- Remote control option (programming kit).

Reliability

- Use of surface mount components and LSI circuits.
- Full microprocessor-driven control.
- Front panel separate from measurement circuits.
- Internal switching by miniature relays and electronic switches.

Serviceability

- Quick to open with full access to all components without removing the printed circuit.

User interface

- Controls organized by function.
- Functions implemented simply by pressing momentary action buttons.
- Active functions indicated by leds
- Last configuration stored and recalled automatically on power up.

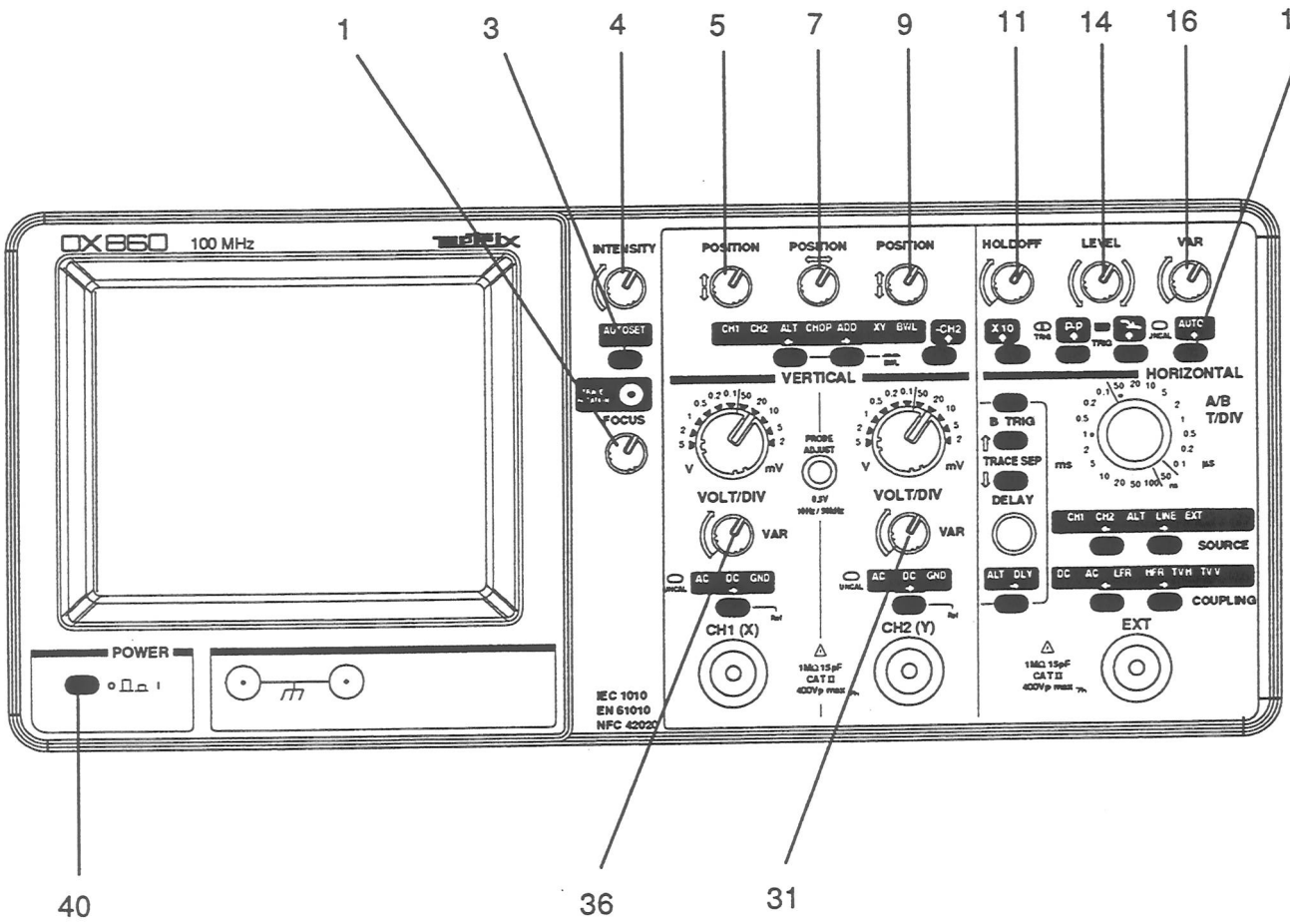

1
3
4
5
7
9
11
14
16
17
OX 860
100 MHz
INTENSITY
POSITION
POSITION
POSITION
HOLDOFF
LEVEL
VAR
AUTOSET
FOCUS
CH1 CH2 ALT CHOP ADD XY BWL
-CH2
X10
P-P
AUTO
VERTICAL
HORIZONTAL
B TRIG
TRACE SEP
DELAY
A/B T/DIV
VOLT/DIV
VAR
PROBE ADJUST
CH1 CH2 ALT LINE EXT
SOURCE
AC DC GND
ALT DLY
DC AC LFR HFR TVH TVV
COUPLING
CH1 (X)
CH2 (Y)
EXT
IEC 1010
EN 61010
NFC 42020
POWER
40
36
31

figure 1

3. COMMISSIONING

☝ ***Caution! Observe all the safety instructions set out in section 1.***

- Set the controls as shown below.

Potentiometer	Identifier	Position
INTENSITY	(4)	right end stop
POSITION	(5) (7) (9)	mid travel
HOLDOFF	(11)	left end stop
LEVEL	(14)	mid travel
VAR	(16) (31) (36)	left end stop
FOCUS	(1)	mid travel

- Press the POWER on/off key (40): the last stored configuration is reinstated.
- Valide the key AUTO (17).
- Adjust the intensity (4) and focus (1) (figure 1).
- Apply the signal to be displayed to CH1 or CH2.
- Briefly press the AUTOSET key (3) (See § 4.1.).

☞ ***Note: If you hold down the AUTOSET key (3), you access the "BEAM FINDER" function.***

☞ ***Note: If the instrument does not start, respect a stop of 5 sec. before switching it on again (the interval between 2 successives switching on must be at least of 5 sec.).***

4. FUNCTIONAL DESCRIPTION

4.1 Autoset

Pressed briefly: Autoset (key 3)
The autoset function automatically hunts for the following:

* channel
* vertical sensitivity
* horizontal deflection
* level
* trigger edge

The autoset function automatically sets the OX 860 to the following configuration:

* PTP synchro
* AC coupling of the connected channel
* X 1
* BWL (off)
* BDT A
* DC coupling of the trigger source

The autoset function does not affect:

* POSITION (H and V)
* VAR
* DELAY
* TRACE SEP
* INTENSITY
* FOCUS

After the autoset function, the CH1 and CH2 vertical sensitivity values set by the corresponding knobs may no longer correspond to the sensitivities defined by the autoset function. If the CH1 and CH2 UNCAL leds are blinking, this indicates that you need to adjust the CH1 and/or CH2 attenuators to obtain the same vertical deflections. Operating the VOLT/DIV control returns the channel to the sensitivity set by the knob position.

Held down: BEAM FINDER, trace research

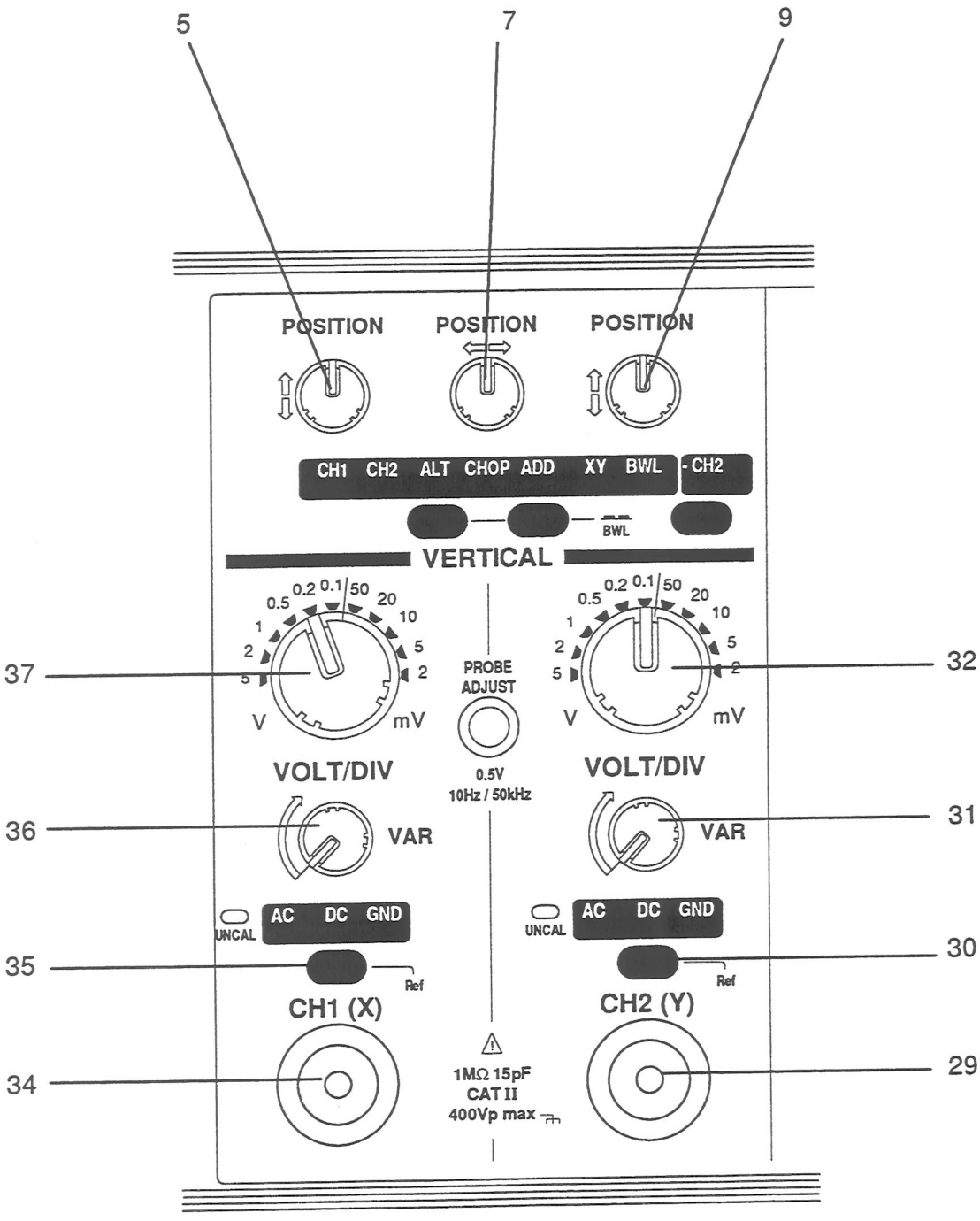

5
7
9
POSITION
POSITION
POSITION
CH1 CH2 ALT CHOP ADD XY BWL
- CH2
BWL
VERTICAL
0.5 0.2 0.1 50 20 10 5 2 1 2 5
V mV
PROBE ADJUST
0.5V 10Hz / 50kHz
37
32
VOLT/DIV
VOLT/DIV
36
VAR
31
VAR
UNCAL
AC DC GND
UNCAL
AC DC GND
35
Ref
30
Ref
CH1 (X)
CH2 (Y)
1MΩ 15pF
CAT II
400Vp max
34
29

figure 2

4.2 Vertical channels

(5 - 9) **POSITION** - Vertical alignment of traces.

(7) **POSITION** - Horizontal alignment of traces. This knob operates on CH1 and CH2 together.

(32 - 37) **VOLT/DIV.** - Vertical sensitivity: 11 positions (2 mV to 5 V/div.).

(31 - 36) **VAR** - Continuous vertical sensitivity adjustment.
When the knob is locked in the left endstop position, the UNCAL LED is off. The led blinking indicate that the real sensitivity does not correspond to the one indicate by the button volt/div. = turn this button (see § 4.1)..

(30 - 35) **AC DC GND**

Pressed briefly : selects input coupling.

AC Displays the AC component (DC component off).

DC Displays the complete signal (0 to 100 MHz).

GND Displays the channel's 0 V reference (without short-circuiting the input signal). Used to position the trace accurately on screen using POSITION controls (5 and 9).

Held down: Displays the 0 volt reference [35 (CH1) or 30 (CH2)].

(34 - 29) **CH1 and CH2** - BNC socket inputs for signals to be monitored.

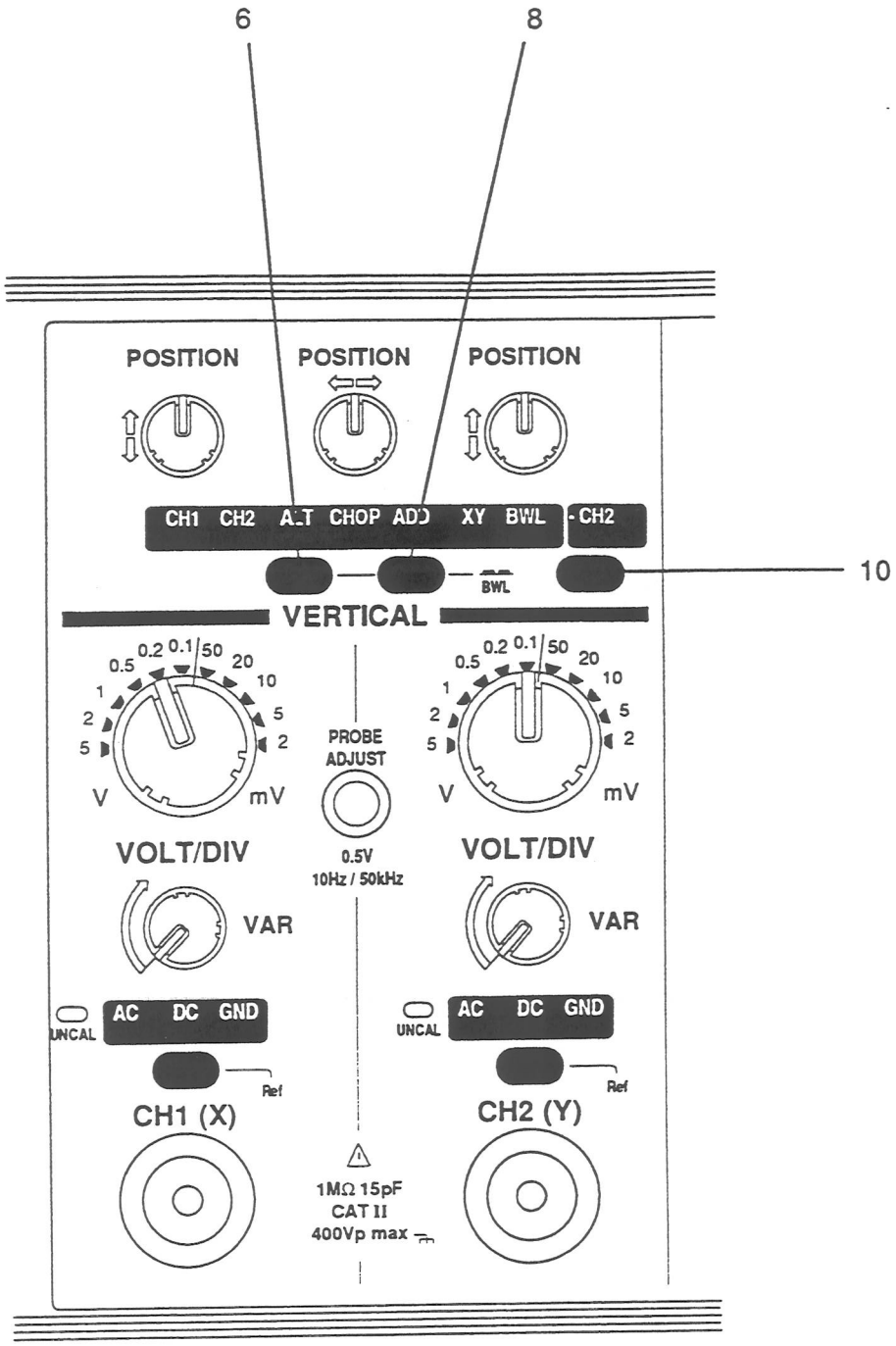

6
8
10
POSITION
POSITION
POSITION
CH1 CH2 ALT CHOP ADD XY BWL CH2
BWL
VERTICAL
0.5 0.2 0.1 50 20 10 5 2 1 2 5
V mV
PROBE ADJUST
0.5V 10Hz / 50kHz
VOLT/DIV
VAR
AC DC GND
UNCAL
Ref
CH1 (X)
CH2 (Y)
1MΩ 15pF
CAT II
400Vp max

figure 3

4.3 Display modes

(6 - 8) **CH1 - CH2 - ALT - CHOP - ADD - XY - BWL**

Select by pressing → (8) or ← (6):

CH1 Displays CH1 only.

CH2 Displays CH2 only.

ALT Displays CH1 and CH2 (in alternate mode).

CHOP Displays CH1 and CH2 in chopped mode; during a single sweep, the channel switches from CH1 to CH2 at the chopping frequency (500 kHz).

ADD Displays CH1+CH2; the difference between CH1-CH2 is displayed if -CH2 mode is on.

XY Displays CH1 and CH2 in X-Y mode (X = CH1, Y = CH2).
The timebase is off and vertical alignment is adjusted by POSITION control (9).

BWL Bandwidth limited to 20 MHz for CH1 and CH2 simultaneously. At the same time press buttons 6 and 8.
Enables the reduction of the thickness of the trace when the masses are long or when the input junction is not normally shielded.

BWL function has a mechanism which launch it as soon as one of the 2 channels is on 2 mV/div.
If the necessary bandwith is of 100 MHz, desactivate the BWL with 6 et 8.
Inhibited automatic device in AUTOSET.

(10) **-CH2** Inverts CH2.

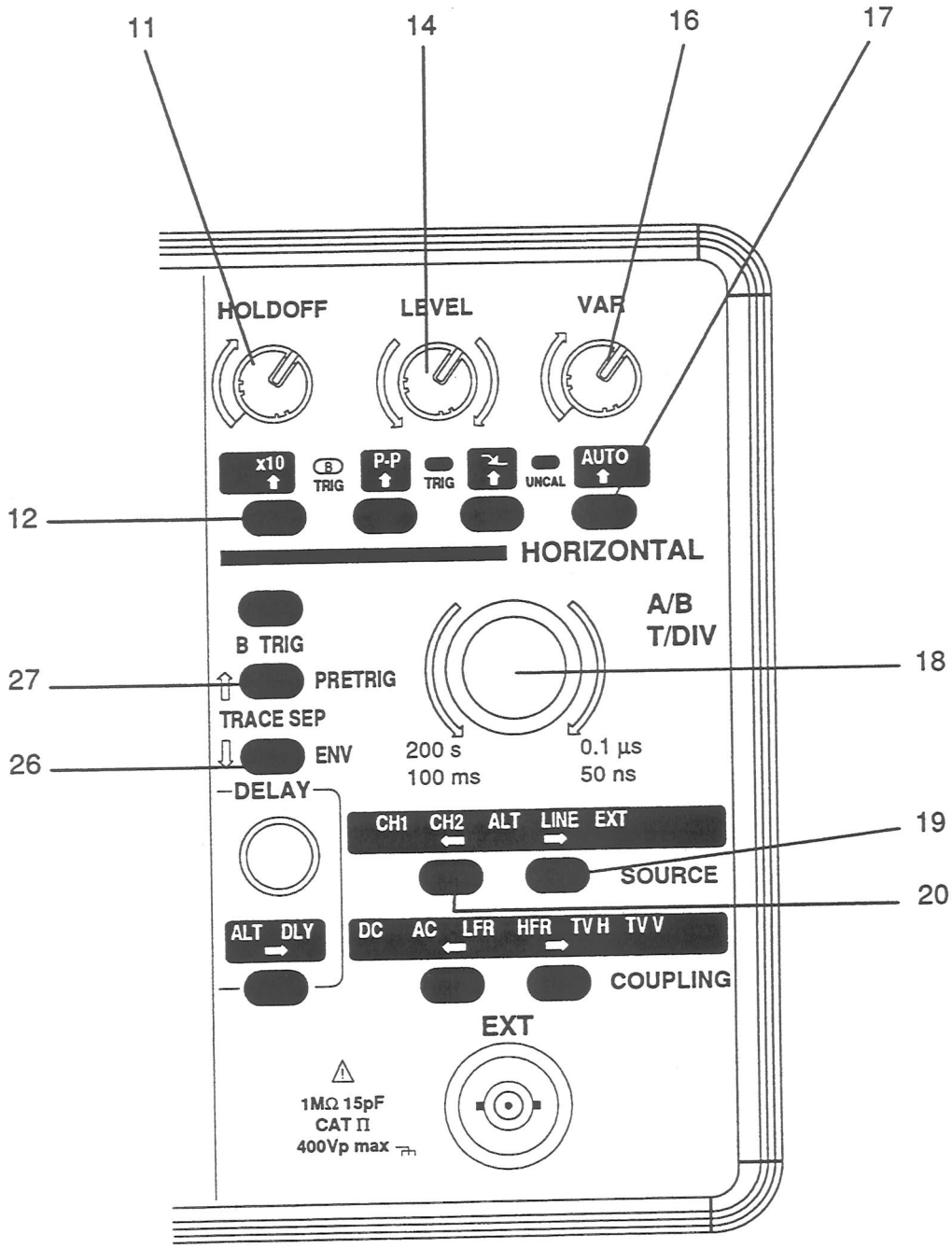

11
14
16
17
HOLDOFF
LEVEL
VAR
x10
B TRIG
P-P
TRIG
UNCAL
AUTO
12
HORIZONTAL
B TRIG
A/B
T/DIV
18
27
PRETRIG
TRACE SEP
26
ENV
200 s
100 ms
0.1 µs
50 ns
DELAY
CH1 CH2 ALT LINE EXT
19
SOURCE
20
ALT DLY
DC AC LFR HFR TV H TV V
COUPLING
EXT
1MΩ 15pF
CAT II
400Vp max

figure 4

4.4 Timebase

(18) **T/DIV A/B** - Sweep speed:
20 positions (50 ns to 100 ms/div) for the 1st timebase A.
20 positions (50 ns to 100 ms/div) for the 2nd timebase B.

(16) **VAR** - Continuous sweep speed adjustment for timebase A
When the knob is locked in the left end stop position, the UNCAL led is off.

(11) **HOLDOFF** - Continuous adjustment of the time between consecutive sweeps. This control can be used to inhibit unwanted trigger events (multiple trigger conditions in one period of the signal under observation). In normal use, set the knob to the left end stop position.

(12) **x10** - Horizontal expansion (x 10).

(26 - 27) **TRACE SEP** - Separation between the A and B traces in ALT mode.

4.5 Triggering

(19 - 20) **SOURCE** - Select by pressing → (19) or ← (20):
The same source synchronizes both timebases A and B.

CH1 Synchronized on channel CH1.

CH2 Synchronized on channel CH2.

ALT Trigger source defined by display mode:

Display mode	Trigger source
CH1	CH1
CH2	CH2
ALT	channel 1 synchronized with CH1
	channel 2 synchronized with CH2
CHOP	CH1
ADD	CH1
- CH2	CH2

LINE Synchronized on mains power supply frequency. Phase can be adjusted using the LEVEL control. The coupling control is disabled.

EXT Synchronized on external source.

(17) **AUTO** - Automatic timebase trigger.
Traces visible even without trigger event.

(14) **LEVEL** - Trigger level adjustment
The TRIG led is on when a trigger event is detected (timebase activated).

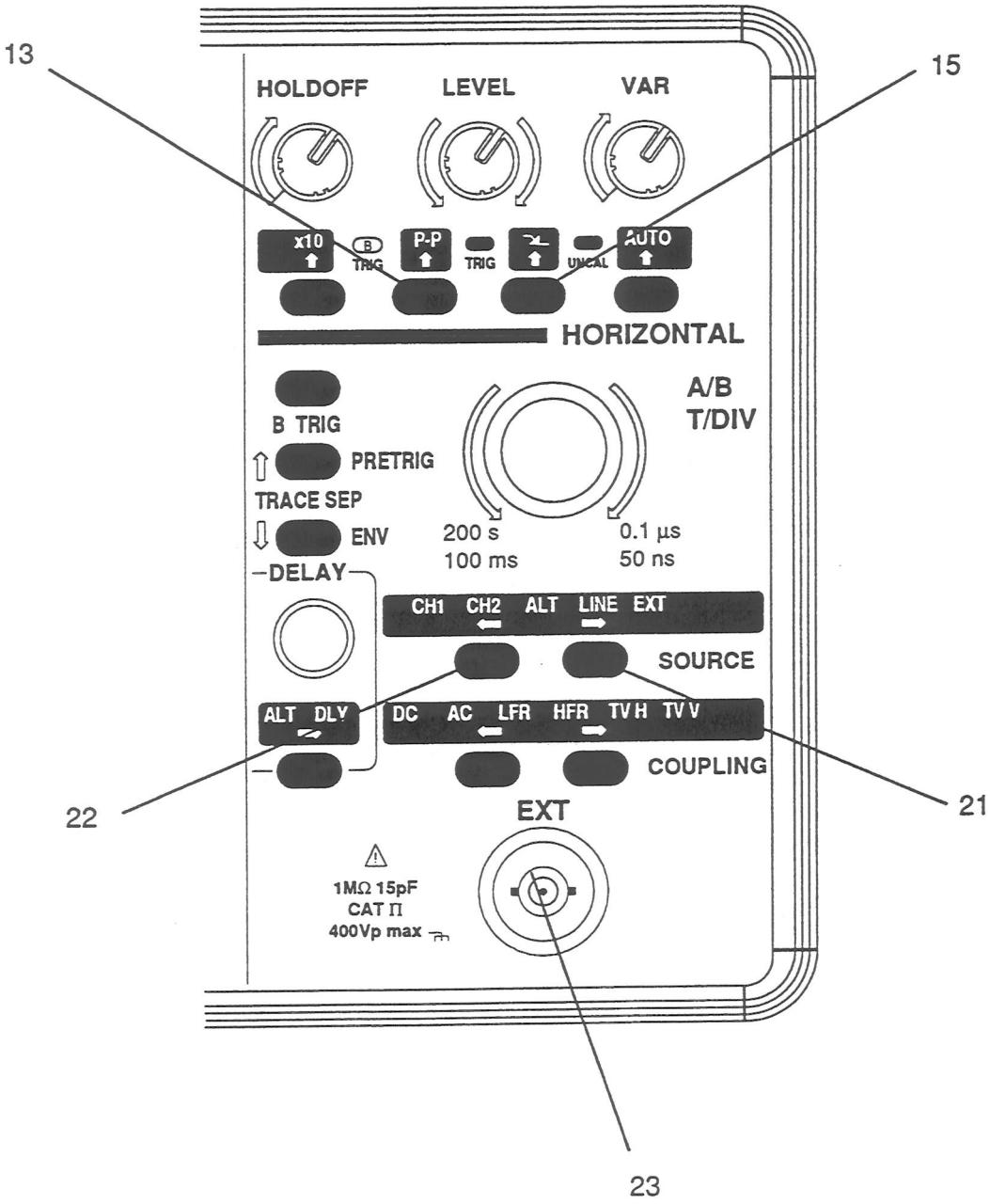

13
15
HOLDOFF
LEVEL
VAR
x10
B TRIG
P-P
TRIG
UNCAL
AUTO
HORIZONTAL
B TRIG
PRETRIG
TRACE SEP
ENV
A/B
T/DIV
200 s
100 ms
0.1 µs
50 ns
DELAY
CH1 CH2 ALT LINE EXT
SOURCE
ALT DLY
DC AC LFR HFR TV H TV V
COUPLING
22
21
EXT
1MΩ 15pF
CAT II
400Vp max
23

figure 5

(23) **EXT** - BNC socket for external sync signal input.
(See Specifications, Section 6)

(15) Trigger slope

led on: trigger on negative edge

led off: trigger on positive edge

(21 - 22) **COUPLING** - Trigger source coupling

Select by pressing → (21) or ← (22):

DC DC coupling (See Specifications, Section 6)

AC AC coupling ((See Specifications, Section 6)

LFR Rejects frequencies < 10 kHz from source signal (facilitates observation of signals with unwanted 50 Hz low frequency component, for example).

HFR Rejects frequencies > 10 kHz from source signal (facilitates observation of low frequency signals with high frequency noise).

TVH Triggers on video signal line sync pulses (sweep speed recommended for examining a TV line: 0.5 µs to 20 µs/div).

TVV Triggers on video signal field sync pulse (sweep speed recommended for examining a field: 50 µs to 200 ms/div).

☞ ***Note:*** ***Observing a TV signal with TVH and TVV:***

led off : ***TV signal with positive video modulation***

led on : ***TV signal with negative video modulation***

(13) **P - P** - Peak-to-peak trigger

The reference trigger level (accurately set using LEVEL) is automatically set between the low and high peaks of the signal, so ensuring triggering regardless of the amplitude or DC component of the source signal (80% of signal amplitude for f > 100 Hz).

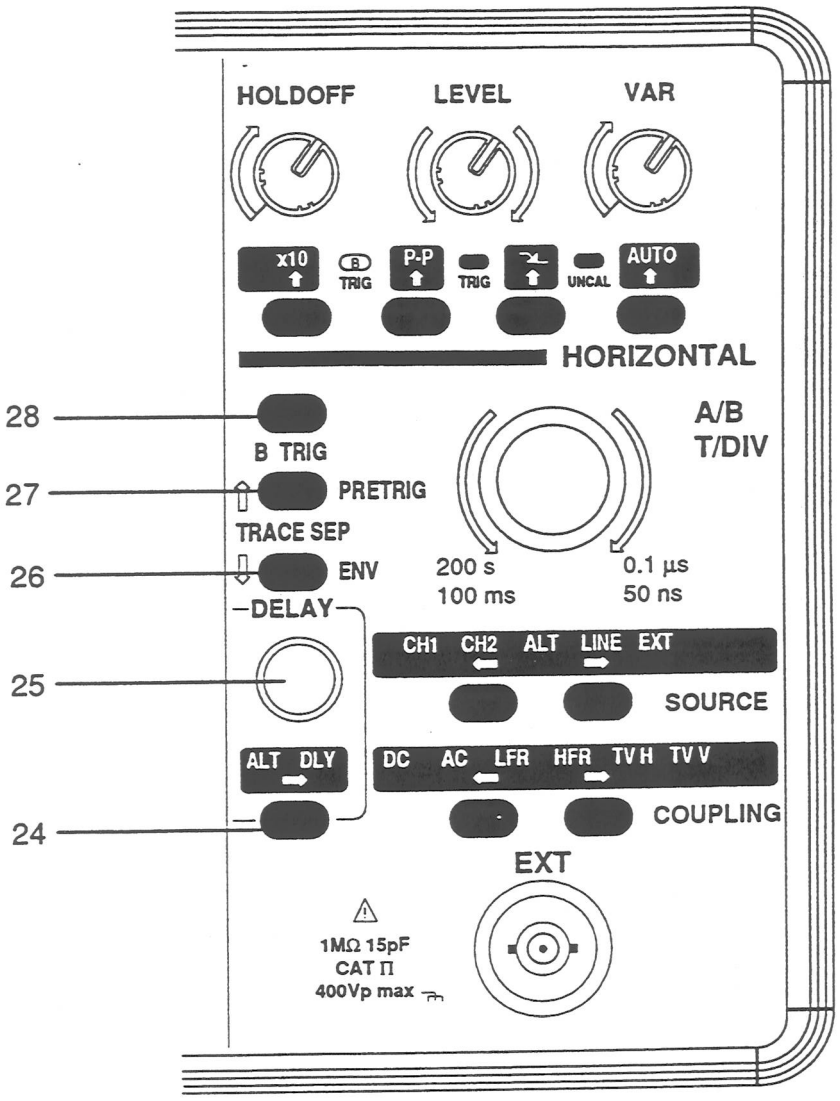

HOLDOFF
LEVEL
VAR
x10
B TRIG
P-P
TRIG
UNCAL
AUTO
HORIZONTAL
28
B TRIG
A/B
T/DIV
27
PRETRIG
TRACE SEP
26
ENV
200 s
100 ms
0.1 µs
50 ns
DELAY
CH1 CH2 ALT LINE EXT
25
SOURCE
ALT DLY
DC AC LFR HFR TV H TV V
24
COUPLING
EXT
1MΩ 15pF
CAT II
400Vp max

figure 6

4.6 Trigger delay - Timebase B

You can use this mode to examine (at high sweep speed) the details of a portion of a signal after the selected trigger event.

The DELAY control (25) provides continuous adjustment from at least 10 div.

(24 - 25) **DELAY** - Select by pressing LAT DLY → (24):

- Normal mode (ALT and DLY off):

  Sweep starts immediately (trigger event at extreme left of trace).

- Alternate mode (ALT on):

  Two traces are obtained for each Y channel: the first represents the main sweep A with a dimmed area of duration B lagging by the DELAY value. The second trace is offset below the first.

  This has a duration corresponding to B and is offset using the Trace Sep buttons (26 - 27). In ALT or CHOP mode, four traces are obtained:

  1 : CH1 timebase A 2 : CH1 timebase B
  3 : CH2 timebase A 4 : CH2 timebase B

  Sweep speeds
  The timebase A/B button is assigned :
  to the timebase A speed in normal mode (ALT and DLY off)
  and
  to timebase B in ALT or DLY mode.

  The timebase B sweep speed can not be inferior to the A sweep speed.

☞ ***Remarque :*** ***Before valid ALT or DLY mode, you must imperatively choose the sweep speed A with the button TIME BASE A/B.***

Delay: To adjust the delay, use the ten-turn DELAY knob.

Alternate mode separation: From -1 to -5 div. Use both TRACE SEP keys located on the same vertical as the DELAY knob. The top key reduces separation and the bottom key increases it.

- Delay mode (DLY on). Only the timebase B sweep speed is displayed.

(28) **B.TRIG** - Resynchronizes timebase B. Active in ALT or ALT timebase B mode.

B.TRIG LED off
Timebase B sweep is triggered automatically at the end of the DELAY time. Mode "RUN AFTER DELAY "

B.TRIG LED on
The timebase B sweep is triggered by the same trigger as the timebase A sweep at the end of the DELAY time. Mode "TRIG AFTER DELAY"

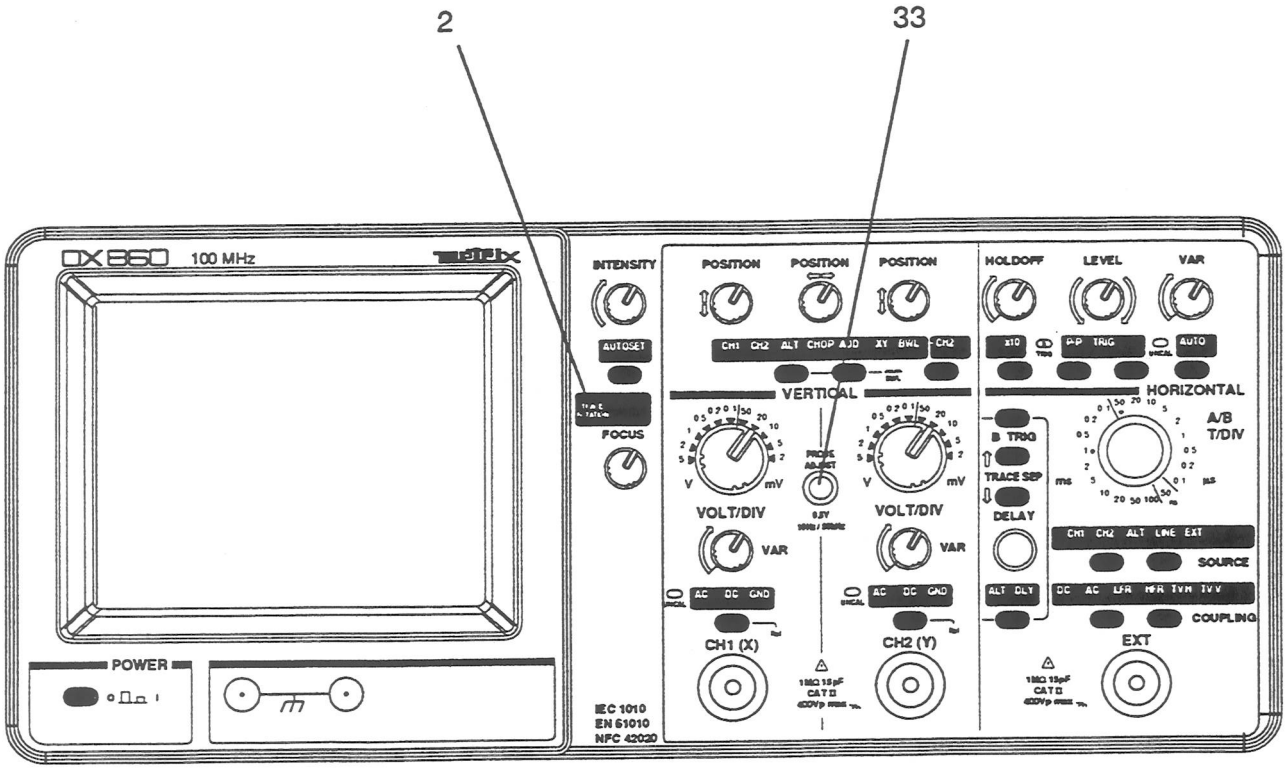


figure 7

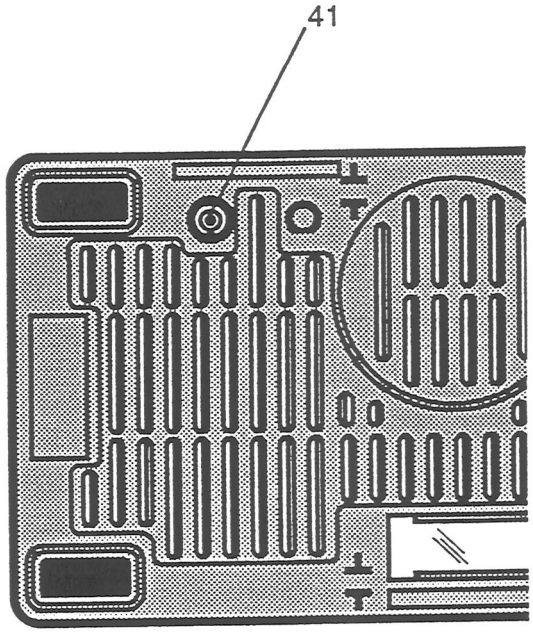


figure 8

4.7 Other functions

(33) **PROBE** - Outputs a squarewave signal (0.5 V peak-to-peak).

This signal is used for measurement probe compensation or to check vertical amplifiers and the timebase (see section 5.1). The calibrator frequency is defined by the channel A sweep speed.

This frequency ranges from 10 Hz to 50 kHz so that each period makes five horizontal divisions from 20 ms/div to 0.1 ms/div. The 1 kHz frequency corresponds to 0.2 ms/div.

This signal is used for LF and HF probe compensation. The reference plateau is the top level of the pulse.

(2) **TRACE ROTATE** - Adjusts parallel alignment of traces horizontally (this is done using a screwdriver).

(41) **Z MODULATION** - Inputs, via a BNC socket (41) on the rear panel (Figure 8), a TTL signal to extinguish the spot (0 V level → trace on, 5 V level → trace off).

This input also allows the use of a timing reference signal (marker).

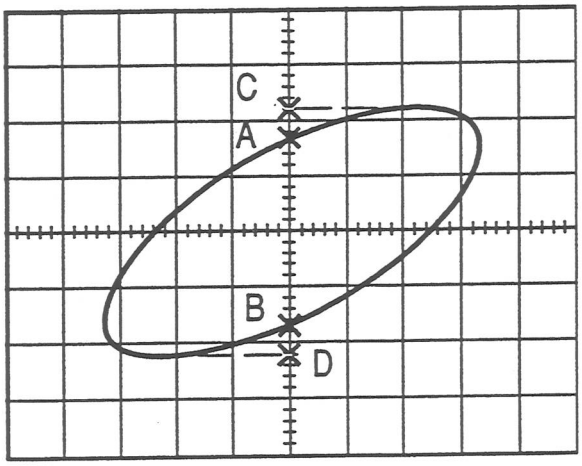


figure 9 : XY mode

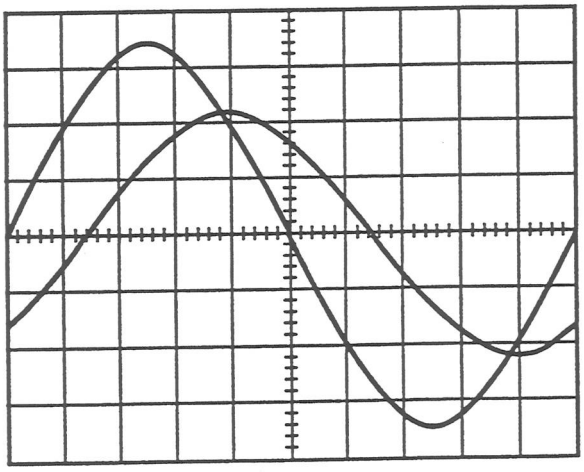


figure 10 : Dual-curve mode

5. APPLICATIONS

5.1 Viewing the calibration signal and adjusting probe compensation

- Connect the PROBE output (33) to the CH1 input (34) using a 1/1 or 1/10 measurement probe.

- Select the following functions:
  - . CH1 sensitivity (37): 0.1 V/div (1/1 probe); 10 mV/div (1/10 probe)
  - . sweep speed (18): 0.2 ms/div
  - . trigger source (19 or 20): CH1
  - . trigger mode (17): AUTO

- If necessary, adjust vertical alignment using POSITION control (7) and stabilize the trace using LEVEL control (14).

- Adjust the probe LF compensation so that the top plateau of the pulse is horizontal.

50 ns/div sweep speed

- Adjust the probe HF compensation so that the edge and start of the plateau are as rectangular as possible.

☞ ***Note: To make the compensations, please see the manual given with the probe.***

5.2 Measuring phase difference

5.2.1 In XY mode

- Select the XY display mode (6 or 8).
- Adjust vertical sensitivity (32 and 37) to obtain the image shown in figure 9.

Calculating phase difference φ sine φ = AB/CD = 3.5 div/5 div = 0.7, so φ = 45°

5.2.2 In dual-curve mode

- Select the following functions:
  - . display mode (6 or 8): CHOP
  - . trigger mode (17): AUTO

- Adjust the LEVEL control (14) and adjust :
  - . vertical sensitivity (32 and 37): to obtain satisfactory Y1 and Y2 amplitudes
  - . sweep speed (18): for a period that corresponds to ten divisions

Calculating phase difference φ

The phase difference between voltage Vc and total voltage is given by a horizontal offset of 1.25 divisions (figure 10). The period of the signal (360°) corresponds to ten divisions.

The phase difference is: φ = (1.25/10) x 360° = 45°

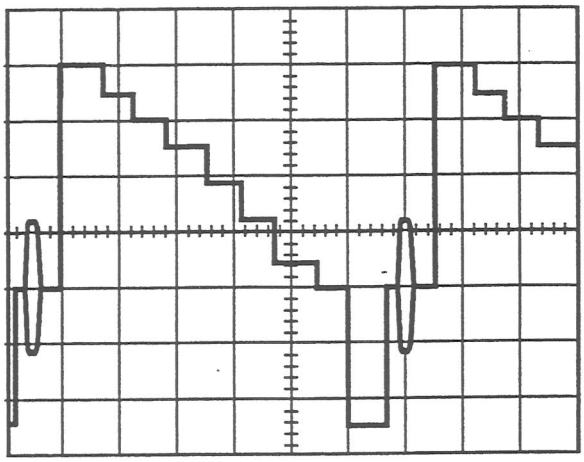


figure 11

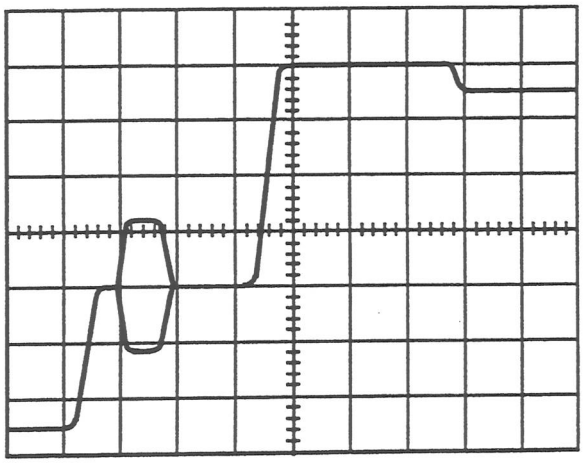


figure 12

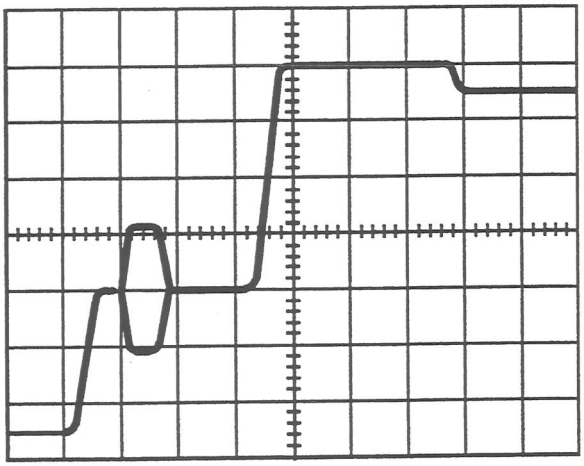


figure 13

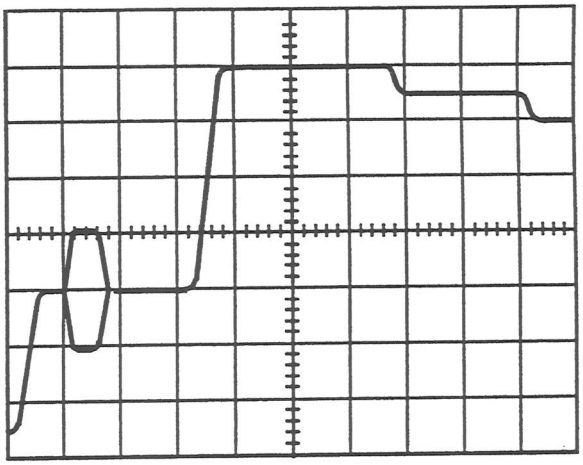


figure 14

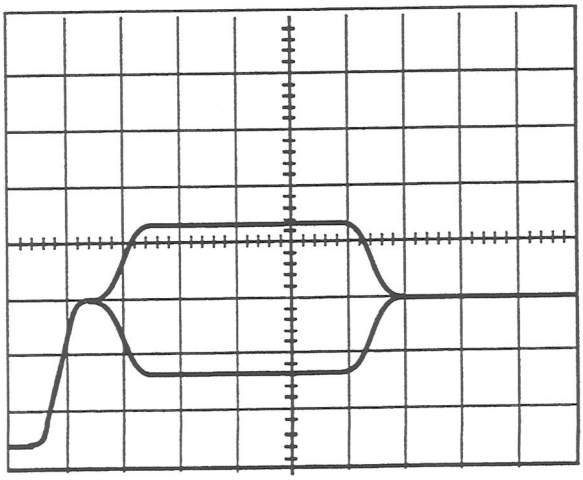


figure 15

5.3 Displaying a video signal

This example illustrates the TV sync (H and V) and trigger delay.

Examining a TV line

- Select:

  . display mode (6 or 8): CH1
  . trigger source (19 or 20): CH1
  . coupling (21 or 22): TVH
  . positive edge (15): (LED off)
  . sweep speed (18): 10 µs/div

- To channel CH1, apply a composite video TV signal with the following characteristics:
  . positive modulation,
  . vertical bands in grey scales.

- Select the appropriate vertical sensitivity for the amplitude of the signal, so that the image covers approximately 80% of the height of the screen. Adjust the alignment as required. The image displayed corresponds to a complete TV line (64 µs). The sync pulse, chrominance burst and video content are clearly visible (figure 11).

- Select the bandwith limit at 20 MHz "BWL" with 6 and 8 ; observe the result on the trace fineness.

- Reduce the sweep speed (18) to 2 µs/div. The beginning of the line is expanded with the trigger point unchanged (line sync pulse) (figure 12).

Examining the burst in detail

- Select the ALT mode (24) and adjust the delay (25) so that the start of the highlighted area is aligned with the rising edge of the line sync pulse (figure 13).

- Select the DLY mode (24). The burst is positioned at the start of the screen (figure 14).

- Reduce the sweep speed again (18) to 0.5 µs/div. The burst now spans the entire screen and can be examined in detail (figure 15). Note that the sweep start position is unchanged with respect to the signal. It can be tuned even further using the DELAY control (25).

Examining a TV field

- Select:
  . coupling (21 or 22): TVV
  . sweep speed (18) 1 ms/div

- Cancel trigger delay (ALT and DLY off). Keep the other settings.

The trace represents the first ten milliseconds of the TV field. The sync sequence is clearly visible at the start of the screen. The trace is constructed by of an odd and even field of the composite signal.

The field parity depends of the difference between the power on and the sequence of the TV programm field.

5.4 B.W.L.

The launching of this mechanism allow to improve the trace fineness in the following cases :

- the full bandwith is not necessary : B.F. or video signals
- the input junctions are not normally shielded : thickening of the trace (due to the hertzian spectrum collected at the input).
- the neutral point return is too long.

6. SPECIFICATIONS

Only the values assigned tolerances or limits are guaranteed values (after 30 minutes of heating-up). Values without tolerances are given for information only.

6.1 Vertical deflection

CH1 - CH2	Specifications	Comments
Bandwidth -3 dB	> 100 MHz	
in BWL	≈ 20 MHz	
Rise time	< 3.5 ns	
Vertical deflection factor (sensitivity)	Ranges: 2 mV/div to 5 V/div ± 3%	11 positions 1-2-5 sequences
Variable vertical deflection factors	Multiplication of V/div range by 1 to 2.5 (reducing displayed signal amplitude)	Calibrated position: control in left end stop position, led off.
		Uncalibrated position, led on.
Max. input voltage	Protection: ± 400 V CAT II (DC + AC peak at 1 kHz)	
Level limitation / frequency	DC at 3 MHz 400 Veff from 3 MHz to 100 MHz : -20dB/decade	
Focused trace thickness	< 2 mm	
Chopping frequency (CHOP)	500 kHz approx.	
Input coupling	DC: 0 to 100 MHz AC: 10 Hz to 100 MHz GND: 0 V reference	
Input impedance	1 MΩ ± 1% // 15 pF	
Squarewave signal response	Overshoot < 5% Aberration at 10 mV/div - on plateau < 1 mm - on edge < 2 mm	 1 kHz to 1 MHz 1 MHz (Rise time < 100ps)
Crosstalk	42 dB typical (2 mV/div. : 36 db typ.)	until 100 MHz same sensitivity on CH1 and CH2, 6 div.
Display	CH1: CH1 only CH2: CH2 only ALT: CH1 then CH2 alternating CHOP: CH1 and CH2 chopped ADD: CH1 + CH2 or CH1 - CH2 XY: X = CH1 and Y = CH2	

6.2 Horizontal deflection (timebase)

CH1 - CH2	Specifications	Comments
Sweep speed	Ranges 50 ns to 100 ms/div ± 3%	20 positions1-2-5 sequences
Variable factor (A only)	Modification of ms/div range by 1 to 2.5 (signal horizontally contracted)	Calibrated position : control in left end stopposition, led off.
		Uncalibrated position, led on.
x 10 expansion	Accuracy : ± 5%	Gives 5 ns/div
HOLDOFF	1 to 10, variable	
XY mode	X = CH1	
	DC coupling : 0 Hz to 4 MHz AC coupling : 10 Hz to 4 MHz	
	Y = CH2	
	DC coupling : 0 Hz to 100 MHz AC coupling : 10 Hz to 100 MHz	
	Phase difference < 1.5° at 100 kHz	

6.3 Trigger system

	Specifications		Comments
Source:	*Sensitivity in normal mode - Trigger from 0 to 180 MHz*		
CH1	0.5 div	to 1 kHz	
or	1 div	to 100 MHz	
CH2	2 div	to 160 MHz	
ALT			Source according to display mode:
			CH1 trigger CH1
			CH2 trigger CH2
			ALT trigger CH1 then CH2
			CHOP trigger CH1
			ADD trigger CH1
			-CH2 trigger CH2
LINE	0.5 div		
EXT	100 mVrms	10 to 50 MHz	protection ± 400 V (DC + AC peak, f < 1 kHz) CAT II
	200 mVrms	50 to 100 MHz	
Filters (coupling)	*Bandwidth:*		
	AC	10 Hz to 180 MHz	
	DC	0 Hz to 180 MHz	
	LFR (rejection)	10 kHz to 130 MHz	
	HFR (rejection)	0 Hz to 10 kHz	
	TVH: synchronize video signal on line pulses		Rising edge positive video
	TVV: synchronize video signal on field pulses		Falling edge negative video
Horizontal mode	AUTO		Relaxed mode
	Normal		Triggered mode
Slope	Negative-going edge		
	Positive-going edge		
Level	*Adjustment range:*		
	P-P: between signal minimum and maximum		
	Normal: ± 12 divisions		

6.4 Miscellaneous

Calibration signal

Shape	squarewave
Amplitude	-0.5 V ± 1% CAT I
Frequency	10 Hz to 50 kHz according to button 18

Z modulation

Input	BNC socket on rear panel
Sensitivity	TTL level
Input resistance	10 kΩ
Bandwidth	20 MHz
Maximum voltage	± 50 V DC CAT I

6.5 General features

CRT

Type	rectangular with internal graticule, 13 cm diagonal
Graticule	eight vertical divisions with five sub-divisions ten horizontal divisions with five sub-divisions 1 division = 1 cm
Screen	average persistence phosphor GY
Trace	trace rotate adjustment focus adjustment intensity adjustment beam find feature

Total Acceleration voltage 15,5 kV.

Power supply

Mains: automatic selection, 94 to 264 Vrms, 45 Hz to 440 Hz, CAT II
Removable mains power cord.
Cord winder with plug support on back of instrument.
Consumption: 50 W maximum.

Safety

According to IEC 1010, class 1 (NFC 42020 ; VDE 0411) degree of pollution 2

Environment

Indoor use
Altitude up to 2000 m

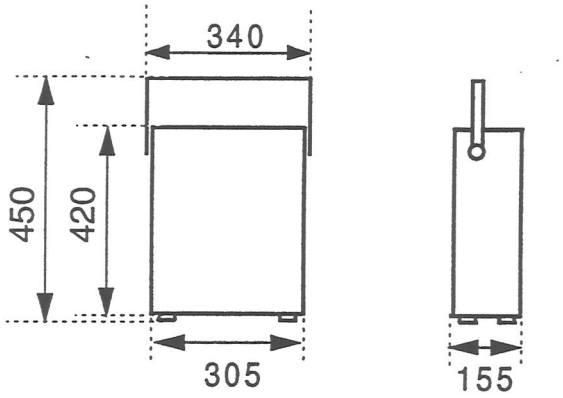
Reference temperature	+18°C	to +28°C
Range of use	+10°C	to +40°C
Operating temperature	0°C	to +50°C
Storage range	-20°C	to +70°C
Relative humidity	< 80%	at +40°C

Electromagnetic compatibility CE

Susceptibility and interference: according to NF EN 55011; VDE 871; IEC 801.

Mechanical features

Stackable, with handle which also doubles as stand.
Dimensions: See figure below.
Weight: ≈ 5.5 kg



Packaging

Dimensions: 719 x 480 x 300.
Weight: ≈ 7 kg

7. ACCESSORIES AND OPTIONS

7.1 Accessories

Supplied with instrument

• Operating manual	
• Spare ceramic fuse T2.5A / 5 x 20 / 250 V located inside the instrument in a recess on the CRT mounting (Manufacturer: FERRAZ, B.P. 25, 69391 LYON Cedex)	AT0090
• Mains power cord	AG 0416
• 2 x 1/10 - 10 MΩ stepdown passive probes	HA 1316

Supplied to order

• Male BNC/male plug lead 50 Ω	PA 2249C48
• Male BNC/male banana plug lead	HA 844
• 1/100 - 100 MΩ stepdown passive probe	HA 1317
• 15 MHz differential probe	MX 9000
• 50 Ω BNC Charge	PA4119-50
• BNC T male/female	PA3285
• 19" rack mounting set	RK 0008

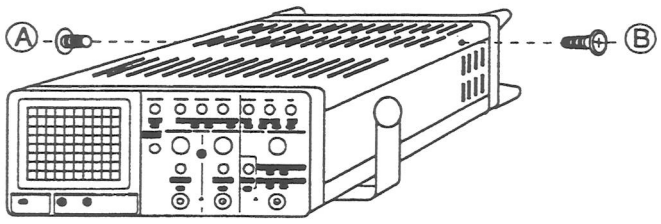


figure 16

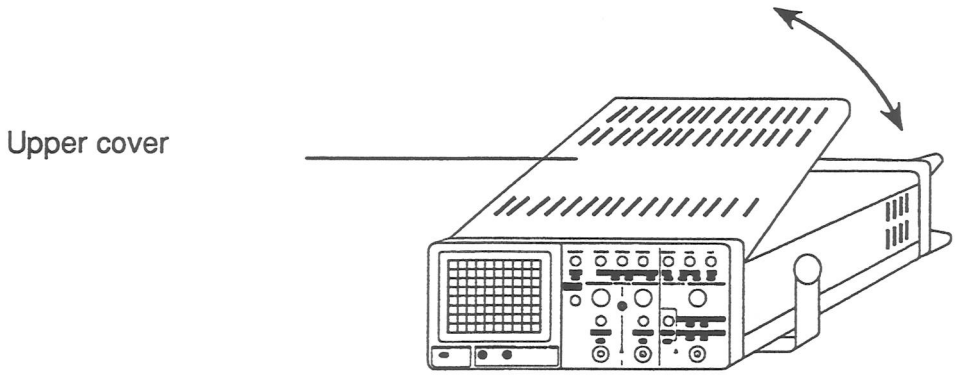


figure 17

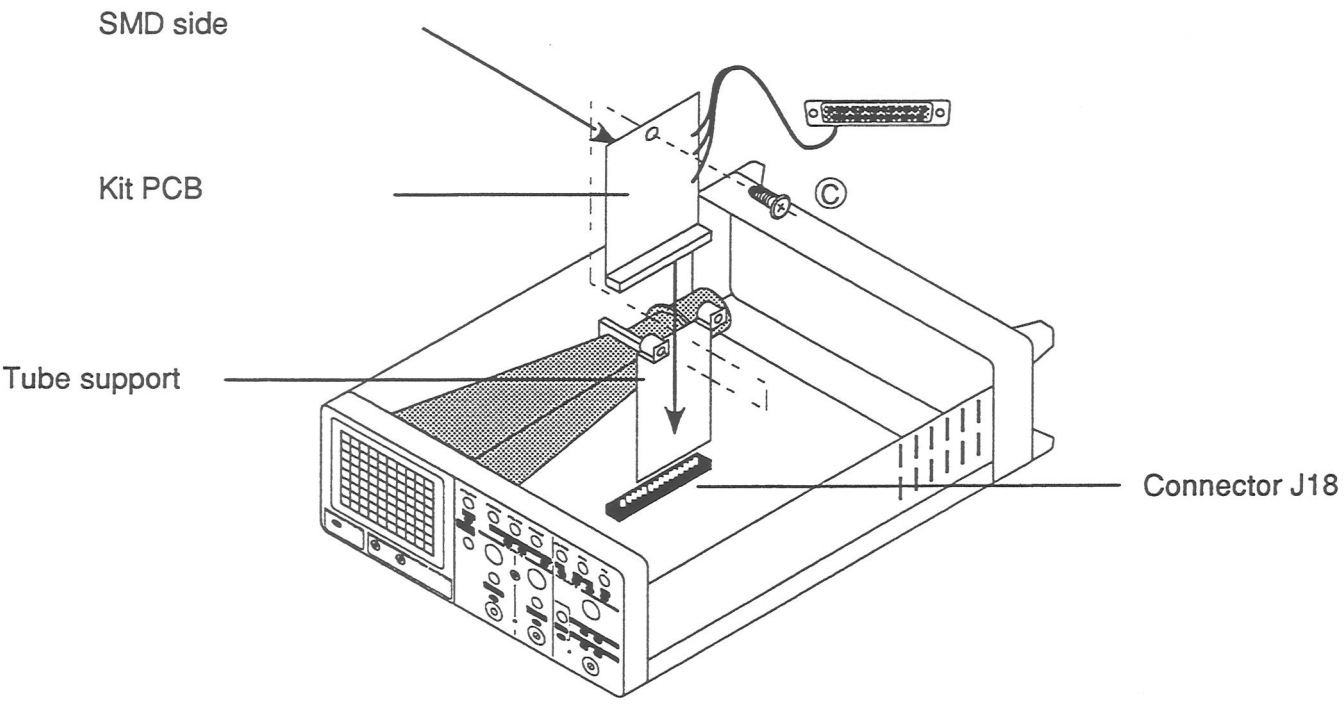


figure 18

7.2 Programming kit

7.2.1 General description

HA 1259 is a serial interface kit (hardware and software) for the OX 860 oscilloscope. This RS232 standard serial link is for communications etween the OX 860 and a PC or compatible computer.

Kit functions include :

- remote programming of the OX 860
- reading the configuration of the OX 860.

7.2.2 Serial link characteristics

OX 860 connector :	25-pin cannon plug
cable :	three wires (two transmission wires plus one ground wire)
Protocol :	Xon/Xoff
Data rate :	9600 bauds
Data format :	8 bits - no parity - 1 bit stop
Protection :	per EIA RS232C standard

7.2.3 Fitting of the HA 1259 kit

7.2.3.1 Parts list

The HA 1259 kit is supplied with the following :

- one PCB assembled
- one cross-head screw,
- two washers,
- two hex bolts,
- one program diskette (3"1/2 format)
- one adaptor 25-way / 9-way (Ref. AG 0449)

7.2.3.2 Fitting instructions

- Disconnect the mains cable and any probes connected.
- Remove screws A and B (figure 16).
- Remove the top cover, taking care to disengage it from the front panel (figure 17).
- Fit the printed circuit supplied with the kit to connector J18 on the oscilloscope backplane (figure 18).
- Secure the printed circuit against the suppport using cross-head screw (C) (figure 18).

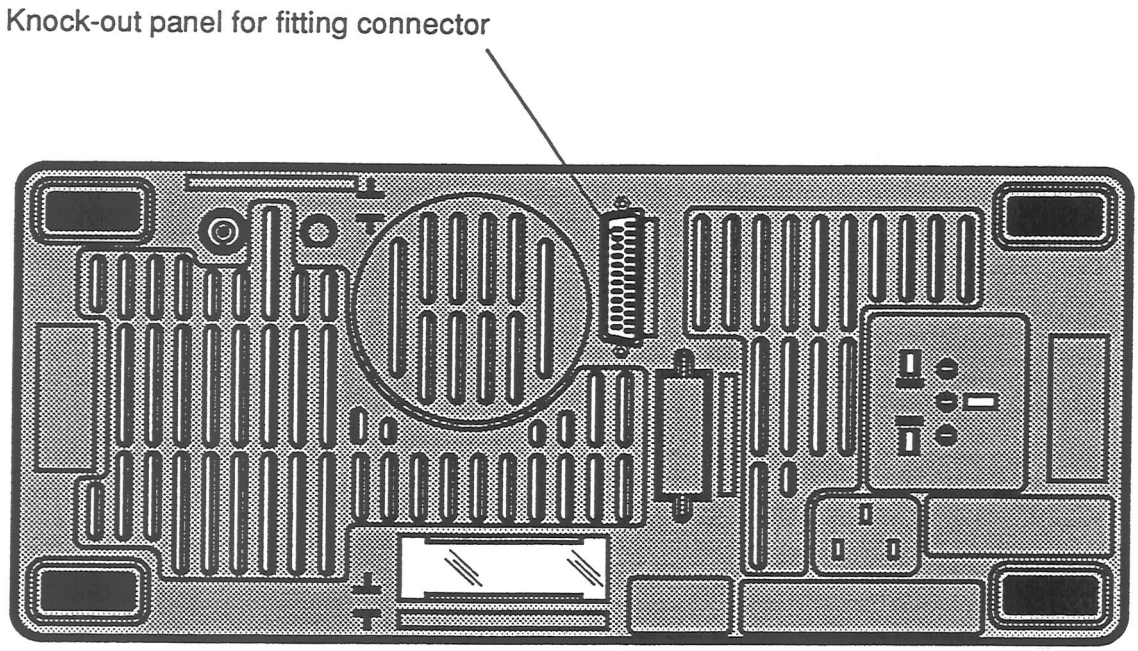


figure 19

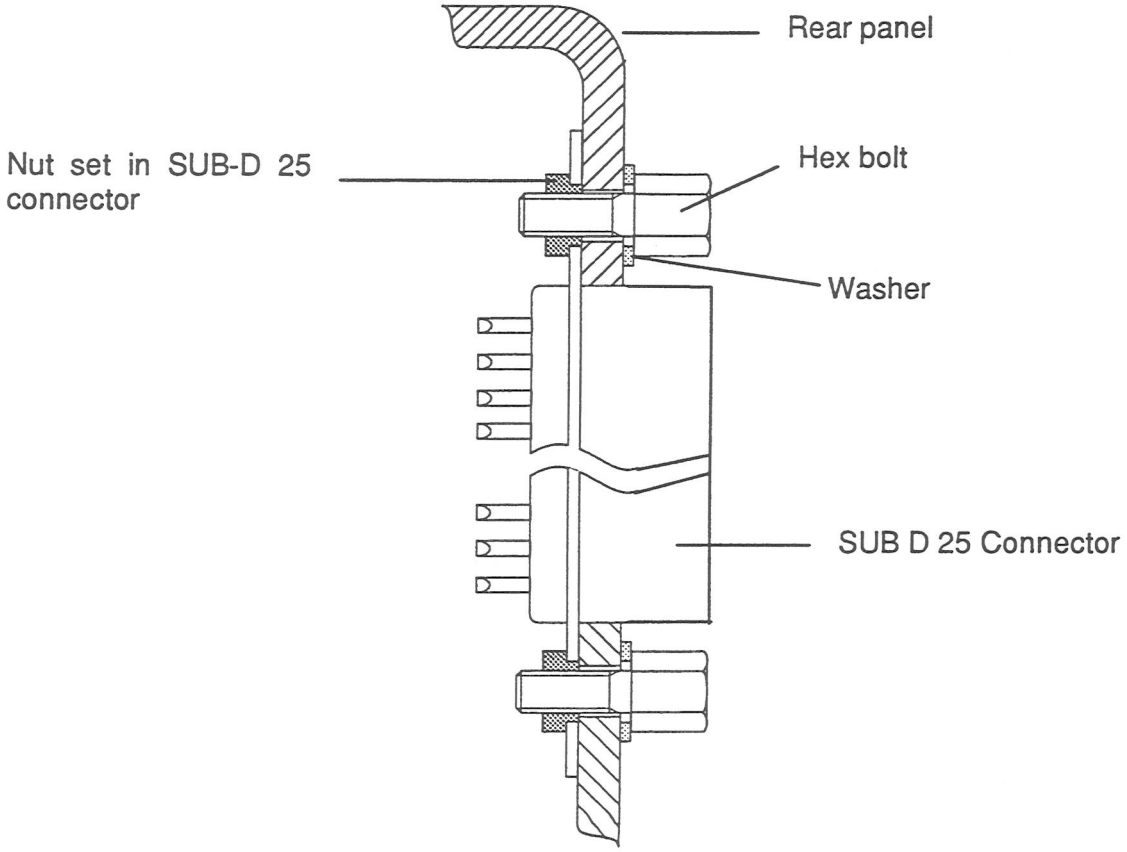


figure 20

- Snap through thte bits holding the knock-out panel in place (figure 19) on the rear panel of the oscillsocope.

- Fit the 25-pin SUB D connector supplied with the kit in the exposed recess.

- Secure the connector to the oscilloscope subrack using the hex bolts, washers and nuts provided (Figure 20).

- Reposition the cover, ensuring the front part mates with the front part of the oscilloscope (Figure 17).

- Replace screws A and B to secure the cover (Figure 16).

7.2.4 PC / OX 860 ling wiring

The serial link cable from the OX 800 to the PC or compatible microcomputer has three wires :

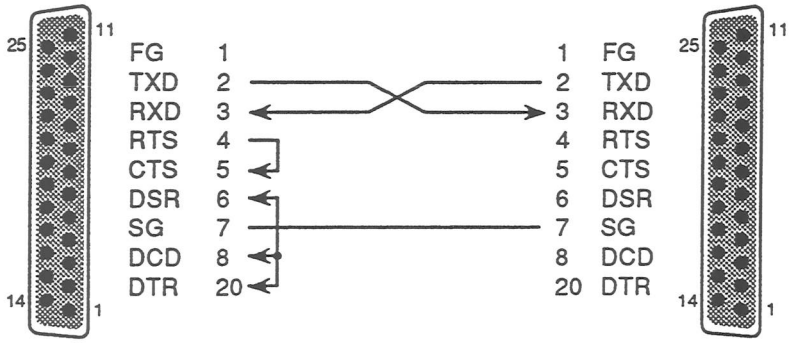
- a TXD wire for transmitted data,
- an RXD wire for received data,
- an SG wire for signal ground.

The serial connector at the OX 800 end is a 25-pin cannon plug.
The pin-out of the connecting cable depends on the connector at the PC end. There are two possible types :

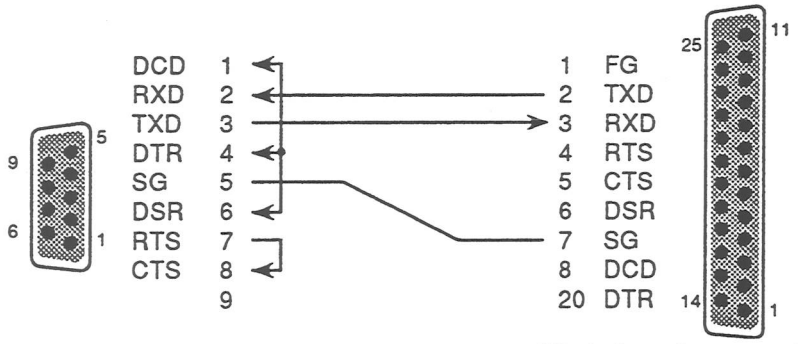
- 25-pin cannon plug (the most widely used),
- 9-pin plug (mainly on portables).

The link cable comprises two female connectors (25 or 9-pin). The wiring will depend on the connector on your computer (figure above):

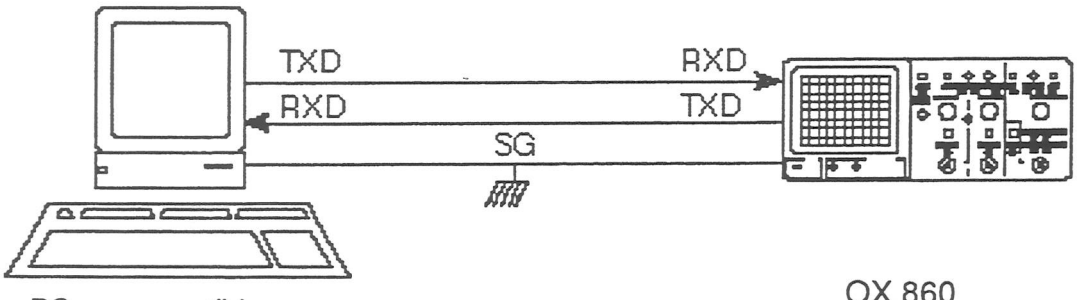
☞ ***Note*** ***An RS232 cable measuring under 15 metres is recommended.***



25-pin female connector 25-pin female connector



9-pin female connector 25-pin female connector



PC or compatible OX 860

7.2.5 Commands syntaxis

7.2.5.1 Oscilloscope configuration

All of the functions of the OX 860 oscilloscope (apart from potentiometer settings and the ON/OFF switch) can be programmed remotely from a PC or compatible computer. There are 15 programmable commands available.

Each command is divided into three characters:

<function> active function number,

<parameter> function parameter (depending on the current state of the OX 860),

<terminator> end of text character EOT.

Tables giving the syntax of all the OX 860 commands are in points 7.2.7. and following (codes expressed in decimal).

A «Decimal-Hexadecimal-ASCII» mapping table is given at the end of the notice.

Example :

Configuration of the vertical ADD mode in Decimal, Hexadecimal and ASCII.

Used code	<Function>	<Parameter>	<Terminator>
in decimal	100	52	04
in hexadecimal	64	34	04
in ASCII	"d"	"4"	EOT

This configuration can be programmed (in hexadecimal) under QBASIC, as follows :

```
comm$=CHR$(&H64)+CHR$(&H34)+CHR$(&H04)
PRINT #1, comm$;
```

Caution ! ***After a software command (functions 96 and 97, see § 7.2.7) or an autoset, the vertical sensitivity button (CH1 (37) or CH2 (32)) can indicate a different value than the configured one.***

In this case, the associatedc UNCAL led blink.

Adjust the vertical sensitivity button to have the concordance between the values and stop the blinking.

☞ ***Note***

- ***Vertical mode on "XY"***
  When the vertical mode XY is configured (handly or remotly), some functions are inhibited (above table). The leds are off and the keys corresponding to the concerned functions are inactives (the programming is not possible).

- ***Trigger source on "LINE"***
  When the trigger source "LINE" is configured (handly or remotly), the function "Trigger filter" is inhibited. The led is off and the keys 21 and 22 are inactives.

Functions	Key	XY mode	Synchro line
Time base	18	Inhibited	
x 10 Expansion	12	Inhibited	
Trigger source	19/20	Inhibited	
Automatic trigger	17	Inhibited	
Trigger coupling	21/22	Inhibited	Inhibited
Peak to Peak mode	13	Inhibited	
Trigger edge	15	Inhibited	
Trigger delay	24	Inhibited	
B-TRIG	28	Inhibited	
TRACE-SEP	26/27	Inhibited	

7.2.5.2 Reading the decalibration potentiometers

After a command "State of the decalibration", the oscilloscope send a serial of 3 messages corresponding to the state of decalibrations of CH1 (36), of CH2 (31) and of timebase A (16).

To have the state of the decalibrations, send the command :

<0X78> <0X30> <0X04>

The answer is :

Function	<Function>	<Parameter>	<Terminator>
Decalibration CH1	<0X51>	<STATUS>	<0X04>
Decalibration CH2	<0X52>	<STATUS>	<0X04>
Decalibration BDT A	<0X53>	<STATUS>	<0X04>

with STATUS = 0X26 Potentiometer in calibrated position
0X3A Potentiometer in decalibrated position

7.2.5.3 Reading the oscilloscope configuration

You can query the internal configuration of the OX 860 at any time from the computer, by sending the «Configuration request» command.

Response to configuration request

Functions	<Function>	<Parameter>	<Terminator>
Writing code of a configuration	119	48	04
Vertical sensitivity CH1	96	(according OX 860 state)	04
Input coupling CH1	106	(according OX 860 state)	04
Vertical sensitivity CH2	97	(according OX 860 state)	04
Input coupling CH2	108	(according OX 860 state)	04
CH2 invert	110	(according OX 860 state)	04
Bandwith limit	111	(according OX 860 state)	04
Time base A	98	(according OX 860 state)	04
Time base B	99	(according OX 860 state)	04
Base resynchronisation B	102	(according OX 860 state)	04
x10 expansion	113	(according OX 860 state)	04
Automatic trigger	115	(according OX 860 state)	04
Trace separate	103	(according OX 860 state)	04
Trigger filter	105	(according OX 860 state)	04
Trigger source	104	(according OX 860 state)	04
Peak to Peak mode	112	(according OX 860 state)	04
Trigger edge	114	(according OX 860 state)	04
Trigger delay	101	(according OX 860 state)	04
Vertical mode	100	(according OX 860 state)	04

When the OX 860 identifies the «Configuration request» command, it returns 19 messages to the computer, showing the configuration of the oscilloscope.

Message structure

Each message comprises three characters, using the format described previously for commands:

<function> active function number,

<parameter> function parameter (depending on the current state of the OX 860),

<terminator> end of text character EOT.

The 19 configuration messages are described in the decimal format in the above table.

The parameter values depend on the current state of the OX 860. The parameter value also depends on the function (the values are given in the table of configuration commands).

☞ ***Note*** ***Configuration read messages have the same format as programming commands.***

Configuration read messages can be filed (for configuration backup purposes) so that the OX 860 can subsequently be reconfigured (restoring the configuration).

7.2.6 Remote programming

The disk supplied with the HA 1259 includes :

- the installation software (install.exe)
- a software control program for the OX 860 (a:\execut\ox860.exe) running with DOS 3.31 or later and the associated documentation (ASCII file a:\execut\readme.doc). This software controls the instrument in real time from a graphic panel on PC.
- the Windows icon file (a:\execut\ox860.ico)
- an example QBasic program (a:\execut\tst860.bas)
- the Labwindows driver (National Instruments) (directory a:\driver)
- general documentation for HA 1259 (ASCII file a:\ha 1259\ha1259f.doc and a:\ha 1259\ha1259gb.doc)

```
a:\installf.uir
installgb.uir
install.exe
 langage.uir  ...   EXECUT...   lisezmoi.doc   french documentation ox860.exe
              (                 ox860.exe      OX 860 program
              (                 ox860.ico      icon OX 860 (windows)
              (                 ox860f.uir     french version panel
              (                 ox860gb.uir    english version panel
              (                 readme.doc     english documentation ox860.exe
              (                 tst860.bas     Qbasic program example
              (
              (    DRIVER...    ox860.bas      Qbasic source
              ...
              (                 ox860.c        Qc source
              (                 ox860.doc      Driver documentation
              (                 ox860.fp       front panel
              (                 ox860.h        file include Qc
              (                 ox860.inc      file include QBasic
              (                 ox860.lbw      Labwindows object
              (                 ox860.lwi      Labwindows object
              (
              (    HA1259...    ha1259.doc     french documentation HA 1259
              ...
                                ha1259.doc     english documentation HA 1259
```

7.2.6.1 Installation

The installation software copies the relevant files to your computers's hard disk.

- select drive a:
- type "install".

After choosing the language you need (french or english), a first panel allows you to define the directory a:\execut and a:\ha1259 will be copied (default is c:\ox860).

After execution or abandon, a second panel offers the choice of directory for the files which are under a:\driver (default is c:\lw\instr).

The files with the TXT extension can de opened from any word processor or text editor. They can be printed using the DOS PRINT command.

7.2.6.2 Example of programming in QBASIC

The sample program which follows is for configuring the oscilloscope functions.
It is written in QBASIC, so you must have the QBASIC program to execute it.

Running the program

- enter DOS,
- run QBASIC,
- edit the TST860.BAS program,
- on the oscilloscope, apply the calibration signal to the 1/10 probe CH1 input,
- run the TST860.BAS program.

The TST860.BAS program configures the oscilloscope functions : the LEDs show the new states.

Program listing

```
 9      'CONSTANTS DECLARATION

10      ComMdeVertical = &H64
20      ParMdeVertCh1 = &H30

30      ComAttCh1 = &H60
40      ParAtt10mv = &H38

50      ComBdt = &H62
60      ParBdt200us = &H38

70      ComCplCh1 = &H6A
80      ParCplDc = &H31

90      ComSrcTrg = &H68
100     ParSrcTrgCh1 = &H30

110     ComFltTrg = &H69
120     ParFltTrgDc = &H30
130     ComPeakPeak = &H70
140     ParPeakPeakOn = &H31

150     ComExpX10 = &H71
160     ParExpX1 = &H30

180     ParEot = &H4

190     'Setting Serial port COM1
191     '9600 bauds, 8 bits, 1 stop bit, no parity
200     OPEN "COM1:9600,N,8,1,RS,CS,DS,CD" FOR RANDOM AS #1

209     'Vertical Mode : CH1
210     numfunct = ComMdeVertical
220     parameter = ParMdeVertCh1
230     GOSUB 1000

239     'Range CH1 calibre 10 mV/Div
240     numfunct = ComAttCh1
250     parameter= ParAtt10mV
260     GOSUB 1000

269     'Time Base 200us/Div
270     numfunct = ComBdt
280     parameter = ParBdt200us
290     GOSUB 1000

299     'Coupling CH1 DC
300     numfunct = ComCplCh1
310     parameter = ParCplDc
320     GOSUB 1000

329     'Trigger Source CH1
330     numfunct = ComSrcTrg
340     parameter= ParSrcTrgCh1
350     GOSUB 1000
```

```
359   'Trigger Coupling : DC
360   numfunct = ComFltTrg
370   parameter = ParFltTrgDc
380   GOSUB 1000

389   'Trigger Mode Peak to peak
390   numfunct = ComPeakPeak
400   parameter = ParPeakPeakOn
410   GOSUB 1000

419   'Exp10 : Off
420   numfunct = ComExpX10
430   parameter = ParExpX1
440   GOSUB 1000

450   CLOSE #1
460   END

 999  'Sending Command on COM1
1000  comm$ = CHR$(numfunct) + CHR$(parameter) +   CHR$(ParEot)
1010  PRINT #1, commande$;
1020  RETURN
```

7.2.7 Summary tables

7.2.7.1 Configuration commands

AUTOSET

Function	Selection	<function>	<parameter>	<terminator>
Autoset pressed briefly, key 3				
		117	48	04
Bandwith limit, keys 6 & 8				
	normal	111	48	04
	Bandwith limit	111	49	04

VERTICAL MODE

Function	Selection	<function>	<parameter>	<terminator>
Display mode (vertical), keys 6-8				
	CH1	100	48	04
	CH2	100	49	04
	ALT	100	50	04
	CHOP	100	51	04
	ADD	100	52	04
	XY	100	53	04
CH1 Vertical sensitivity, switch 37				
	5 V	96	48	04
	2 V	96	49	04
	1 V	96	50	04
	0.5 V	96	51	04
	0.2 V	96	52	04
	0.1 V	96	53	04
	50 mV	96	54	04
	20 mV	96	55	04
	10 mV	96	56	04
	5 mV	96	57	04
	2 mV	96	58	04
CH2 Vertical sensitivity, switch 32				
	5 V	97	48	04
	2 V	97	49	04
	1 V	97	50	04
	0.5 V	97	51	04
	0.2 V	97	52	04
	0.1 V	97	53	04
	50 mV	97	54	04
	20 mV	97	55	04
	10 mV	97	56	04
	5 mV	97	57	04
	2 mV	97	58	04
CH1 input coupling, key 35				
	AC	106	48	04
	DC	106	49	04
	GND	106	50	04
CH2 input coupling, key 30				
	AC	108	48	04
	DC	108	49	04
	GND	108	50	04
CH2 invert, key 10				
	CH2 normal	110	48	04
	CH2 inverted	110	49	04

TIME BASE

Function	Selection	<function>		<parameter>	<terminator>
Sweep speed (s/div.), switch 18					
		TB A	TB B		
	100 ms/div.	98	99	48	04
	50 ms/div.	98	99	49	04
	20 ms/div.	98	99	50	04
	10 ms/div.	98	99	51	04
	5 ms/div.	98	99	52	04
	2 ms/div.	98	99	53	04
	1 ms/div.	98	99	54	04
	0.5 µs/div.	98	99	55	04
	0.2 µs/div.	98	99	56	04
	0.1 µs/div.	98	99	57	04
	50 µs/div.	98	99	58	04
	20 µs/div.	98	99	59	04
	10 µs/div.	98	99	60	04
	5 µs/div.	98	99	61	04
	2 µs/div.	98	99	62	04
	1 µs/div.	98	99	63	04
	0.5 µs/div.	98	99	64	04
	0.2 µs/div.	98	99	65	04
	0.1 µs/div.	98	99	66	04
	50 ns/div.	98	99	67	04
x 10 expansion, key 12					
	x 1	113		48	04
	x 10	113		49	04

TRIGGERING

Function	Selection	<function>	<parameter>	<terminator>
Trigger source, keys 19-20				
	CH1	104	48	04
	CH2	104	49	04
	ALT	104	50	04
	LINE	104	51	04
	EXT	104	52	04
Automatic trigger, key 17				
	normal	115	48	04
	automatic	115	49	04
Trigger coupling, keys 21-22				
	DC	105	48	04
	AC	105	49	04
	LFR	105	50	04
	HFR	105	51	04
	TVH	105	52	04
	TVV	105	53	04
Peak to Peak (P-P) mode, key 13				
	normal	112	48	04
	Peak to Peak	112	49	04
Trigger edge, key 15				
	rising	114	48	04
	falling	114	49	04

Function	Selection	<function>	<parameter>	<terminator>
Trigger delay, key 24				
	normal	101	48	04
	ALT	101	49	04
	DLY	101	50	04
Time base B resynchronisation, key 28				
	Run after delay	102	48	04
	Trig after delay	102	49	04
Trace separate, key 26 & 27				
	value	103	48 ≤ parameter ≤ 63	04

For a parameter of value > 63, the increment is modulo 16.

MISCELLANEOUS

Function	Selection	<function>	<parameter>	<terminator>
Beam finder, key 3				
	normal	116	48	04
	beam finder	116	49	04

7.2.7.2 Configuration request

CONFIGURATION REQUEST

Function	Selection	<function>	<parameter>	<terminator>
Configuration request		118	48	04
Reading decalibrations		120	48	04

7.2.7.3 ASCII Table

ASCII CODE

B7 B6 B5	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1

B4 B3 B2 B1	Controle		Uppercase figure		Uppercase letter		Lowercase letter	
0 0 0 0	0 **NUL** 0	10 **DLE** 16	20 **SP** 32	30 **0** 48	40 **@** 64	50 **P** 80	60 **'** 96	70 **p** 112
0 0 0 1	1 **SOH** 1	11 **DC1** 17	21 **!** 33	31 **1** 49	41 **A** 65	51 **Q** 81	61 **a** 97	71 **q** 113
0 0 1 0	2 **STX** 2	12 **DC2** 18	22 **"** 34	32 **2** 50	42 **B** 66	52 **R** 82	62 **b** 98	72 **r** 114
0 0 1 1	3 **ETX** 3	13 **DC3** 19	23 **#** 35	33 **3** 51	43 **C** 67	53 **S** 83	63 **c** 99	73 **s** 115
0 1 0 0	4 **EOT** 4	14 **DC4** 20	24 **$** 36	34 **4** 52	44 **D** 68	54 **T** 84	64 **d** 100	74 **t** 116
0 1 0 1	5 **ENQ** 5	15 **NAK** 21	25 **%** 37	35 **5** 53	45 **E** 69	55 **U** 85	65 **e** 101	75 **u** 117
0 1 1 0	6 **ACK** 6	16 **SYN** 22	26 **&** 38	36 **6** 54	46 **F** 70	56 **V** 86	66 **f** 102	76 **v** 118
0 1 1 1	7 **BEL** 7	17 **ETB** 23	27 **'** 39	37 **7** 55	47 **G** 71	57 **W** 87	67 **g** 103	77 **w** 119
1 0 0 0	8 **BS** 8	18 **CAN** 24	28 **(** 40	38 **8** 56	48 **H** 72	58 **X** 88	68 **h** 104	78 **x** 120
1 0 0 1	9 **HT** 9	19 **EM** 25	29 **)** 41	39 **9** 57	49 **I** 73	59 **Y** 89	69 **i** 105	79 **y** 121
1 0 1 0	A **LF** 10	1A **SUB** 26	2A ***** 42	3A **:** 58	4A **J** 74	5A **Z** 90	6A **j** 106	7A **z** 122
1 0 1 1	B **VT** 11	1B **ESC** 27	2B **+** 43	3B **;** 59	4B **K** 75	5B **[** 91	6B **k** 107	7B **{** 123
1 1 0 0	C **FF** 12	1C **FS** 28	2C **,** 44	3C **<** 60	4C **L** 76	5C **** 92	6C **l** 108	7C **|** 124
1 1 0 1	D **CR** 13	1D **CS** 29	2D **-** 45	3D **=** 61	4D **M** 77	5D **]** 93	6D **m** 109	7D **}** 125
1 1 1 0	E **S0** 14	1E **RS** 30	2E **.** 46	3E **>** 62	4E **N** 78	5E **^** 94	6E **n** 110	7E **~** 126
1 1 1 1	F **S1** 15	1F **US** 31	2F **/** 47	3F **?** 63	4F **O** 79	5F **_** 95	6F **o** 111	7F **DEL** 127

Hexadécimal | **XY**

Decimal |

INDEX