USER MANUAL

for

ORTOFON P400 MEASURING COMPUTER

ORTOFON INSTRUMENTS A/S

Copenhagen, 3 November , 1988

SAFETY PRECAUTIONS

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warning elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Ortofon assumes no liability for the customer's failure to comply with these requirements.

GROUND THE INSTRUMENT
To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE
Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS
Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel only. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE
Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

USE CAUTION WHEN EXPOSING OR HANDLING THE CRT
Breakage of the Cathode-Ray Tube(CRT) causes a high-velocity scattering of glass fragments (implosion). To prevent CRT implosion,avoid rough handling or jarring of the instrument. Handling of the CRT shall be done only by qualified maintenance personnel using approved safety mask and gloves.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT
Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Contact an Ortofon Sales and Service Office for service and repair to ensure that safety features are maintained.

WARNING

TO HELP MINIMIZE THE POSSIBILITY OF ELECTRICAL FIRE OR SHOCK HAZARDS,DO NOT EXPOSE THIS INSTRUMENT TO RAIN OR EXCESSIVE MOISTURE.

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P400 SPECIFICATIONS

Measuring Inputs	
Individual channels	2 (A & B)
Full scale sensitivity	10 mV - 100V
Input impedance	§1Mohm 200 pf
Display dyn.range(log-mode)	60 dB
Scale	log/lin
Frequency ranges	1 Hz - 100 kHz
Detector modes	RMS, DC, AC Average, AC absolute, + peak, - peak (lin./log. modes for all)
Resolution x, y (12 bit)	2000/4000 points(approx.values)
S/N ratio	§80 dB
Filters (standard)	
Individual channels	2 (A & B)
Type	Tracking Constant relative bandwidth
Center frequency	Fundamental to 12th harmonic
Gain fundamental and 2nd harmonic	0 dB
Gain 3rd to 12th harm.	20 dB
S/N ratio 5 Hz - 5 kHz	§80 dB

Other filters exist for special applications and can be offered on request.

Generator	
Frequency range	5 Hz - 20 kHz Frequency crystal derived Amplitude precision voltage Reference based
Modes	Sine wave Pulsed sine wave Swept sine wave
Sweep: Standard	Exponential
Distortion: Harmonics	½ -70 dB
Spurius responses	½ -70 dB
Attenuator	0 - -84 dB
Output (CVA2)	
CONSTANT VOLTAGE:	
Max. low range	5 V RMS
Max. high range	20 V RMS
Output impedance, incl. DIN connector	150 mOhm
CONSTANT CURRENT:	
Max low range	20 mA
Output impedance	20 kOhm 10 Hz - 1 kHz decreasing at high frequency
Max. high range	2 A
Output impedance	§1 kOhm 10 Hz - 1 kHz decreasing at high frequency

Frequency Counter		
Frequency range		1-130000 Hz with 3< digit disp.
The period of the frequency is measured and converted into frequency.		
Display		
RGB-CRT		10" 8 colour CRT
Resolution x, y		250/250 display points
y scale, log		60 dB
x scale, time based		0.1 sec to 6000 sec full scale
x scale, frequency based		2-5 decades in approx. 1/3 decade steps
x zoom, reversible		2,4,8
y zoom, reversible		2,4,8,16
Interface		RS 232 for Siemens PT88 Printer, IEEE 488 for external controller, RS 232 for service use
Controller I/O		IEEE 488 IEC 625 GPIB HP-IB
Transfer rate		Typ 40 µs/Byte, however depending on type of controller and length of interface cable,which can limit transfer speed
Graphic printer		Siemens PT88 (modified) via RS 232 output
Transfer rate		19200 baud
Time/plot		20 - 80 sec.
General		
CPU		Motorola 6809, 8 bits
Total RAM internal		(min.) 103 kByte
Total ROM internal		137 kByte
EEPROM external		2, 4, 8 or 16 kByte
One test programme requires		2 kBytes of storage capacity.
Power requirements		100/120 V ± 10% 220/240 V ± 10% 50/60 Hz
Power consumption		250 watt
Dimensions:	Width	44 cm/17.3 in.
	Height	25 cm/ 9.6 in.
	Depth	56 cm/27.5 in.
	Weight	35 kg/77 lbs (shipping weight)
Operating temperature		15 - 40° C/59 - 104° F
Rel. humidity		20 - 80%

Ortofon reserves the right to change specifications without notice.

ACCESSORIES

Standard Version

1. User manual
2. Programming instructions
3. 1 pc. 2 kb EEPROM
4. 1 Keybox
5. 1 test cable (for shorting outputs to inputs)
6. 2 input cables
7. 1 output cable
8. 2 input connectors
9. 1 output connector
10. 1 power cable
11. 2 spare fuses
12. Instrumentation manual

Compressor Option

1. Compressor
2. Compressor manual
3. RS 232 shorting plug
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4. DIN shorting plug
   (for operation without equalizer)

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1. Multiplexer
2. Multiplexer manual

P400 USER MANUAL

1.0 INTRODUCTION

The P400 is a measuring computer primarily designed to meet the demands from the audio industri in production control.

The design is based on the results from a world-wide market research where most of the large manufacturers of audio transducers and systems have been consulted to get the exact specifications for what was really needed within this industry.

First of all the results from this market research told us the parameters to be measured and gave us an indication of the problems we might expect to meet. Secondly we were informed that the major design factors should be: One instrument, reliability, serviceability, speed, reproducible measurements, easy programming for more units to be tested, preparation for interfacing for statistical data handling, etc.

Having realized the needs of the market, we evaluated how a solution with existing equipment could be found. However, no solution could fulfil the demands satisfactorily.

Therefore, Ortofon Instruments developed a measuring computer which is designed to meet the demands previously mentioned, and the system is marketed world-wide.

The system is especially developed for production control of headphones, microphones, loudspeakers and drivers. However, the flexible design offers further applications which will not be described here.

The P400 used for production control can be programmed for each individual type of transducer. A programme is made direct from the front keyboard. The measuring conditions: Output level, sensitivity etc. can be entered direct from the keyboard. Furthermore the tolerance bands, the compensations curves etc. can be made out of curves or drawn direct with a cursor on the colour CRT using the keyboard. The display of the curves makes it very simple and easy to programme the limits. When the programme has been made, the keyboard set-up and the curves are stored on an exchangeable EEPROM-cassette. This enables the user to use the programme in another P400, and at the same time it is a very fast and safe way to change a programme when the type of unit under test is to be changed.

When the programme has been made, it can be tested with the built-in test programme which will determine failures in the user programme and inform the user the type of failure which has been made.

For automatic production control an operator control unit is available. When this unit is connected, the main keyboard is disconnected, i.e. the operator cannot change the programme by accident.

From the operator keyboard the actual programme can be selected for the type of unit to be tested. The type is indicated on the CRT. Furthermore the test can be selected as a complete GO/NO GO test or as a single test for operator evaluation of the test results.

In the automatic production control mode the P400 (standard version) will automaticly run a test of sensitivity, frequency response, rub & buzz and polarity. The results from the automatic test will be shown as APPROVED or REJECTED. In the single test the full response for the test will be shown on the colour CRT together with the results of the test approved or rejected.

An option is available for impedance test and rub & buzz test on units with a higher distortion. Furthermore this option offers quite a lot of other features which are described in a later chapter of this user manual.

Another option, the IEEE 488/IEC 625 interface, is available for communication between the P400 and another computer. A printer interface is included for making hard copies of the response displayed.

The IEEE option offers the opportunity to transfer the test results from the P400 to another computer for statistical handling. Either the GO/NO GO results or the complete response for a reject can be transferred. In case of a reject this will make it possible to evaluate what has caused the reject and consequently give information to the supervisor or the production manager where to adjust the production line.

Further, in connection with another computer the IEEE bus offers the possibility of complete user control with the P400 and consequently the opportunity of making complete user defined production control routines, or the P400 can be integrated in a complete fully- or semi-automatic production system.

1.1 DESCRIPTION OF P400

P400 is a measuring system built into one unit.

For external connection and communication the following connections are available:

COLOUR CRT: The P400 has a built-in colour CRT and a touch sensitive keyboard for communication with the user. The monitor is a 10", 8 colour high resolution CRT.

Front Panel Connections

EEPROM CASSETTE HOLDER: See 18.0.

MULTIPLEXER OUTPUT: (optional) Optho coupler, output for DATA VALID and APPROVED/REJECTED. This option is needed for multiplexer option.

INPUT A: A 3 pin DIN 180° connector (see 19.0 for connections). The input is a true differential instrumentation amplifier. Input impedance is 1 MOhm/200 pf. Full scale sensitivity is 10 mV to 100 V in 10 dB steps. The input is DC coupled in DC and ABSOLUTE AVERAGE modes.

When used as a single ended input, pin 2-3 is connected to screen of input cable. NB! Single ended input connection is more sensitive to hum and noise and should only be used with signal sources with a low output impedance and high output levels.

BRIGHTNESS CONTROL: Input B: Equal to input A.

OUTPUT: 5 pin 240° DIN connector (see 19.0).
CVA2 (see 12.8): Dual differential output amplifiers, each with two ranges max. 5.0 V RMS (L) or 20.0 V RMS (H). The amplifiers can also operate as constant current generators with 2.0 Amp (H) or 20 mA (L) max output.

WARNING: The CVA2 amplifier outputs must not be referred to ground as this will influence the measurements or might cause damage to the amplifiers.

CONTROL: Connection for keybox (see 17.6).

Connections at the Rear

MAINS CONNECTION: Standard mains connection with selective supply voltage (100 V, 120 V, 220 V, 240 V AC) (50/60 Hz) with a power consumption of 250 VA. The mains fuse is positioned in the connector on the equipment and is for 100 V, 120 V/3.15 A and for 200 V, 220 V/1.6 A. All internal power consumption is switched by the built-in voltage selector.

MAINS SWITCH:The switch is an ON/OFF switch and is positioned at the rear of P400.

DEGAUSSING SWITCH: The switch is a toggle switch for degaussing the colour CRT. The switch is positioned at the rear of the P400.

IEEE 488/IEC 625 CONNECTOR: The connector is positioned at the rear of P400. The connector is defined by the standard and is described further in a later chapter.The connections are open if the IEEE option is not installed.

ADDRESS SWITCH: The switch for programming the IEEE address is positioned next to the IEEE connector. The P400 must be switched off when changing any positions of this switch.

PRINTER/PARALLEL I/O: The connector for interfacing the high speed thermal printer. Operational only with GPIB/RS232 interface option installed in P400. For use with Ortofon printers only.

ANALOG I/O: Connections for compressor, external filters, back panel setting, oscillator ON and shorts test options.

1.3 DESCRIPTION OF P400 HARDWARE IN PRINCIPLE

P400 is primarily built up internally as a measuring system with a 19" rack system. The parts of the P400 impossible to build up in the rack system due to high noise sensitivity or high power consumption have been designed in easily exchangeable modules.

On designing the P400 each card or module was given a defined function which makes it very easy to determine failures and minimize the repair time as repair has been reduced to exchange of a card or a module. Furthermore the functional design offers the possibility of adding present options and future options to a system in use as the P400 is designed with future demands in mind.

1.4 FUNCTIONAL DESCRIPTION OF P400

The P400 is designed with one output channel (two, if the impedance option is built-in). The output channel is programmable in frequency for a single tone (Frequency), burst (Repeated Sine Pulse), sweep (Start/Stop Frequency, Sweep Time) and output (Voltage/Current, Amplitude). This makes the P400 work as a programmable generator.

Furthermore the P400 has two individual inputs which can be set-up for various measurements.

The inputs can be set individually for different kinds of voltage measurements: RMS, DC, average, absolute average, positive peak, negative peak, and the time constant can be set for the RMS detector. The input can also be measured linearly or logarithmicly and the sensitivity of the inputs can be set. This makes the P400 work as a programmable voltmeter.

Furthermore the P400 has a frequency counter which can be selected separately.

CPU
The micro processor in the P400 is a Motorola 6809 extended with a 6829 MMU controller. The clock Frequency is 1 Mhz or 2 Mhz for CPU 2.0 version.

ROM
A total of 137 kByte **R**ead **O**nly **M**emory is provided for the internal programme.

RAM
A 64 kByte **R**andom **A**ccess **M**emory is available for keyboard settings, measured data, and reference curves.

EEPROM
Exchangeable cassettes containing 2, 4 or 8 kByte **E**lectrically **E**rasable **P**rogrammable **R**ead **O**nly **M**emory are available for storing P400 settings and reference curves.

2 kByte cassettes can store one full programme (blue)
4 kByte cassettes will typ. store 3 full programmes(red)
8 kByte cassettes will typ. store 7 full programmes(black)

EEPROM cassettes are insensitive to magnetic fields and shocks.

Keyboard
The P400 is menu and cursor oriented. The most common settings are pre-selected for easy operation. Once programmed, all relevant settings and references are stored in an EEPROM or external memory. When the keybox is connected, the operator does not have access to the keyboard and is left with only three keys with which to select and run programmes.

Keybox
With the keybox connected to the P400 the operator can only:

select programmes from the EEPROM memory
select part of a programme or **run** a programme

The operator is unable to change anything in the programme. This ensures safety and easy usage in a production environment.

Frequency Counter
The counter function and the x-axis of the display is controlled by the output of the frequency counter. The input of the counter is normally connected to the output of the generator but the output of either the A or B channel can be selected.

Video Control
It is possible to display colour graphics and numerical data on the CRT.

The 10" colour CRT is a true high resolution RGB monitor and is able to display 8 colours having an approx. 250 x 250 points graphics area superimposed on an alphanumeric field with 24 lines of 70 characters, each character being 8 x 13 dots. By using the zoom function, the full internal resolution of approx.2000 points (x-axis) and 4000 points (y-axis) can be displayed for parts of a curve.

Generator
A sinusoidal signal is generated from a pre-programmed 12 x 4096 RAM. In a D/A converter these data are converted into a low distortion sine wave (harmonics and spurius responses more then 70 dB down). This sine wave can be pulsed for polarity tests, manually controlled for listening tests or swept for automatic measurements. The sweep is hyper-exponential: a very slow sweep speed at low frequencies, and a rapidly increasing sweep speed at higher frequencies. An exponential sweep is optional.

The sweep range is programmable between 5 Hz and 20 kHz. Sweeping from low to high frequencies, or alternatively from high to low frequencies, is possible. This is a valuable feature for testing larger woofers.

The output of the generator is sent to the frequency counter and an attenuator, permitting output level adjustments between 0 and -84 dB.

Analog Measuring Amplifiers
The P400 has two identical measuring channels A and B. The two inputs have a full scale sensitivity of 10 mV - 100 V. AC or DC coupling can be programmed.

The output from either channel can be selected and measured in the frequency counter. Each output is, either direct or through a rub & buzz filter, converted into a linear or logarithmic expression for DC-value, AC-average value, AC-absolute value, + peak, - peak or RMS-(AC)-value of the signal (with selectable time constants in the RMS-case), before it is connected to a 12 bit A/D converter.

Rub & Buzz Filters
Tracking filters can be locked into the frequency of the internal generator. A center frequency from the fundamental up to the 12th harmonic can be selected. The design of the filters has been based on a large number of field measurements rather than scientific data. This empiric approach has resulted in a flexible filter system adaptable to various rub & buzz conditions. All filters from the 3rd harnomic and above have 20 dB gain.

Band Pass Filter
(See chapter 13.4)

Detectors
True RMS detectors are used with 60 dB dynamic range and logarithmic and linear outputs.

A/D Converters
The analog signal is converted into a digital form in the 12 bit A/D converters (0.02 dB resolution in logarithmic mode).

Output Amplifier:

CVA2 For output voltages up to 20 V RMS and currents up to 2 A (not simultaneously), CVA2 amplifiers are used. These amplifiers can operate both in normal constant voltage mode and as a constant current source. When constant current is selected, the output signal is fed directly to the input of the measuring amplifiers. In this mode impedance and a special rub & buzz measurement can be made (without using a microphone). Two CVA2's are mounted in the P400, one for each channel A and B.

The CVA2 outputs are differential and must not be connected to the analog or chassis ground of the P400.

IEEE 488 Interface Output (Optional)
For use with an external controller the P400 can be provided with an IEEE control board. All functions that can be controlled from the keyboard (as well as a few additional ones) can be controlled over the IEEE 488 (IEC625) bus.

Furthermore, an external controller can store a larger number of programmes in the same way as the EEPROM. Also calculation of i.e. Q, resonance, frequency bandwidth or statistics can be made via the bus and a controller.

The IEEE bus is also a suitable basis for integrating the P400 into automatic systems.

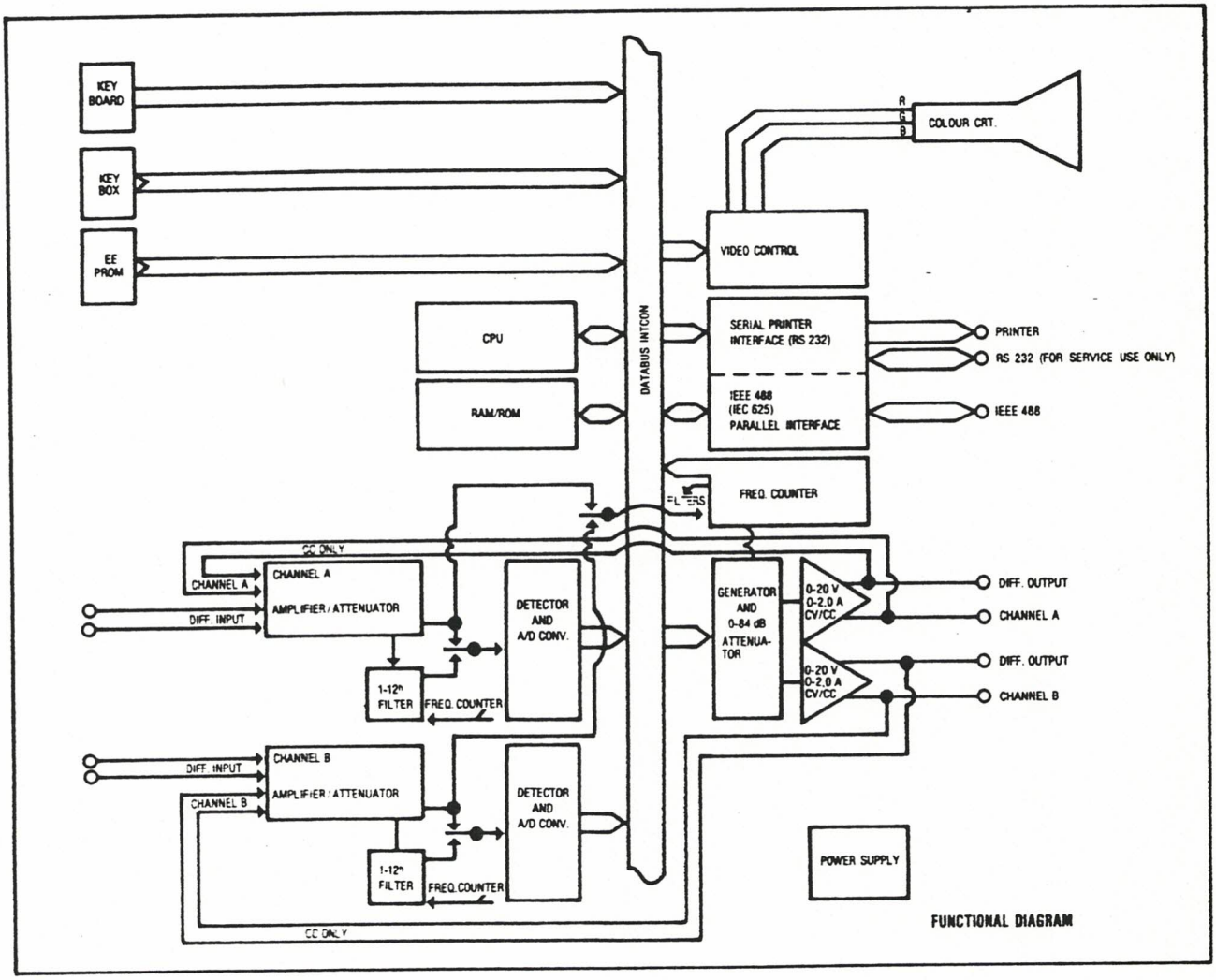
Printer Output
An RS232 output is available for use with the external printer Siemens PT88.

Power Supply
The P400 can operate on 100, 120, 220 or 240 V within 10% of nominal setting and at a line frequency of 50 or 60 Hz.

It is recommended that the P400 is grounded via the mains cable for safety and reduced noise sensitivity.

1.5 BLOCK DIAGRAM P400 (including CVA2 and IEEE488)

The basic modules of the computer can be described as follows:



2.0 OPERATION

The measuring computer P400 is controlled by an operating system which may be considered as a kind of interface between the user and the P400. The operating system informs the user of the status of the P400 in two ways, i.e. via the colour CRT-screen and via the LEDs (light Emitting Diodes) situated on the main keyboard.

The setting up of the P400 can be done in a couple of ways:

1. With the operator keybox (in automatic tests)
2. From the main keyboard
3. Remotely, if the IEEE 488/RS 232 C option is installed

The following is based on the operation of a standard P400 from the main keyboard. In case of deviation, references will be made.

When the P400 is switched on, a self-test procedure is initiated (see 2.1 for details). When SELFTEST COMPLETED and NO ERRORS DETECTED is displayed, press START/STOP key at the lower right on the keyboard. If an error message is displayed, go to section 2.1 and the trouble shooting procedures. Two different displays may appear on the colour CRT depending on the EE-PROM cassette being inserted or not. In the following description we have chosen to describe the situation where no memory cassette has been inserted. We shall later describe the procedure if a cassette has been inserted.

Having switched on the P400, the CRT shows an AC-Voltmeter for channels A and B where 2 horizontal bar-graphs are indicating the voltage. The default values are the following:

> 10 Volt full scale, 60 dB Log display range,
> RMS weighting with a 50 millisec time constant
> and manual input ranging.

The voltmeter mode is one of several modes to be selected by pushing the key PROGRAM. Having selected this, the corresponding menu appears on the CRT and all the specifications in blue form the basis of the programming. You can make the corresponding setting by using the soft keys on the keyboard for instance higher values, lower values etc., and also the keys with the arrows.

When you have pushed the key PROGRAM and selected a menu point, a sub menu may appear or the CRT which further specifies a detailed set-up of the P400.

When you leave a menu,the P400 always returns to the operating mode specified by the modified status of the set-up. This means that you can never return direct from a sub menu to a main menu. This can only be achieved by (for instance) pressing the PROGRAM key once more.

Some of the most important functions and operations can be selected direct by separate keys on the main keyboard.

As mentioned in the introduction, the programming and the operation of the measuring computer is new and exceptional and it may therefore take some time before the user is familiar with all the possibilities offered by the P400. However, it should hardly take more than 1 - 2 working days before the user is familiar with the keyboard and the programming.

2.1 Self-Test Procedure

When P400 is switched on, an automatic self-test procedure is initiated, unless disabled by switch "1" on INTCON PC board (closed, see 2.2).

First, the video controller memory is tested. When error is detected, ALPHA-RAM ERRORS or GRAPHIC-RAM ERRORS is displayed in red on CRT.

Second test is user RAM test. If this test fails, USER-RAM ERRORS is displayed.

Third test is a ROM test. On error ROM CHECKSUM ERROR is displayed. Go to trouble shooting procedure to locate failure.

Second line on CRT indicates software release installed.

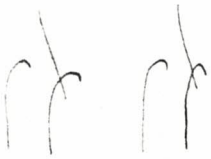
When no errors are detected, this is indicated as SELFTEST COMPLETED NO ERRORS DETECTED.

When self-test is completed, OPTIONS AVAILABLE is listed.

64 K USER RAM	Giving a total of 23 curve registers (8.6)
128 K USER RAM	Giving a total of 39 curve registers (8.6)
192 K USER RAM	Giving a total of 55 curve registers (8.6)
CVA2	Constant voltage/current option (12.8)
CASSETTE INIT	Initializing of cassettes provided (9.8.7)
EXT.CONNECTIONS	IEEE 488/RS 232 interface installed (see special manual)
	Siemens PT88 or Siemens PT88 printer (6.4)
	IEEE back panel switch = xx SRQ "ON" / Address
NONE	No options installed (standard version)

To exit self-test mode and get into programming mode follow the instruction, PRESS START TO CONTINUE. The START mentioned is the START/STOP key at the lower right of the keyboard.

2.2 Options Settings INTCON



	Component Side		Top
	Open	Closed	
	EXTCON installed	EXTCON not instal.	/.7
	Cas.initiated(9.8.7)	Disabled	/.6
	CVA2 installed(12.8)	VA1 installed	/.5
	Siemens PT88 printer	Olivetti TH240 printer	/.4
Normal	Polarity skipped	Polarity performed	/.3
Setting	Unused	Unused	/.2
	Power up selftest(2.1)	Skip selftest	/.1
	User mode	Debug mode	/.0
			Bottom

3.0 KEYBOARD LAYOUT AND FUNCTION

The keyboard layout and function is described in chapters 3.0 to 16.0.

The keyboard functions can be divided into the following sections:

Numbers and operators	4.0
Menus	5.0 to 14.0
Curve operation	15.0
Input setting	16.0

Numbers and operators are used for selecting menus, setting up status, and controlling the equipment.

Menus are for programming various kinds of measurements, functions, and productions control programmes.

Curve operations include functions for graphic manipulation of the curves.

Input setting is a description of setting up the input channels for measurements.

Below is shown a keyboard/chapter reference to make it easier to find the description.

4.1 1	6.0 program A	° 15.1 move curve B	4.2 ←	4.2 →
4.1 2	7.0 trigger C	15.2 cursor D	4.2 ↑	4.2 ↓
4.1 3	8.0 curve E	15.3 zoom X F	° 16.1 channel A G	° 16.2 channel B H
4.1 4	9.0 reference I	15.4 zoom Y J	16.3 lin/log K	16.3 lin/log L
4.1 5	10.0 function A M	15.5 curve A N	16.4 auto O	16.4 auto P
4.1 6	11.0 function B Q	15.6 curve B R	16.5 gain up S	16.5 gain up T
4.1 7	12.0 generator U	15.7 status V	16.6 gain down X	16.6 gain down Y
4.1 8	13.0 filter Z	15.8 graphics ( )	° 4.3 letters	° 4.3 capitals
4.1 9	. +	° 4.4 local ' -	4.5 hard copy " =	° 4.6 start/stop space

4.0 NUMBERS AND OPERATORS

4.1 1	6.0 program A	° 15.1 move curve B	4.2 ←	4.2 →
4.1 2	7.0 trigger C	15.2 cursor D	4.2 ↑	4.2 ↓
4.1 3	8.0 curve E	15.3 zoom X F	° 16.1 channel A G	° 16.2 channel B H
4.1 4	9.0 reference I	15.4 zoom Y J	16.3 lin/log K	16.3 lin/log L
4.1 5	10.0 function A M	15.5 curve A N	16.4 auto O	16.4 auto P
4.1 6	11.0 function B Q	15.6 curve B R	16.5 gain up S	16.5 gain up T
4.1 7	12.0 generator U	15.7 status V	16.6 gain down X	16.6 gain down Y
4.1 8	13.0 filter Z	15.8 graphics ( )	° 4.3 letters	° 4.3 capitals
4.1 9	. +	° 4.4 local ' -	4.5 hard copy " =	° 4.6 start/stop space

4.1 NUMBERS: 1 to 9

The number-keys are used for selecting menu points or selecting sub menus. In the writing mode the digital keys are used for printing numbers to the screen (4.3).

4.2 ARROWS ← → ↑ ↓

In some of the menus the arrows are used for selecting conditions i.e. start and stop frequency.

Furthermore the arrows are used for moving the cursor in the different directions, e.g. for reading frequency - amplitude values on curves,moving curves,and drawing reference curves.

The arrows have a repeat function which means that the key will repeat itself when continuously activated.

4.3 LETTERS AND CAPITALS KEYS

The buttons LETTERS and CAPITALS are used for writing text on the screen for curves. The test can be printed out on the optional hard copies. The cursor controlled by the arrows is to be positioned where you want to write. A LED in the LETTERS and CAPITALS buttons indicates which button is active.

It is only possible to write text on the CRT when a coordinate system is shown.

In order to write the text, one of the buttons LETTERS or CAPITALS HAS TO BE ACTIVATED AND THE LED will show that it is functioning.It is possible to go from LETTERS to CAPITALS and reverse direct. Having printed the text, the function has to be switched off. This is done by pressing the active button LETTERS or CAPITALS.

In some of the menus the alpha numeric keyboard is used for writing the names of curves and status. This is also controlled by the LETTERS and CAPITALS buttons as described above.

4.4 LOCAL KEY

This button is only used together with the IEEE 488 option for controlling the P400 from keyboard. The hardware and software for this operation is made according to the IEEE standard. The LED in the LOCAL button indicates when the equipment is controlled by the keyboard (see IEEE 488 manual for further details).

4.5 HARD COPY KEY

This function is available only with IEEE 488/RS 232 option installed. This is indicated when self-test is completed with a line under OPTIONS AVAILABLE telling EXTERNAL CONNECTIONS. The function will give a print-out according to the selections made in the first line of the printer menu (6.4) and to the selected screens.

If the graphics screen is on, a print-out of the graphics will be produced.

If the "QUICK MODE" is selected on printer menu, the print will consist of the following:

1. AXIS incl. TICS
2. CURVES
3. CURSOR AND CURSOR VALUES

If the "QUICK MODE" is deselected, the print will consist of the following:

1. AXIS incl. TICS
2. CURVES
3. DOTS MAY BE CONNECTED
4. USER TEXT AND SYSTEM TEXT
5. A GRID is added to prove readability
6. CURSOR AND CURSOR VALUES

If the status screen is on, a status print-out will be produced.

The user should be aware that only the curves selected on the graphics screen will produce a status print-out.

4.6 START/STOP KEY

This function is used for manual measurements for starting and stopping measurements, for instance frequency sweep, and time response.

During measurements the LED in the button indicates that the equipment is measuring actively.

This key must be pressed to exit the SELFTEST MODE INITIATED when the P400 is switched on.

4.1 1	6.0 program A	° 15.1 move curve B	4.2 ←	4.2 →
4.1 2	7.0 trigger C	15.2 cursor D	4.2 ↑	4.2 ↓
4.1 3	8.0 curve E	15.3 zoom X F	° 16.1 channel A G	° 16.2 channel B H
4.1 4	9.0 reference I	15.4 zoom Y J	16.3 lin/log K	16.3 lin/log L
4.1 5	10.0 function A M	15.5 curve A N	16.4 auto O	16.4 auto P
4.1 6	11.0 function B Q	15.6 curve B R	16.5 gain up S	16.5 gain up T
4.1 7	12.0 generator U	15.7 status V	16.6 gain down X	16.6 gain down Y
4.1 8	13.0 filter Z	15.8 graphics ( )	° 4.3 letters	° 4.3 capitals
4.1 9	. +	° 4.4 local ' -	4.5 hard copy " =	° 4.6 start/stop space

For setting up measurements the P400 Measuring Computer has built-in a huge number of menus which will be described in the following chapters.

6.0 PROGRAM

In the PROGRAM mode it is possible to set up the type of measurement which is to be executed.

To go into the PROGRAM mode activate the PROGRAM button and the menu will be shown on the display.

Select the required function using the softkeys 1 to 9. Some menus have sub-menus which are programmed as the main menus using the number-keys and the arrow keys. To return from the sub-menus, PROGRAM has to be activated, and the chosen menu is programmed.

PROGRAM MENU

```
PROGRAMMING MODE ENTERED:

1:  VOLTMETER
2:  FREQUENCY COUNTER
3:  TIME AND FREQUENCY RESPONSE ANALYSIS
4:  PRINTER SETTING
5:  PRODUCTION CONTROL (test procedures)
6:  KEYBOARD SET-UP (memory cassette)
7:  PROGRAMMING OPTIONS

Push PROGRAM to exit MENU
```

6.1 VOLTMETER

When the VOLTMETER program is selected from the menu, the display will show bar graphs equivalent to the level and read out in digital form for the two channels A and B. At the botton of the display the keyboard set up for function (10) (11), measuring status for channels A and B and the input setting (16) are shown.

The CHANNEL A (16.1) and CHANNEL B (16.2) buttons are used for switching the corresponding measuring channels ON and OFF.

Default value is both channels A and B ON.

6.2 FREQUENCY COUNTER

In the frequency counter program the frequency of one of the channels A or B,depending on the inputs in the two channels, will be written in the display.

The CHANNEL A (16.1) and CHANNEL B (16.2) are used for switching the corresponding measuring channels ON and OFF.

It is possible to force the measurement to one of the two channels by switching the channels on and off. If both channels are switched off or the input level is too low, the frequency counter will be blank. The channel in which the frequency is measured is indicated on the CRT.

If input is too low for more than 1 sec., the other input will be selected automatically.

6.3 TIME AND FREQUENCY RESPONSE ANALYSIS

```
TIME BASED X-AXIS

1:  SELECT TIME BASE <-  ->

FREQUENCY BASED X-AXIS

2:  SELECT START FREQUENCY <- -> 20.0  Hz
3:  SELECT STOP  FREQUENCY <- -> 20.0 kHz

FREQUENCY MEASURING

4:  INTERNAL FREQ.                  ON
5:  EXTERNAL FREQ. CHANNEL A
6:  EXTERNAL FREQ. CHANNEL B

Push PROGRAM to exit MENU
```

This menu is for programming two-dimensional response analysis. Amplitude versus time or frequency. In this menu the x-axis is programmed for time or frequency correlation. Time responses are correlated to the internal timing. For frequency response the frequency can be measured both internally as well as in one of the two channels.

6.3.1 TIME BASED X-AXIS
SELECT TIME BASE

Time settings possible are from 0.1 to 6000.0 seconds full scale. Default value is 3.2 seconds. Horizontal arrows control 1/10 and 1 second steps and vertical arrows control the more significant digits of the time setting. The arrow keys have repeat function. The time axis is linear.

If only 0.1 sec. is selected for the time response, measurements can only be made in one channel, as the sampling frequency for the A/D converter is max. 20 kHz. For time responses larger than 0.1 sec., responses can be measured in both channels simultaneously.

6.3.2 FREQUENCY BASED X-AXIS SELECT START FREQUENCY

A frequency based x-asix is always shown on a logarithmic scale ranging from 2 to 5 decades. Start frequency can be stepped in 1-2-5 sequence with 1 Hz as minimum and 1 kHz as maximum. Start/stop frequency setting to less than 2 decades are not possible.

6.3.3 FREQUENCY BASED X-AXIS SELECT STOP FREQUENCY

A frequency based x-axis is always shown on a logarithmic scale ranging from 2 to 5 decades. Stop frequency can be stepped in 1-2-5 sequence with 100 Hz as minimum and 100 kHz as maximum. NB! Start/stop frequency setting to less than 2 decades are not possible.

6.3.4 FREQUENCY MEASUREMENT - INTERNAL FREQUENCY

There are three possible ways of measuring the frequency in the frequency response measuring mode:

INTERNAL FREQUENCY
EXTERNAL FREQUENCY CHANNEL A
EXTERNAL FREQUENCY CHANNEL B

The selected source will then be used as reference for the x-axis and will be indicated with an "ON" written after the source.

Internal frequency means the generator frequency is used as reference for the x-axis.

6.3.5 EXTERNAL FREQUENCY - CHANNEL A

When this mode has been chosen, the frequency in the A channel will be used as reference for the x-axis and for the frequency trigger channel (even if channel B is selected for the level measurement).

Further description 6.3.4.

6.3.6 EXTERNAL FREQUENCY - CHANNEL B

When this mode has been chosen, the frequency in the B channel will be used as reference for the x-axis and for frequency trigger channel (even if channel A is selected for the curve measurement).

6.4 PRINTER SETTING

```
                    PRINTER SETTING

  1:  QUICK MODE                          OFF

      SETTING FOR AUTO-MODE:

  2:  TRIG ON REJECT                      OFF
  3:  TRIG ON APPROVE                     OFF
  4:  AUTO CURVE SELECT                   OFF
  5:  A-CURVE SELECT                      OFF
  6:  A-REF SELECT                        OFF
  7:  B-CURVE SELECT                      OFF
  8:  B-REF SELECT                        OFF
  9:  STATUS PRINT                        OFF

  Push PROGRAM to exit MENU
```

6.4.1 QUICK MODE

Is already described (4.5).

6.4.2 TRIG ON REJECT
6.4.3 TRIG ON APPROVE

These two functions are used only in production control mode. A print-out has to be "trigged" and the trigging event has to be selected by one or both of these functions.If both are deselected, no print-out will be produced.

A print-out may consist of 1 to 3 different parts:

1. Curve print-out
2. Status print-out
3. Test report print-out

If a curve print-out is desired, one or more of the items 4-8 must be selected.

If a status print-out is desired, item 9 must be selected.

The test report is always produced.

6.4.4 AUTO CURVE SELECT

This function excludes 6.4.5 - 6.4.8. The curves are selected this way:

1. If the trig is on APPROVED, the frequency response is reproduced.

2. If the trig is on REJECT, the first curve causing the reject is reproduced.

Only one print-out is made for each test session.

6.4.5 A CURVE SELECT
6.4.6 A REF SELECT
6.4.7 B CURVE SELECT
6.4.8 B REF SELECT

Functions used to manually select the curves to be printed out.

6.4.9 STATUS PRINT

This function selects the status print-out to be reproduced.

IMPORTANT:
Considerations about the Printer

The user must programme a printer set-up to all the tests in a test session. The trigging events must be the same for all the tests. If not, unpredictable results may occur.

The curve selection functions do not need to be the same for all tests. However, the user should make sure that a print-out of a non-existing curve is not requested as unpredictable results might occur.

6.5 PRODUCTION CONTROL (test procedures)

This menu is provided for testing production control programs. When selecting this function from the menu a sub menu will occur.

```
PRODUCTION CONTROL (Test Procedures)


1: LOUDSPEAKERS (enter name):
2: HEADPHONES   (enter name):  (not L-version)
3: MICROPHONES  (enter name):  (not L-version)
4: LIST CONTENT OF  CASSETTE:

Push PROGRAM to exit MENU
```

In the sub-menu the production control program with a given name will be checked for failures in programming.

If no failures are found, this will be indicated. If there are failures in the program, the test procedure will stop when the first error is found and the type of failure will be indicated on the CRT. The error must now be corrected before completing the test procedure.

The name of the program is keyed-in under the type of program to be tested. Headphones, loudspeakers, or microphones. For the keyed-in name the first two characters refer only to the type of unit under test. This means that any status or curve can be used for entering the test of the program. Having keyed-in the name,CAPITAL has to be activated to execute the order.

The P400 will then check the program on the cassette for failures and give the information on the display:

1. No errors detected
   if no failures are found

2. File Not Found
   if the production control program is not found

3. CO (name) Must Be Relative Compensation
   if the programmed compensation curves are not programmed as relative curves

4. CHANGE GEN FREQ OR X-TIME
   if the generator frequency or x-time is out of limits for the polarity measurements

5. Invalid Test Status
   if the status shown does not correspond to the type of measurement to be executed in the program

6. Curves Not Same Type
   if reference curve and STATUS are not equal regarding gain, START/STOP frequency. log/lin

The test of the production control program will stop when the first failure is found. The failure has to be corrected before the rest of the program can be tested.

It is also possible to get the contents of cassettes listed (6.5.4).

6.5.1 LOUDSPEAKERS (enter name)

This function will test the production control program for loudspeakers given by a keyed-in name.

When the function has been selected, the cursor occurs and the name of the program to be tested must be keyed-in followed by a CAPITAL activation.

The keyed-in name can be the name of the tolerance band for loudspeaker control.

The P400 will make the following tests:

1. Cassette in P400
2. Production Control program does exist, L1 (name)
3. The Test Status exists, L1 (name).s, L2 (name).s L3 (name).s
4. The Curves and Tolerance curves exist, L1 (name).c L2 (name).c, CO (name).c
5. That the status and the curve status are the same
6. That the compensation curve CO (name).c is relative and has the same status as L1 (name).c
7. That the time response and generator frequency corresponds for polarity test
8. That the status for polarity test is set correctly DC and LIN

Information (6.5) about the result of the test is shown on the CRT.

6.5.2 HEADPHONES (enter name) (not L-version)

This function will test the production control program for headphones given by a keyed-in name.

When the function has been selected, the cursor occurs and the name of the program to be tested must be keyed-in followed by a CAPITAL activation.

The keyed-in name can be the name of the tolerance band for headphones control.

The P400 will make the following tests:

1. Cassette in P400

2. Production Control program does exist, H1 (name)

3. The Test Status exists, H1 (name).s, H2 (name).s H3 (name).s

4. The Curves and Tolerance curves exist, H1 (name).c H2 (name).c, CO (name).c

5. That the status and the curve status are the same

6. That the compensation curve CO (name).c is relative and has the same status as H1 (name).c

7. That the time response and generator frequency corresponds for polarity test

8. That the status for polarity test is set correctly DC and LIN

Information (6.5) about the result of the test is shown on the CRT.

6.5.3 MICROPHONES (Enter Name) (not L-version)

This function will test the production control programme for microphones given by a keyed-in name. When the function is selected, the cursor occurs and the name of the programme to be tested must be keyed-in followed by an activation of the CAPITAL key. The keyed-in name can e.g. be the name of the tolerance band for a microphone test.

P400 will make the following tests:

1. Cassette in P400

2. Production control programme does exist M1(name)

3. The test status exists, M1(name).S,M2(name).S,M3(name).S

4. Tolerance curves exist M1(name).C,M2(name).C,CO(name)C

5. That the status and curve status is the same

6. That the compensation curve CO(name).C is relative and has the same status as M1(name).C

7. That the time response settings and the generator frequency correspond to polarity test

8. That the status for polarity test is set correctly at DC and LIN

Information (6.5) about the result of the test is shown on the CRT.

6.5.4 LIST CONTENTS OF CASSETTE

This function will list the contents of the cassette on the display in order to inform the user of the status set-ups that are stored on the cassette.

If no cassette is inserted "NO CASSETTE IN P400" will inform the user to insert the cassette or to make sure that the cassette is inserted correctly.

6.6 KEYBOARD SET-UP (Memory Cassette)

This menu is for saving keyboard set-ups in the memory cassette, recalling and deleting them whenever needed. The spece used for saving a keyboard set-up on the cassette is one unit (18.0).

```
KEYBOARD SET-UP (Memory Cassette)

1:  SAVE STATUS   (enter name):
2:  LOAD STATUS   (enter name):
3:  DELETE STATUS (enter name):
4:  LIST CONTENT OF CASSETTE


Push PROGRAM to exit MENU
```

The information saved in the cassette contains:

1. Mode: Voltmeter 6.1
   Frequency counter 6.2
   Time and frequency response 6.3
2. X-axis definition 6.3.1 - 6.3.5
3. Trigger 7.0
4. Function 10 - 11
5. Generator 12
6. Filter 13
7. Smoothing 8.1 - 8.2
8. Dot connection 8.3 - 8.4
9. Input setting 16
10. Printer 6.4
11. Programming options 6.7

The set-up for the two channels A, B is independent.

The name of the STATUS can be alpha-numeric and have a length up to 6 characters. After entering the name, CAPITAL has to be activated. The name can be entered as soon as the function has been selected. The first character in the name must not be a space as this will be interpreted as the instruction has been cancelled.

If a status is named "START", the P400 will be programmed with this set-up whenever it is switched on with the cassette inserted.

In this menu the following warnings may occur:

NO CASSETTE IN P400

indicating that no cassette has been inserted and the given command cannot be executed.

FILE ALREADY EXISTS

indicating that the keyboard set-up cannot be programmed bacause a keyboard set-up under the name in question has been programmed already. To change an old file it is necessary to delete this file and store the new one.

FILE DOES NOT EXIST

indicates that the given command concerning a keyboard set-up on the cassette cannot be executed because the keyboard set-up under the given name does not exist on the cassette. No access to the menu points in the sub-menu can be made during the time when P400 is accessing the EEPROM cassette.

6.6.1 SAVE STATUS (enter name)

This function saves the status of the keyboard set-up (6.6) under agiven name on the EEPROM cassette (6.6).

Keyboard set-up for both channels A and B are saved at the same time.

6.6.2 LOAD STATUS (enter name)

This function loads from the EEPROM cassette the status of the keyboard set-up previously saved (6.6) under a given name (6.6).

Set-up for both channels A and B is loaded at the same time.

6.6.3 DELETE STATUS (enter name)

This function deletes the status with (6.6) a given name (6.6) from the cassette.

Set-up for both channels A and B is deleted at the same time.

6.6.4 LIST CONTENT OF CASSETTE

This function will list the contents of names of keyboard set-ups on the cassette on the display.

When more than 16 status are stored on the EEPROM, a "continue" flag is shown at lower left part of the display. To see the reminder, press key 4 again. Pressing key 4 again will give the list of the first 16 status.

6.7 PROGRAMMING OPTIONS

This function selects programmable features for special use.

```
┌──────────────────────────────────────────────────────┐
│                                                      │
│                  PROGRAMMING OPTIONS                 │
│                                                      │
│        1:  COMPRESSOR COMPENSATION OFF  (not L-version) │
│        2:  BACK PANEL SETTING      0                 │
│        3:  MOVED Function Disable  OFF               │
│                                                      │
│        Push PROGRAM to exit MENU                     │
│                                                      │
└──────────────────────────────────────────────────────┘
```

6.7.1 COMPRESSOR COMPENSATION (not L-version)

This function is executing the (A MODIFIED BY B) STORED IN A (8.5.5) as a part of an automatic programme when on. Default value is the OFF condition.

6.7.2 BACK PANEL SETTING

This function can be set to give an octal code (0 to 7) on the RS 232 connector. This can be used to control external equipment like a rotary table for microphone test or switch in a different microphone for e.g. polarity test. Default value is "0".

Pin 22 = Binary "1" Low when selected
Pin 10 = Binary "2" Low when selected
Pin 23 = Binary "4" Low when selected

Pin 14 = Oscillator ON High when Osc. is on

6.7.3 MOVED Function Disable

This function can disable the MOVED function from the frequency response test.

MOVED is an automatic function that will shift the measured frequency response curve upwards or downwards if that will make the curve fit within the tolerance band, with the text "MOVED" in front of the result. If the sensitivity is outside the tolerance bands, sensitivity is "REJECTED" and indicated as the absolute value.

7.0 TRIGGER

A trigger point for the start of measurements can be programmed for both time and frequency measurements.

```
TRIGGER PROGRAMMING

1:  FREQUENCY TRIGGERING:
    (select frq.)  <-  ->
2:  MANUAL TRIGGERING                    ON
3:  DELAY (select delay time) <- -> 250 mSEC
4:  DELAY ON/OFF                         ON

Push TRIG to exit menu
```

The trigger point for the measurement can be programmed either to a certain delay after manual triggering or to a frequency.

7.1 FREQUENCY TRIGGERING: Select frequency

This function will start the measurement when the frequency measured equals the keyed-in frequency.

The trigger frequency is selected with the horizontal arrows and can be selected to 1 - 2 and 5 in the decades between 1 Hz to 100 kHz.

The frequency measurement which is compared with the trigger frequency can be either the internal frequency or measured in channels A or B as described in 6.3.3 to 6.3.5.

Frequency triggering can be used in both time and frequency response.

7.2 MANUAL TRIGGERING

This function start the measurements when the START/STOP key (4.6) is activated. When manual triggering has been chosen, this will be indicated with an ON after the text.The default value is ON.

7.3 DELAY (Select delay time)

This function can delay the start of measurement.

The delay time can be set with both the vertical and the horizontal arrows. The time is written in the CRT after the text. The delay time can be programmed from 0 msec to 600 sec in steps of 10 msec. The default value is 250 msec.

The delay function can be programmed for a delay before start of measurement after manual as well as frequency triggering and can therefore be used for both time and frequency response.

7.4 DELAY ON/OFF

This function is for switching ON and OFF the delay time. Default value is OFF.

8.0 CURVE

This function can only be entered when a keyboard set-up for graphic measurements has been made (time or frequency response).

This menu covers curve manipulation. Furthermore two sub-menus cover addition and subtraction of curves and saving of curves in the RAM memory.

The CURVE menu is shown below:

```
|_____________________CURVE MANUPULATION_____________________|
|                                                            |
|        1: CURVE SMOOTHING;           CH. A <-  ->          |
|           number of data in summ,: 1                       |
|        2: CURVE SMOOTHING;           CH. B <-  ->          |
|           number of data in summ.: 1                       |
|        3: CONNECT DOTS (vertical); CH. A   ON              |
|        4: CONNECT DOTS (vertical); CH. B   ON              |
|        5: SUMM AND SUBTR OF CURVES                         |
|        6: CURVE REGISTERS                                  |
|                                                            |
|        Push CURVE to exit MENU                             |
|____________________________________________________________|
```

Each curve has a corresponding curve status which is stored together with the curve in the curve register.

The curve status contains information about:

- x axis start and stop frequency or time (6.3)
- y axis sensitivity (16.5 and 16.6)
  - lin/log (16.3)
  - function (10 and 11)
- Time constant (10.7 and 11.7)
- Smoothing (8.1 and 8.2)
- Sensitivity freq. (9.5.6)
- Filter gain (13.3)
- Balance (9.5.7)
- Decimation count (9.9.1 and 9.9.2)
- Absolute or relative curve

8.1 CURVE SMOOTHING; CH. A
Number of data in summ.: 1 (Default Value)

With this function it is possible to smooth the curves for averaging out noise or decreasing displayed details. This function can be compared to lowering writing speed on earlier analog-type level-recorders. The smoothing is a sliding average of a number of measured points. "Number of data in sum" indicates the number of datas in the averaging and thus the amount of smoothing.

The number of data in the averaging can be selected with the horizontal arrows and can be the value of 1, 2, 4, 8, 16, 32, 64, or 128.

The number of data in the memory is 2000 in the horizontal direction and the "number of data in sum" refers to these data. Curve smoothing is reversible and no source data are lost. Default value for smoothing is 1.

8.2 CURVE SMOOTHING; CH. B
Number of data in summ.: 1 (Default Value)

With this function it is possible to smooth the curves for averaging out noise or decreasing displayed details. This function can be compared to lowering writing speed on earlier analog-type level-recorder. The smoothing is a sliding average of a number of measured points. "Number of data in sum" indicates the number of datas in the averaging and thus the amount of smoothing.

The number of data in the averaging can be selected with the horizontal arrows and can be the value of 1, 2, 4, 8, 16, 32, 64, or 128.

The number of data in the memory is 2000 in the horizontal direction and the "number of data in sum" refers to these data. Curve smoothing is reversible and no source data are lost. Default value for smoothing is 1.

8.3 CONNECT DOTS (vertical; CH. A) ON (Default Value)

This function connects and disconnects the dots of the curve vertically. It works as an ON/OFF switch for the dot connection.

Whether the dot connection is ON or not will be indicated to the right of the menu text.

The dot connection will automatically be switched OFF when manipulation is made to reference curves (9.3, 9.4) but the dot connection will be re-established when the menu is exited.

8.4 CONNECT DOTS (vertical; CH. B) ON (Default Value)

This function connects and disconnects the dots of the curve vertically. It works as an ON/OFF switch for dot connection.

Whether the dot connection is ON or not will be indicated to the right of the menu text.

The dot connection will automatically be switched OFF when manipulation is made to reference curves (9.3, 9.4) but the dot connection will be re-established when the menu is exited.

8.5 SUM AND SUBTR OF CURVES

Under this function a sub-menu gives the possibility of adding and subtracting curves.

```
SUM AND SUBTR OF CURVES

1: (A + A-REFERENCE) STORED IN A
2: (A - A-REFERENCE) STORED IN A
3: (B + B-REFERENCE) STORED IN B
4: (B - B-REFERENCE) STORED IN B
5: (A MODIFIED BY B) STORED IN A (not L-vers.)

Push CURVE to exit MENU
```

It is important to note that the curves must have the same curve status (8.0) for this type of manipulation. If the curved do not have the same status (except absolute or relative), the warning CURVES NOT SAME TYPE will be indicated on the CRT. The data for the two curves will not be affected when the warning occurs.

8.5.1 (A+A REFERENCE) STORED IN A

This function adds the A reference curve to the A curve and stores the result as the new A curve. Please note that the A curve has to be absolute and the A ref curve has to be relative.

During this operation the original data for the A curve will be destroyed. If you wish to save the curve, it can be stored in the curve register (8.6) before the operation.

8.5.2 (A-A REFERENCE) STORED IN A

This function subtracts the A reference curve from the A curve and stores the result as the new A curve. Please note that the A curve has to be absolute whereas the A ref curve can be both relative or absolute, - or both curves have to be relative.

During this operation the original data for the A curve will be destroyed. If you wish to save the curve, it can be stored in the curve register (8.6) before the operation.

8.5.3 (B+B REFERENCE) STORED IN B

This function adds the B reference curve to the B curve and stores the result as the new B curve. Please note that the B curve has to be absolute and the B ref curve has to be relative.

During this operation the original data for the B curve will be destroyed. If you wish to save the curve, it can be stored in the curve register (8.6) before the operation.

8.5.4 (B-B REFERENCE) STORE IN B

This function subtracts the B reference curve from the B curve and stores the result as the new B curve. Please note that the B curve has to be absolute whereas the B ref curve can be both relative or absolute, - or both curves have to be relative.

During this operation the original data for the B curve will be destroyed. If you wish to save the curve, it can be stored in the curve register (8.6) before the operation.

8.5.5 (A MODIFIED BY B) STORED IN A (not L-version)

This function subtract the measured B curve from the measured A curve and the resulting curve is stored as the new A curve. This new A curve = (A curve - B curve + B value 20 dB below full scale).

During this operation the original data of the A curve is destroyed. If you wish to save the curve, it can be stored in the curve register (8.6) before the operation.

8.6 CURVE REGISTER

With this register the A and B curves can be stored individually in the registers, loaded from the registers or exchanged with curves in the registers.

Sub-Menu CURVE REGISTER

```
┌──────────────────────────────────────────────────┐
│                                                  │
│                  EXTRA CURVES                    │
│                                                  │
│          1: STORE A CURVE IN NO.:                │
│          2: STORE B CURVE IN NO.:                │
│          3: LOAD A CURVE FROM NO.:               │
│          4: LOAD B CURVE FROM NO.:               │
│          5: EXCH. A CURVE WITH NO.:              │
│          6: EXCH. B CURVE WITH NO.:              │
│                                                  │
│                                                  │
│          Push CURVE to exit MENU                 │
└──────────────────────────────────────────────────┘
```

The curve status (8.0) will be store together with the curves.

The standard version offers the possibility of storing 7 curves. Additional options for further curve registers are available. The capacity of each extra option is 16 curves. The P400 offers the possibility of storing up to 55 curves when equipped with all RAM options.

If additional RAM options are installed in the P400, this will be indicated under SELFTEST COMPLETED - OPTIONS AVAILABLE USER RAM 64 K (or 128 K or 192 K). The 128 K or 192 K user RAM option cannot be combined with the IEEE 488/RS 232 option.

Only numbers up to the highest number of curves can be used. If a number higher than the number of curve registers is used for curve identification, the error message ILLEGAL REGISTER NO: will appear on the CRT.

The curve register is a RAM memory and all the curves in the memory will be deleted if the mains is switched off.

8.6.1 STORE A CURVE IN NO:

This function will copy curve A and status into the curve register under the number entered from the numeric keyboard. To execute this order the CAPITAL button has to be activated.

8.6.2 STORE B CURVE IN NO:

This function will copy curve B and status into the curve register under the number entered from the numeric keyboard. To execute this order the CAPITAL button has to be activated.

8.6.3 LOAD A CURVE FROM NO:

This function copies the curve from the register to the A curve register.

The curve addressed by the keyed-in number with the corresponding curve status will be copied into the A curve register. The keyboard set-up for measuring in the A channel will not be affected by this operation.

To execute the instruction CAPITAL has to be activated.

8.6.4 LOAD B CURVE FROM NO:

This function copies the curve from the register to the B curve register.

The curve addressed by the keyed-in number with the corresponding curve status will be copied into the B curve register. The keyboard set-up for measuring in the B channel will not be affected by this operation.

To execute the instruction CAPITAL has to be activated.

8.6.5 EXCH A CURVE WITH NO:

This function exchanges the curve from the register to the A curve register.

The curve addressed by the keyed-in number with the corresponding curve status will be exchanged into the A curve register. The keyboard set-up for measuring in the A channel will not be affected by this operation.

To execute the instruction CAPITAL has to be activated.

8.6.6 EXCH B CURVE WITH NO:

This function exchanges the curve from the register to the B curve register.

The curve addressed by the keyed-in number with the corresponding curve status will be exchanged into the B curve register. The keyboard set-up for measuring in the B channel will not be affected by this operation.

To execute the instruction CAPITAL has to be activated.

8.7 ABSOLUTE/RELATIVE CURVES

A measured curve is an absolute curve as the values of each print reflect the absolute value of the input signal. Relative curves are the results of a subtraction or an addition in relation to another curve or absolute level. A compensation curve (CO) is a relative curve (see 20.0).

9.0 REFERENCE

This menu includes all functions concerning reference curves and tolerance bands. Manipulation like curve smoothing (8.1 and 8.2) and dot connection (8.3 and 8.4) will also affect the reference curves.

```
REFERENCE CURVES

1: REFERENCE A ON/OFF
2: REFERENCE B ON/OFF
3: CHANGE A CURVE TO REF.CURVE
4: CHANGE B CURVE TO REF.CURVE
5: MODIFY REFERENCE CURVES
6: GENERATE REF.CURVES WITH CURSOR
7: REFERENCE CURVE AQUISITION
8: NON-VOLATILE MEMORY STORAGE
9: TEST DECIMATION COUNT

Push REFERENCE to exit MENU
```

The curve status (8.0) for the reference will not be affected by changes in the keyboard set-up.

When the menu is entered and changes are made to the graphics, the graphics will always be switched on.

9.1 REFERENCE A ON/OFF (Default ON)

With this function the A reference can be switched OFF and ON on the CRT. The instruction does not affect the data.

9.2 REFERENCE B ON/OFF (Default ON)

With this function the B reference can be switched OFF and ON on the CRT. The instruction does not affect the data.

9.3 CHANGE A CURVE TO REF.CURVE

This function changes the A curve (green colour) to a reference curve (yellow colour). The A curve is deleted by this operation.

9.4 CHANGE B CURVE TO REF.CURVE

This function changes the red B curve to a blue reference curve. The B curve is deleted by this operation.

9.5 MODIFY REFERENCE CURVES

This submenu includes functions for manipulating the reference curves and special functions for production control purposes.

```
MODIFICATION OF REFERENCE CURVES

1: MOVE CURVE TO UPPER LIMIT  <- ->
2: MOVE CURVE TO LOWER LIMIT  <- ->
3: MOVE PARTS OF CURVE  <- ->
4: MODIFY CURVE  <- ->
5: RELEASE CURSOR
6: SAVE X-CURSOR FOR SENSITIVITY TEST
7: MAX CHANNEL BALANCE DEVIATION <- ->
   (Not L-version)

Push REFERENCE to exit MENU
```

The first five functions 9.5.1 to 9.5.5 are for reference curve manipulation. 9.5.6 and 9.5.7 are functions used in production control programmes only.

Functions in this menu which affect the ref. curve will automatically decrease in resolution to the number of points seen in the display (8-bits resolution). Furthermore any dot connection (8.3 and 8.4) will be deleted when the functions have been entered. The dot connection (8.3 and 8.4) must be re-established after finishing the reference curve manipulation.

The amount of smoothing which has been set for the reference curve will be fixed after entering of the functions described in 9.5.1 to 9.5.5. This means that smoothing cannot be changed for the reference curve when entering of these functions has been done.

9.5.1 MOVE CURVE TO UPPER LIMIT

This function is for programming upper limit for tolerance bands. When the function has been entered, every second point of the ref. curve can be moved up with the corresponding vertical arrow keys. (All points will be moved if a lower limit has not been programmed). Switch on the cursor and position it on the curve to be manipulated. If the cursor is set on the A or B curve, the warning MOVE CURSOR TO A OR B REF will occur.

If STATUS (15.7) is activated, the menu text is switched off the display but can still be activated from the keyboard. The cursor value and the relative movement of the upper limit are indicated in the CRT.

When a tolerance band is necessary, enter the MOVE CURVE TO LOWER LIMIT function (15.2) and set the lower limit before going out of the sub-menu - otherwise only an upper limit has been programmed.

9.5.2 MOVE CURVE TO LOWER LIMIT

This function is for programming lower limit for tolerance bands. When the function has been entered, every second point of the ref. curve can be moved up or down with the corresponding vertical arrow keys. (All points will be moved if an upper limit has not been programmed). Switch on the cursor and position it on the curve to be manipulated. If the cursor is set on the A or B curve, the warning MOVE CURSOR TO A OR B REF will occur.

WARNING: Upper limit only is used in B channel.

If STATUS (15.7) is activated, the menu text is switched off the display but can still be activated from the keyboard. The cursor value and the relative movement of the lower limit are indicated in the CRT. By activating STATUS again, the menu is switched on again.

When a tolerance band is necessary, enter the MOVE CURVE TO UPPER LIMIT function (9.5.1) and set the upper limit before going out of the sub-menu - otherwise only a lower limit has been programmed.

9.5.3 MOVE PARTS OF CURVE

This function is used for moving parts of curves in the vertical direction. The function can be used both for reference curves and upper or lower limits.

When the cursor has been set on the curve to be manipulated, in the area where the parallel movement is desired, enter the MOVE PART OF CURVE function.

With the vertical arrows the movement of the parallel transfer can be set and with the horizontal arrows the points of the curve will be moved. If the direction of the horizontal movement of the cursor is changed, the vertical movement is set to zero. The vertical movement can continuously be increased or decreased while the cursor is moved in the horizontal direction.

RELEASE CURSOR (9.5.5) has to be entered when the part of the curve, which you want to move, has been moved and then the cursor can bemoved quite freely again without affecting the reference curve.

The cursor value is indicated in the display and the menu text can be switched on and off if STATUS (15.7) is activated.

9.5.4 MODIFY CURVE

This function is for modifying curves with the cursor, i.e. the curve is changed by drawing with the cursor.

The function can be used both for reference curves and upper or lower limits.

When the cursor has been set on the curve to be manipulated and in the area where the modifications are to be made, enter the MODIFY CURVE function. The modifications of the curve can now be drawn with the vertical and horizontal arrows.

When the modifications are drawn, the cursor can be released by entering RELEASE CURSOR (9.5.5) and the cursor can be moved freely without affecting the reference curve.

The cursor value can be indicated in the display and the MENU can be switched on and off the display if STATUS (15.7) is activated.

9.5.5 RELEASE CURSOR

This function will release the cursor when the curve manipulation functions (9.5.1) to (9.5.4) have been used.

When the CURSOR (15.2) is released, it can be moved as in all other modes but only on the reference curve which has just been modified, or between upper and lower limit of a tolerance band.

9.5.6 SAVE X CURSOR FOR SENSITIVITY TEST

This function is for setting the frequency for the sensitivity test in production control programmes.

If the frequency for the sensitivity test has not been set, the sensitivity will be measured at 1 kHz.

The frequency for the sensitivity measurement is set as the x-value of the cursor when the menu point is selected, and the exact frequency will be written out in digits at the menu point. During setting of the test frequency, ZOOM X can be used to increase resolution and gives the opportunity of setting an exact frequency for the sensitivity measurement.

Using this menu, it will often be advantageous to use the STATUS (15.7) function to switch on and off the menu to get a read out of the cursor value.

The sensitivity is measured as the deviation from the average of lower and upper limit. The deviation in sensitivity is measured at the frequency which is programmed by this function.

9.5.7 MAX CHANNEL BALANCE DEVIATION (NOT L-VERSION)

This function is especially made for production control of headphones.

When selecting this function, a maximum deviation in the two channels used for headphone measurements can be set. The value is set with the vertical arrows and can be set to values from 0.0 dB to 30.0 dB.

(NOT L-VERSION)

The channel balance is measured at the same frequency as the sensitivity (9.5.6) is measured.

If no MAX CHENNEL BALANCE DEVIATION is set, the channel deviation test will not be executed during automatic production control.

9.6. GENERATE CURVES WITH CURSOR

This sub-menu is for programming reference curve with the cursor. The curves are programmed by entering key points which automatically will be connected by the P400.

```
┌──────────────────────────────────────────────┐
│                                              │
│              CURSOR REFERENCES               │
│                                              │
│          1: A REFERENCE                      │
│          2: B REFERENCE                      │
│          3: UPPER OR LOWER LIMIT             │
│          4: ENTER KEYPOINT                   │
│                                              │
│          Push REFERENCE to exit MENU         │
└──────────────────────────────────────────────┘
```

During programming of the curves, the menu text can be switched on and off by activating the STATUS key so that the cursor value can be shown.

Both upper and lower limit for reference bands can be programmed individually, or a tolerance band can be made.

The drawn reference curves can be modified by using the sub-menu described in chapter 9.5.

9.6.1 A REFERENCE

This function is a selection of the reference curve to be drawn. Reference curves drawn after having selected this sub-menu point will be A reference. If an upper or a lower limit, or both as a tolerance band, has to be drawn, this can be selected as described in 9.6.3.

The reference curve is drawn by moving the cursor with the vertical and horizontal arrows. Whenever a keypoint is wanted, the ENTER KEYPOINT function is activated. The keypoints are immediately connected by the P400.

9.6.2 B REFERENCE

This function is a selection of the reference curve to be drawn. Reference curves drawn after having selected this sub-menu point will be B reference. If an upper or a lower limit, or both as a tolerance band, has to be drawn, this can be selected as described in 9.6.3.

The reference curve is drawn by moving the cursor with the vertical and horizontal arrows. Whenever a keypoint is wanted, the ENTER KEYPOINT function is activated. The keypoints are immediately connected by the P400.

9.6.3 UPPER OR LOWER LIMIT

This function will select the limit (upper or lower) which is to be drawn. If both limits are drawn, the function will shift the cursor between upper and lower limit. After the first limit has been drawn, this function will release the cursor for drawing the other part of a tolerance band.

WARNING: A lower limit will not be used in AUTOMATIC programmes for RUB & BUZZ in channel B.

9.6.4 ENTER KEYPOINT

This function is for entering keypoint for reference curves drawn with the cursor. When a keypoint is entered, the point will automatically be connected with the neighbouring points.

9.7 REFERENCE CURVE ACQUISITION

This function is for generating referance bands or upper limits out of a number of tests. This is done automatically by selecting one or two of these functions (one for channel A and one for channel B) and run 1,2,4,8 or 16 tests.

9.7.1 USE NEXT ... A CURVES AS REF. (average)

This function is for averaging measurements for the reference curve.

With the horizontal arrows a number of responses (0, 1, 2, 4, 8, and 16) can be selected for making an average of the reference curve.

The selected number of curves for the averaging will be indicated on the CRT (lower left corner) and this number will be decreased by each measurement.

The average of the curves will be shown as the A reference curve and the last measurement will be shown as A curve.

9.7.2 USE NEXT ... B CURVES AS REF. (average)

This function is for averaging measurements for the reference curve.

With the horizontal arrows a number of responses (0, 1, 2, 4, 8, and 16) can be selected for making an average of the reference curve.

The selected number of curves for the averaging will be indicated on the CRT (lower left corner) and this number will be decreased by each measurement.

The average of the curves will be shown as the B reference curve and the last measurement will be shown as B curve.

9.7.3 USE NEXT ... A CURVES AS REF. BAND

This function will generate a reference band (envelope) out of the selected number of tests. The upper limit is generated of the highest values found for each point out of the total number of tests. The lower limit band is made in the same way except for the lowest values used. The resulting reference band will accept all the curves used for generating the reference band.

Select with the horizontal arrows any number between 0 and 250 of responses for making the A reference band. The selected number of curves for generatingthe reference band will be indicated on the CRT in the lower left corner and this number will be counted down by each measurement.

The resulting curves will be shown as the A reference band and the last measurement will be shown as the A curve.

9.7.4 USE NEXT ... B CURVES AS REF. BAND

This function will generate a reference band (envelope) out of the selected number of tests. The upper limit is generated of the highest values found for each point out of the total number of tests. The lower limit band is made in the same way except for the lowest values used. The resulting reference band will accept all the curves used for generating the reference band.

Select with the horizontal arrows any number between 0 and 250 of responses for making the B reference band. The selected number of curves for generatingthe reference band will be indicated on the CRT in the lower left corner and this number will be counted down by each measurement.

The resulting curves will be shown as the B reference band and the last measurement will be shown as the B curve.

WARNING: A lower limit will not be used in AUTOMATIC programmes for RUB & BUZZ in channel B.

9.7.5 USE NEXT ... A CURVES AS UPPER LIM

This function is equal to 9.7.3 except for the fact that only the upper limit will be generated.

9.7.6 USE NEXT ... B CURVES AS UPPER LIM

This function is similar to 9.7.4 except for the fact that only the upper limit will be generated.

9.8 NON VOLATILE MEMORY STORAGE

```
REFERENCE CURVES IN MEMORY CASSETTE

1: SAVE A REFERENCE (enter name):
2: SAVE B REFERENCE (enter name):
3: LOAD A REFERENCE (enter name):
4: LOAD B REFERENCE (enter name):
5: DELETE REFERENCE (enter name):
6: LIST CONTENT OF CASSETTE
7: INITIALIZE CASSETTE
   ENTER NUMBER+NAME+DATE
         nnxxxxxxyymmdd

Push REFERENCE to exit MENU
```

This sub-menu is for communications between the P400 and the memory cassette. The curves can either be stored, loaded or deleted from the memory cassette. Furthermore the contents of the cassette can be listed on the CRT.

When a curve is programmed on the cassette, it will automatically loose resolution to the resolution seen on the CRT without ZOOM. This means that the resolution will change from 12 to 8 bits in y-direction and from 2000 to 250 points in x-direction.

The space used on a cassette (18.0) for programming a curve is 5 units and for a tolerance band 9 units.

Whenever the memory cassette is in access, no measurements can be made. Furthermore the memory cassette cannot be accessed again till the earlier access is finished. This means that the cassette cannot be accessed during the programming time.

During access to the memory cassette a red flashing P will indicate that the P400 is busy accessing the cassette.

IMPORTANT
It is important to note that the cassette must not be removed during the programming. This may damage the cassette.

Programming a curve or a tolerance band on the cassette may take a little time. Consequently the P400 cleares the status for a curve only when it is deleted. This means that reprogramming an almost identical curve can be done very quickly as only the data which are changed have to be reprogrammed.

Accessing the cassette the following warnings can occur. They are shown on the upper right corner of the CRT:

FILE EXIST ALREADY: This warning occurs when access to the cassette is made for programming a curve under a name which already exists.

FILE NOT FOUND: This warning occurs when access to the cassette is made for loading a curve from the cassette which does not exist.

NO CASSETTE IN P400: This warning occurs when access is made to the cassette and no cassette has been inserted.

UNABLE TO PROGRAM: This warning occurs if a failure should arise on the cassette or the cassette has been removed during programming.

9.8.1 SAVE A REFERENCE (enter name):

This function is for saving the A reference curves or tolerance bands in the memory cassette.

When the menu has been selected,the cursor will start flashing to the right of the menu point. The alpha numeric keyboard is then in function and the keyed-in name for the reference curve must be entered followed by a CAPITAL activation.

There are six characters available for the name. If the first one is blank, the order to save will be ignored. With the horizontal arrows the cursor can be moved so that failures can be corrected.

If warnings occur during programming, see chapter 9.8.

9.8.2 SAVE B REFERENCE (enter name):

This function is for saving the B reference curves or tolerance bands in the memory cassette.

When the menu has been selected,the cursor will start flashing to the right of the menu point. The Alpha numeric keyboard is then functioning and a name for the reference curve must be entered followed by a CAPITAL activation.

There are six characters available for the name. If the first one is blank, the order to save will be ignored. With the horizontal arrows the cursor can be moved so that failures can be corrected.

If warnings occur during programming, see chapter 9.8.

9.8.3 LOAD A REFERENCE (enter name):

This function is for loading the A reference curves or tolerance bands from the memory cassette.

When the menu has been selected,the cursor will start flashing to the right of the menu point. The Alpha numeric keyboard is then functioning and a name for the reference curve must be entered followed by a CAPITAL activation.

There are six characters available for the name. If the first one is blank, the order to load will be ignored. With the horizontal arrows the cursor can be moved so that failures can be corrected.

If warnings occur, see chapter 9.8.

9.8.4 LOAD B REFERENCE (enter name):

This function is for loading the B reference curves or tolerance bands from the memory cassette.

When the menu has been selected,the cursor will start flashing to the right of the menu point. The Alpha numeric keyboard is then functioning and a name for the reference curve must be entered followed by a CAPITAL activation.

There are six characters available for the name. If the first one is blank, the order to load will be ignored. With the horizontal arrows the cursor can be moved so that failures can be corrected.

If warnings occur, see chapter 9.8.

9.8.5 DELETE REFERENCE (enter name):

This function is for deleting reference curves or tolerance bands from the memory cassette.

When the menu has been selected,the cursor will start flashing to the right of the menu point. The Alpha numeric keyboard is then functioning and a name for the reference curve must be entered followed by a CAPITAL activation.

There are six characters available for the name. If the first one is blank, the order to delete will be ignored. With the horizontal arrows the cursor can be moved so that failures can be corrected.

If warnings occur, see chapter 9.9.

9.8.6 LIST CONTENTS OF CASSETTE

This function will list the contents of reference curves and tolerance bands in the cassette on the display. The list will be shown below the menu.

The list shown on the display is updated only when this menu point is selected.

When more than 16 curves are stored on an EEPROM, a "continue"flag is shown in lower left corner of the display. Press key 6 again to see reminder of stored curves.The first 16 curves are displayed again when key 6 is pressed again.

9.8.7 INITIALIZE CASSETTE
ENTER NUMBER+NAME+DATE
nnxxxxxxyymmdd

This function is optional and only available when indicated under SELFTEST COMPLETED - OPTIONS AVAILABLE with the test CASSETTE INIT. If tried to initialize without option available, the error message NOT AVAILABLE IN THIS VERSION will be shown on the CRT.

The function of this procedure:

Testing EEPROM size (2,4,8 or 16 k Byte)
Entering cassette No. (nn)
Entering name (xxxxxx)
Entering date (year,month,date = yymmdd)
Testing for defective sector
Resetting catalogue

This procedure can be used to name cassettes and to re-initialize cassettes not functioning.

This feature can be disabled with switch No. 6 on the INTCON PC board (see 2.2).

9.9 TEST DECIMATION COUNT

```
TEST DECIMATION COUNT

1: A CURVE DECIMATION COUNT  8
2: B CURVE DECIMATION COUNT  8

Push REFERENCE to exit MENU
```

This function determines the number of points where the tolerance and the measured curve is compared.

9.9.1 A CURVE DECIMATION COUNT (Default Value = 8)

By the vertical arrows the number of decimation points can be selected. The course selection can be made by the vertical arrows. The figure indicates the distance between the point on the curve where the curve measured is compared to the tolerance band. The actual number of points compared can be calculated from the formula "2000 / decimation count". The default value is 8 giving 250 comparisons.

NB: All points where the reference curve is 0 on the X-axis will be left out from the comparison.

9.9.2 B CURVE DECIMATION COUNT (Default Value = 8)

By the vertical arrows the number of decimation points can be selected. The course selection can be made by the vertical arrows. The figure indicates the distance between the point on the curve where the curve measured is compared to the tolerance band. The actual number of points compared can be calculated from the formula "2000 / decimation count". The default value is 8 giving 250 comparisons.

NB: All points where the reference curve is 0 on the X-axis will be left out from the comparison.

10.0 FUNCTION A

In this menu the type of voltage measurement detectors and the time constant for the AC measurement is set up for channel A. The current function set-up is indicated at the bottom of the display.

```
CHANNEL A MEASURING MODES

1: DC
2: RMS                  (Default)
3: ABSOLUTE AVERAGE       (NOT L-VERSION)
4: AC AVERAGE             (NOT L-VERSION)
5: POSITIVE PEAK          (NOT L-VERSION)
6: NEGATIVE PEAK          (NOT L-VERSION)
7: TIME CONSTANT SELECTION 20 Hz

Push FUNCTION A to exit MENU
```

The two channels A and B are fully independent and can therefore be set up with different functions.

Read-out, Voltmeter, or Graphics is decided by Program (chapter 6.0). Sensitivity and Log/Lin measurement are set up as described in chapter 16.

Default values for this menu are RMS and 20 Hz as the time constant.

10.1 DC

This function is used for DC voltage measurements, e.g. polarity tests.

10.2 RMS

This function is used for true RMS measurements.

10.3 ABSOLUTE AVERAGE (NOT L-VERSION)

This function is used for absolute average measurements, which is an average measure including any DC component.

10.4 AC AVERAGE (NOT L-VERSION)

This function is used for average measurements and measures the average rejecting any DC component.

10.5 POSITIVE PEAK (NOT L-VERSION)

This function is used for positive peak measurements. The time constant for this measurement is about 0.5 sec.

10.6 NEGATIVE PEAK (NOT L-VERSION)

This function is used for negative peak measurements. The time constant for this measurement is about 0.5 sec.

10.7 TIME CONSTANT SELECTION

This function is for selecting the time constant for the RMS measurement. The selected time constant can be either 1 Hz, 20 Hz or 150 Hz.

If the internal sweep generator is used, the time constant will automatically be set to VAR (variable) indicating that the generator controls the time constant for the RMS measurement.

The time constant cannot be changed while the generator is set for automatic sweep (12.6).

The time constant is changed by selecting the menu point and will shift 1 Hz, 20 Hz, 150 Hz.

11.0 FUNCTION B

In this menu the type of voltage measurement detectors and the time constant for the AC measurement is set up for channel B. The current function set-up is indicated at the bottom of the display.

```
CHANNEL B MEASURING MODES

1: DC
2: RMS                  (Default)
3: ABSOLUTE AVERAGE     (NOT L-VERSION)
4: AC AVERAGE           (NOT L-VERSION)
5: POSITIVE PEAK        (NOT L-VERSION)
6: NEGATIVE PEAK        (NOT L-VERSION)
7: TIME CONSTANT SELECTION 20 Hz

Push FUNCTION B to exit MENU
```

The computer automatically sets up the right type of axis for the measurement. The two channels A and B are fully independent and can be set up with different functions.

Read-out, Voltmeter or Graphic is decided by Program (6.0). Sensitivity and log/lin measurement is set up as described in chapter 16.

Default values for this menu are RMS and 20 Hz as the time constant.

11.1 DC

This function is used for DC voltage measurements, e.g. polarity tests.

11.2 RMS

This function is used for true RMS measurements.

11.3 ABSOLUTE AVERAGE (NOT L-VERSION)

This function is used for absolute average measurements, which is an average measure including any DC component.

11.4 AC AVERAGE (NOT L-VERSION)

This function is used for average measurements and measures the average rejecting any DC component.

11.5 POSITIVE PEAK (NOT L-VERSION)

This function is used for positive peak measurements. The time constant for this measurement is about 0.5 sec.

11.6 NEGATIVE PEAK (NOT L-VERSION)

This function is used for negative peak measurements. The time constant for this measurement is about 0.5 sec.

11.7 TIME CONSTANT SELECTION

This function is for selecting the time constant for the RMS measurement. The selected time constant can be either 1 Hz, 20 Hz or 150 Hz.

If the internal sweep generator is used, the time constant will automatically be set to VAR (variable) indicating that the generator controls the time constant for the RMS measurement.

The time constant cannot be changed while the generator is set for automatic sweep (12.6).

The time constant is changed by selecting the menu point and will shift 1 Hz, 20 Hz, 150 Hz.

12.0 GENERATOR

The P400 has a built-in sine generator which can be programmed as a tone,sine wave puls or sweep generator. Furthermore the output level can be programmed singly.

```
                    GENERATOR

      MANUAL FREQUENCY SET MODE      Default values
1:    FREQUENCY          <-  ->      1,000  Hz
2:    REPEATED SINE-PULSE MODE:      OFF

      SWEEP MODE
3:    START FREQUENCY    <-  ->      20.0   Hz
4:    STOP  FREQUENCY    <-  ->      20.0  kHz
5:    TOTAL SWEEP TIME   <-  ->       4.2  sec

      AMPLIFIER SWITCHING
6:    AUTOMATIC ON/OFF:              ON
7:    MANUAL ON/OFF:                 OFF

8:    AMPLIFIER SET UP

      Push GENERATOR to exit MENU
```

12.1 MANUAL FREQUENCY SET MODE FREQUENCY

This function is for setting the frequency of the generator to a single tone.

The frequency is set with the arrows,the vertical for coarse adjustment and the horizontal for fine adjustment. The exact frequency of the generator is displayed to the right of the menu point when the generator has been set for single tone output.

Default value is 1 kHz for the generator.

12.2 REPEATED SINE PULSE MODE

This function is for programming the generator to generate repeated sine pulses.

The generator sends every fouth sine period to the output when the function has been switched ON. In production control this function is used for testing the polarity.

When selecting this menu point, the function will be switched ON and OFF. This will be displayed in the CRT to the right of the menu point.

Default value is repeated sine pulse mode OFF.

12.3 SWEEP MODE, START FREQUENCY

This function is for selecting the start frequency for sweeps.

The start frequency is selected with the horizontal arrows and the value selected will be displayed.

The start frequencies which can be selected are 5, 10, 20, 30, 40, 50, 100, 200, 400, 500 Hz and 1k, 2k, 5k, 10k, 15k, 20k Hz. This means that the max. sweep range is 5 Hz - 20 kHz and furthermore that the generator can sweep both from lower to higher and from higher to lower frequencies.

Default value is 20 Hz.

12.4 SWEEP MODE, STOP FREQUENCY

This function is for selecting the stop frequency for sweeps.

The stop frequency is selected with the horizontal arrows and the value selected will be displayed.

The stop frequencies which can be selected are 5, 10, 20, 30, 40, 50, 100, 200, 400, 500 Hz and 1k, 2k, 5k, 10k, 15k, 20k Hz. This means that the max. sweep range is 5 Hz - 20 kHz and furthermore that the generator can sweep both from lower to higher and from higher to lower frequencies.

Default value is 20 kHz.

12.5 TOTAL SWEEP TIME

This function is for setting the total sweep time of the sweep.

The sweep time is selected via the horizontal arrows. The sweep time selected is shown to the right of the menu point. If a too low sweep time has been chosen, the P400 will display a warning SWEEP TIME TOO LOW. This means that the sweep speed is too high resulting in decreased resolution for response.

The sweep time will automatically be changed when START FREQUENCY (12.3) and STOP FREQUENCY (12.4) are changed due to the exponential-sweep technique in the P400. The absolute sweep time for a given inverval is not affected by this functions.

Default value is 4.2 sec.

12.6 AUTOMATIC ON/OFF

This function is for automatic synchronization of the generator and the start of the measurements. This means that the generator and the measurement will start simultaneously.

If a delay is inserted, the generator will be switched on at the start frequency and with the programmed amplitude. After the delay time the sweep will be completed as programmed.

Selection of this function will automatically switch off MANUAL ON/OFF (12.7) as the generator and output cannot be controlled in both ways at the same time. Furthermore, selection of this will switch on and off AUTOMATIC ON/OFF. This is indicated to the right of the menu point.

Default value is ON.

12.7 MANUAL OFF

This function is for manual switching on and off of the amplifier and the generator.

Selection of this function will automatically switch off AUTOMATIC (12.6) as the generator and the output cannot be controlled in both ways at the same time. Furthermore, selection of this function switches this on and off. The status is indicated to the right of the menu point.

Default value is OFF.

12.8 AMPLIFIER SET UP (The CVA2 Option)

```
|-------------------------------------------------------|
|                                                       |
|                  AMPLIFIER SET UP                     |
|                                                       |
|          1: OUTPUT RANGE (High/low)          L       |
|          2: OUTPUT ATTENUATOR   ½-  -§      -18.0 dB  |
|          3: OUTPUT MODE (Voltage/Current)    V       |
|          4: MUTE (Channel A)                 OFF      |
|          5: MUTE (Channel B)                 OFF      |
|                                                       |
|          Push GENERATOR to exit MENU                  |
|-------------------------------------------------------|
```

This description only relates to the CVA2 option. This option is installed when indicated under SELFTEST COMPLETED - OPTIONS AVAILABLE CVA2.

This instrument is provided with an additional power amplifier and switch box to permit use of constant current output/impedance measurement. Therefore, the operation of the instrument is slightly changed. A description of the changes can be given as follows:

When setting of the generator takes place, item 8 of the generator menu allows for amplifier set up. When pushing key 8, a sub-menu appears on the display consisting of the following items:

12.8.1 OUTPUT RANGE (HIGH/LOW) (Default value L = LOW)

In the voltage-controlled mode the LOW range allows for a maximum output of 5V RMS, 4 Amps. In the HIGH range the maximum output is 20 V RMS, 2.5 Amps. (into 8 Ohms).

In the current-controlled mode the LOW range allows for a maximum output of 20 mA whereas the HIGH range permits 2 Amps, 20 V RMS (into 10 Ohms).

12.8.2 OUTPUT ATTENUATOR
0 to -84 dB (Default value = -18 dB)

(See 21.2 for output voltage cross reference)
(See 21.3 for output current cross reference)

12.8.3 OUTPUT MODE
(Voltage/Current) (Default value V = Voltage)

The user can choose the output of constant voltage or constant current. In current mode (c), the outputs are connected internally to the respective inputs.

12.8.4 MUTE (Channel A) (Default value = OFF)

The user can choose ON or OFF for normal measurement conditions. This position should be OFF when this channel is in use.

When muted in current mode (19.9.3), the connection is disconnected directly from output to input, and the input will work in the normal way.

12.8.5 MUTE (Channel B) (Default value = OFF)

The user can choose ON or OFF for normal measurement conditions. This position should be OFF when this channel is in use.

When muted in current mode (19.9.3), the connection is disconnected directly from output to input, and the input will work in the normal way.

It should be emphasized that an instrument which can choose between voltage-controlled and current-controlled measuring mode has a different input/output configuration. A description of this configuration is given under chapter 19.0.

13.0 FILTER

This function gives the possibility of coupling filters into the measuring chain.

```
|-------------------------------------------------------|
|                                                       |
|                  FILTER PROGRAMMING                   |
|                                                       |
|          1:  RUB AND BUZZ FILTER CH. A    OFF         |
|          2:  RUB AND BUZZ FILTER CH. B    OFF         |
|          3:  FILTER TRACKING    ½-  -§    5           |
|          4:  BAND PASS FILTER                         |
|                                                       |
|          Push FILTER to exit MENU                     |
|-------------------------------------------------------|
```

13.1 RUB AND BUZZ FILTER CH. A

This function will couple the rub and buzz filter in and out of the measuring chain when it is selected.

The display indicates whether the filter is switched on or off. The rub and buzz filter is developed by Ortofon Instruments A/S especially for measuring mechanical defects in loudspeakers, headphones, and microphones.

Special filter options are available.

13.2 RUB AND BUZZ FILTER CH. B

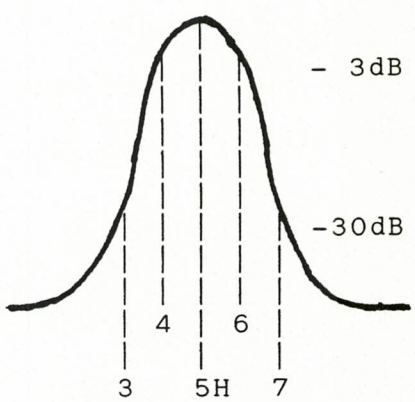
This function will couple the rub and buzz filter in and out of the measuring chain when it is selected.

The display indicates whether the filter is switched on or off. The rub and buzz filter is developed by Ortofon Instruments A/S especially for measuring mechanical defects in loudspeakers, headphones, and microphones.

Special filter options are available.

13.3 FILTER TRACKING

This filter is controlled from the built-in generator and sweeps over the chosen f-range. The filter system can be centered on any harmonic between the 1th and the 12th. During the programming operation you have to choose the filter center frequency which can best differentiate between good units and rejects.



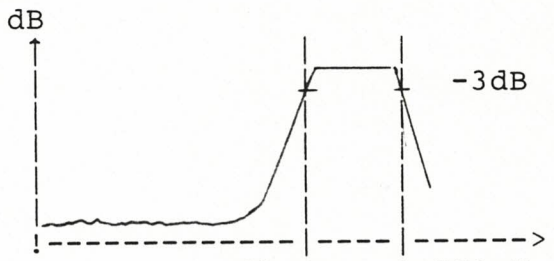
This menu point is for shifting the harmonic which the rub and buzz filter is tracking. The harmonic for the filter shifts when the menu point is selected.

The filter can be set up for tracking from the 1st harmonic (fundamental) and up to the 12th harmonic.

The filters for channel A and B track on the same harmonic.

The gain in filter setting No. 1 is 0 dB and in all other settings 20 dB are added to the measuring chain.

13.4 BAND PASS FILTER



500 Hz 2,000 Hz
1,000 Hz 5,000 Hz
2,000 Hz 10,000 Hz (standard)

The gain in filters and maximum frequencies displayed for different filter settings with a band pass filter installed:

Filter Setting	Gain	Max.Displayed
1	0 dB	20 kHz
2	0 dB	20 kHz
3 (recommended)	+30 dB	20 kHz
4	+30 dB	10 kHz
5	+30 dB	10 kHz
6	+30 dB	10 kHz
7	+30 dB	5 kHz
8	+30 dB	5 kHz
9	+30 dB	5 kHz
10	+30 dB	5 kHz
11	+30 dB	5 kHz
12	+30 dB	5 kHz

15.0 CURVE OPERATIONS

Curves recorded in the frequency or time-based mode can be manipulated in different ways.

4.1 1	6.0 program A	° 15.1 move curve B	4.2 ←	4.2 →
4.1 2	7.0 trigger C	15.2 cursor D	4.2 ↑	4.2 ↓
4.1 3	8.0 curve E	15.3 zoom X F	° 16.1 channel A G	° 16.2 channel B H
4.1 4	9.0 reference I	15.4 zoom Y J	16.3 lin/log K	16.3 lin/log L
4.1 5	10.0 function A M	15.5 curve A N	16.4 auto O	16.4 auto P
4.1 6	11.0 function B Q	15.6 curve B R	16.5 gain up S	16.5 gain up T
4.1 7	12.0 generator U	15.7 status V	16.6 gain down X	16.6 gain down Y
4.1 8	13.0 filter Z	15.8 graphics ( )	° 4.3 letters	° 4.3 capitals
4.1 9	. +	° 4.4 local ' -	4.5 hard copy " =	° 4.6 start/stop space

15.1 MOVE CURVE

This function is for moving curves vertically up and down, and e.g. it can be used for comparing the shape of curves.

The curve is moved by setting the cursor on the curve to be moved, activating the MOVE CURVE button, and moving the curve up or down with the vertical arrows.

The cursor will be released again when the MOVE CURVE button is activated again. The built-in LED in the button will indicate that the function is active.

The curves can also be moved after having used ZOOM X and/or ZOOM Y. If ZOOM X has been used, the curves can also be moved horizontally with the corresponding arrows. The fact that the curves have been moved will be indicated on the Y-axis with a NCal (Not Calibrated) sign.

15.2 CURSOR

The cursor gives the possibility of examining the exact value on curves.

The cursor is turned on and off by activating the CURSOR button and the co-ordinates of the cursor position are written in the upper right corner of the CRT screen.

The cursor can be moved along the curve by using the horizontal arrows and from curve to curve by using the vertical arrows.

15.3 ZOOM X

The ZOOM X facility is for increasing the resolution in the X-direction.The graphics are zoomed around the cursor point. When using zoom, the cursor will move into the centre of the screen.

The cursor has to be positioned at the interesting part of the curve (15.2). If not, the zooming will be made around the centre of the CRT. Horizontal scaling changes according to ZOOM used.

Zooming is made by activating the ZOOM X button. The capability of zooming is 1,2,4, and 8 times. The amount of zoom can be seen from the STATUS (15.7). The ZOOM is non-destructive.

ZOOM X affects both channel A , B incl. reference curves.

15.4 ZOOM Y

The ZOOM Y facility is for increasing the resolution in the Y-direction.The graphics are zoomed around the cursor point. When using zoom, the cursor will move into the centre of the screen.

The cursor has to be positioned at the interesting part of the curve (15.2). If not, the zooming will be made around the centre of the CRT. Horizontal scaling changes according to ZOOM used.

Zooming is made by activating the ZOOM Y button. The capability of zooming is 1,2,4,8, and 16 times. The amount of zoom can be seen from the STATUS (15.7). The ZOOM is non-destructive.

The A and A ref curves - or B and B ref curves - are zoomed simultaneously.

15.5 CURVE A

This function is for switching on and off curve A. Curve A is the response measured at the A input. The CURVE A function is non-destructive.

15.6 CURVE B

This function is for switching on and off curve B. Curve B is the response measured at the B input. The CURVE B function is non-destructive.

15.7 STATUS

This function will switch on and off the status on the display when the key is activated.

The STATUS key is not active in the voltmeter (6.1) and the frequency counter (6.2) modes.

The status function has two modes: one when a menu has been entered and another containing curve information.

During programming (when e.g. programming tolerance bands) it is often advantageous to switch off the menu text from the display. A "M" in the bottom left corner indicates that the keyboard is active in a menu. When a new menu is entered, it will automatically be active but will not be shown on the CRT.

When the MENU is switched off by the status function, the cursor (15.2) and the cursor value can be shown on the CRT. If tolerance bands have been made, the relative movement of the upper and lower limit is indicated.

The second mode for the status function is showing the status of the curves on the CRT. This can only be used when no menu is shown on the display. The status function will show the status for the A,A reference, B, and B reference curves. The status is switched on and off with the STATUS key. The STATUS contains the following information:

CURVE STATUS

	A CURVE	A REF.	B CURVE	B REF.
EXIST:				
Y-AXIS				
Function:	See 10.0 and 11.0			
Time-const.:	See 10.7 and 11.7			
Gain (FS):	See 16.5 and 16.6			
Abs./Rel.:	See 8.7			
Lin/Log:	See 16.3			
Resolution:				
Type				
X-AXIS				
X-base:				
Range:				
Data Numbers:				
DISPLAY STATUS:				
Zoom Y:	See 15.4			
Zoom X:	See 15.3			
Smooth N:	See 8.1 and 8.2			
Dot-connec.	See 8.3 and 8.4			

The display STATUS will automatically be updated when Zoom X (15.3), Zoom Y (15.4),and Smoothing (8.1 and 8.2) are changed or curves are switched on or off.

Changes in the input setting or measuring conditions will not affect the STATUS as the STATUS only shows the condition of the curves seen on the CRT.

15.8 GRAPHICS

This function is for switching on and off all the graphics.

Menus - which are affecting the graphics in the memory - will automatically switch on the graphics. In order to make the menu more readable, it may be advantageous to switch off the graphics.

Entering a menu will switch off the graphics. For menus which affect the graphics, it may be advantageous to set on the graphics before executing any function to get a better view of the results.

16.0 INPUT SETTING

4.1 1	6.0 program A	° 15.1 move curve B	4.2 ←	4.2 →
4.1 2	7.0 trigger C	15.2 cursor D	4.2 ↑	4.2 ↓
4.1 3	8.0 curve E	15.3 zoom X F	° 16.1 channel A G	° 16.2 channel B H
4.1 4	9.0 reference I	15.4 zoom Y J	16.3 lin/log K	16.3 lin/log L
4.1 5	10.0 function A M	15.5 curve A N	16.4 auto O	16.4 auto P
4.1 6	11.0 function B Q	15.6 curve B R	16.5 gain up S	16.5 gain up T
4.1 7	12.0 generator U	15.7 status V	16.6 gain down X	16.6 gain down Y
4.1 8	13.0 filter Z	15.8 graphics ( )	° 4.3 letters	° 4.3 capitals
4.1 9	. +	° 4.4 local ' -	4.5 hard copy " =	° 4.6 start/stop space

16.1 CHANNEL A

This button is used for selecting the A channel, in voltmeter and frequency counter mode for switching on and off the A channel. The red LED indicates that the channel is active.

For time and frequency response the START/STOP key has to be activated for executing the measurements (4.6).

Default value is channel A ON.

16.2 CHANNEL B

This button is used for selecting the B channel, in voltmeter and frequency counter mode for switching on and off the B channel. The red LED indicates that the channel is active.

For time and frequency response the START/STOP key has to be activated for executing the measurements (4.6).

Default value is channel B ON.

16.3 LIN/LOG

This key switches between linear and logarithmic measurements and automatically changes the scales. The logarithmic measurement is done in dBV (20 log V(in)/1V). The current set-up is indicated at the bottom of the CRT.

Default value is log for both channels.

16.4 AUTO

This key automatically sets the input sensitivity for the best reading for the current input. The function can only be used in the voltmeter mode. When time or frequency response is selected, the automatic sensitivity setting is automatically switched off and the current sensitivity is set as fixed.

At the bottom of the CRT, AUTO indicates that the input sensitivity is set automatically - if not, MAN will be shown.

The automatic sensitivity setting is switched off if the AUTO, GAIN UP or GAIN DOWN keys are activated while AUTO is shown in the display.

Default value is MANual.

16.5 GAIN UP

This function increases the sensitivity of the input by 10 dB. The input level can be set for 10 mV, 30 mV, 100 mV, 300 mV, 1 V, 3 V, 10 V, 30 V, and 100 V full scale and the current sensitivity for the two channels is shown at the bottom of the CRT.

Default value is 10 V.

16.6 GAIN DOWN

This function decreases the sensitivity of the input by 10 dB. The input level can be set for 10 mV, 30 mV, 100 mV, 300 mV, 1 V, 3 V, 10 V, 30 V, and 100 V full scale and the current sensitivity for the two channels is shown at the bottom of the CRT.

Default value is 10 V.

17.0 DISPLAY MODES

The P400 has several display modes which are used depending on the access which has been made. In this chapter the different types of display modes are described:

17.1 MENUS

This display mode is used when the P400 is operated in the menus described in chapters 5.0 to 13.3.

When a menu is selected, the content of this will be displayed on the CRT. If a menu point is selected with one of the digital keys, a green horizontal arrow will indicate the menu point which is selected, or a sub-menu is given under the menu point. This sub-menu will be displayed. If now a menu point in this sub-menu is selected, the green horizontal arrow will indicate the selected point.

A flashing cursor by a menu point indicated that the alpha numeric keyboard is active for input. The cursor can be moved horizontally with the corresponding horizontal arrow. The cursor is switched off and the data are entered when the CAPITAL button is activated.

When menu points are selected affecting the curves, or changes are made in this menu point, the graphic will automatically be switched on to visualize the changes. The graphic is switched off with the GRAPHICS button or when another MENU is selected.

In the menus, the graphic can always be switched on and off with the GRAPHICS key.

In some menus it might be advantageous to switch off the menu text. This is done with the STATUS button and is indicated with a red M in the left corner at the bottom of the screen.

When the menu points are entered, which includes communication with the EEPROM cassette, a red P will be flashing in the left corner at the bottom. This flashing P is a warning for operations with the cassette. Furthermore the flashing P will keep gleaming from the instruction is given until it is carried out. When the P is flashing, no other menu point concerning the cassette can be chosen.

Warnings and failure information will be indicated in the right corner at the top.

If access is made to any of the menu points in the FUNCTION menues or any change is made in sensitivity or lin/log read out, the information for the actual set-up will be indicated at the bottom of the screen.

17.2 VOLTMETER

The voltmeter function has both a graphical and a digital display for the two channels or will be indicated as OFF.

The voltage measured is either read out in dBV or V, depending on lin/log set-up. For logarithmic measurements the read out is in 0.1 dB, and for linear measurements the voltage will be read out as a 3½ digit number.

The voltage measurement will also be indicated graphically as a green bargraph for channel A and a red bargraph for channel B.

17.3 FREQUENCY COUNTER

In this display mode the value of the frequency counter is displayed. Furthermore, it is indicated whether the frequency is measured in channel A or B.

The channel in which the frequency is measured is indicated on the CRT and the frequency is read out as a 3½ digit number. If no frequency is measured in either of the two channels, the read out will be blanked.

At the bottom of the display the keyboard set-up for function sensitivity and lin/log is indicated. The setting of their parameters does not influence the frequency counter directly but must, however, be set in a way so that the input is reasonably sensitive without being overloaded.

17.4 TIME RESPONSE

In this mode a co-ordinate system with X and Y axis appears. Time is indicated in the X-direction in mS (milli-seconds) or or in S (seconds), level in the Y-direction in mV (millivolts) or V (volts) for linear measurements and dBV (0 dB = 1 volt) for logarithmic measurements.

At the bottom of the display the current keyboard set-up for function sensitivity and lin/log is indicated.

If the cursor is switched on, the X and Y values are indicated at the top of the screen.

The A curve is green and the A ref. curve is yellow. The B curve is red and the B ref. curve is blue. The reference curve can also be two curves if they are changed to - or drawn as - a tolerance band. This, however, does not influence the colour of the curve.

The scale on the axes corresponds to the curve on which the cursor is set. If the cursor is switched off, the scale shown for the X-axis has the following priority:

1. A curve
2. A ref. curve
3. B curve
4. B ref. curve

This means that if the A curve is displayed, the axis corresponds to the A curve. If not, the scale will correspond to the next one in the hierarchy.

Two scales are shown for the Y axis, one for channel A and one for channel B. The colour of the scale - green or yellow for channel A and red or blue for channel B - corresponds to the curves. The read out follows the colour of the curve where the cursor is set.

If the cursor is switched off, the read out on the Y axis for channel A will have the following priority:

1. A curve
2. A ref. curve

and for channel B:

1. B curve
2. B ref. curve

If a curve has been moved, N-cal (not calibrated) is indicated on the axis because the read out on the axis does not correspond to the curve (chapt. 15.1).

If ZOOM is used, the axis automatically changes according to the selected amount of zoom (chapt. 15.3 and 15.4).

The STATUS - or measuring condition - for the curves in the display and the memory can be displayed when using the STATUS button (chapt. 15.7).

The GRAPHIC button (chapt. 15.8) is available for switching on and off the graphics.

Furthermore the CURVE A and CURVE B buttons (chapter 15.4 and 15.5) can be used for switching on and off the corresponding curves.

17.5 FREQUENCY RESPONSE

In this mode a co-ordinate system with X and Y axis appears. Frequency is indicated in the X direction in Hz or in kHz, level in the Y direction in mV (milli-volts) or V (volts) for linear measurements and dBV (0 dB = 1 volt) for logarithmic measurements.

At the bottom of the display the current keyboard set-up for function sensitivity and lin/log is indicated.

If the cursor is switched on, the X and Y values are indicated at the top of the screen.

The A curve is green and the A ref. curve is yellow. The B curve is red and the B ref. curve is blue. The reference curve can also be two curves if they are changed to - or drawn as - a tolerance band. This, however, does not influence the colour of the curve.

The scale on the axes corresponds to the curve on which the cursor is set. If the cursor is switched off, the scale shown for the X-axis has the following priority:

1. A curve
2. A ref. curve
3. B curve
4. B ref. curve

This means that if the A curve is displayed, the axis corresponds to the A curve. If not, the scale will correspond to the next one in the hierarchy.

Two scales are shown for the Y axis, one for channel A and one for channel B. The colour of the scale - green or yellow for channel A and red or blue for channel B - corresponds to the curves. The read out follows the colour of the curve where the cursor is set.

If the cursor is switched off, the read out on the Y axis for channel A will have the following priority:

1. A curve
2. A ref. curve

and for channel B:

1. B curve
2. B ref. curve

If a curve has been moved, N-cal (not calibrated) is indicated on the axis because the read out on the axis does not correspond to the curve (chapt. 15.1).

If ZOOM is used, the axis automatically changes according to the selected amount of zoom (chapt. 15.3 and 15.4).

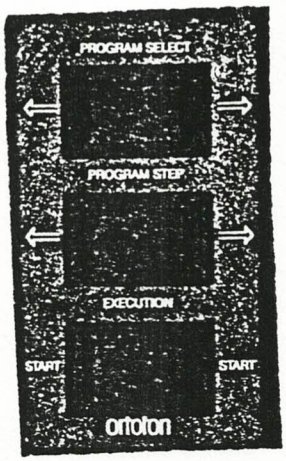
The STATUS - or measuring condition - for the curves in the display and the memory can be displayed when using the STATUS button (chapt. 15.7).

The GRAPHIC button (chapt. 15.8) is available for switching on and off the graphics.

Furthermore the CURVE A and CURVE B buttons (chapter 15.4 and 15.5) can be used for switching on and off the corresponding curves.

17.6 PRODUCTION CONTROL

This display mode can be achieved only when the keybox is connected to the P400.



Button A

Button B

Button C

When the keybox is connected, the P400 has three types of display modes:

Automatic
Single Test
Manual

When the keybox is connected, the display indicates TYPE followed by the name of the first programme. The programme to be executed can be selected with button A = PROGRAM SELECT.

When the type or programme has been selected, the test is selected with button B = PROGRAM STEP at the keybox. The abovementioned test modes can be selected from the keybox.

The test is executed when activating button C = EXECUTION/ START on the keybox.

17.6.1 AUTOMATIC TEST

When the automatic test has been selected from the keybox, this is indicated on the screen with AUTOMATIC followed by the programme. Furthermore, the test parameters and the results for the test are indicated.

For headphones - two elements can be tested in parallel and the parameters are:

SENSITIVITY CH A
SENSITIVITY CH B
CH BALANCE

FREQUENCY RESPONSE CH A
FREQUENCY RESPONSE CH B

RUB AND BUZZ CH A
RUB AND BUZZ CH B

POLARITY CH A
POLARITY CH B

For loudspeakers, microphones, and single headphone capsules the parameters are:

SENSITIVITY
FREQUENCY RESPONSE
RUB AND BUZZ
POLARITY

If the results are within the limits for the test, ACCEPT will be indicated in a green colour - if not, REJECT will be indicated in red colour.

17.6.2 SINGLE TEST

The single test described under the automatic test (17.6.1) can be executed individually and the responses and tolerance bands are shown on the screen for closer evaluation.

The single test is selected from the keybox with the PROGRAM STEP button and will be executed when the EXECUTE button is activated.

17.6.3 MANUAL

From the keybox it is possible to select FREQ. (frequency) and AMP (amplitude) for manual testing with the PROGRAM STEP button. When one of these test parameters has been selected, it is possible to change the level or the frequency manually with the PROGRAM SELECT button for a manual test. Such a change does not influence the programme which is programmed in the cassette.

18.0 EEPROM CASSETTE

The cassettes are used as external storage for keyboard set-ups, curves, and programmes. The cassettes are exchangeable and can be used in all P400 computers.

The capacity of the cassettes can be:

2 kByte	-	26	units (blue)
4 kByte	-	56	units (red)
8 kByte	-	116	units (black)

This space can be used for either keyboard set-ups, curves or tolerance bands. The space needed for storing this is:

Keyboard set-up	1 unit
Curve	5 units
Tolerance band	9 units
Compensation curve (CO)	5 units

Programming of keyboard set-ups is described in chapter 6.6.

Curves and tolerance bands are programmed as described in chapter 9.9.

Keyboard set-ups, curves, and tolerance bands can be copied from one cassette to another by loading them from the cassette to the P400 with the corresponding menues (6.6.2).

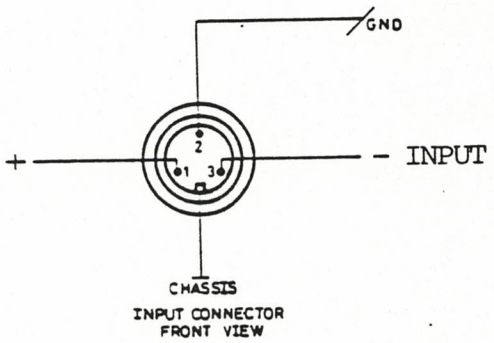
Then after exchanging the cassettes, the saving of the keyboard set-up and curves can be carried out with the functions described in chapter 6.6.1).

WARNING: Programmes stored last on a cassette will take longer time to run than those stored first on a cassette. Each full programme stored in front of programme executed might give a delay of up to 200 ms.

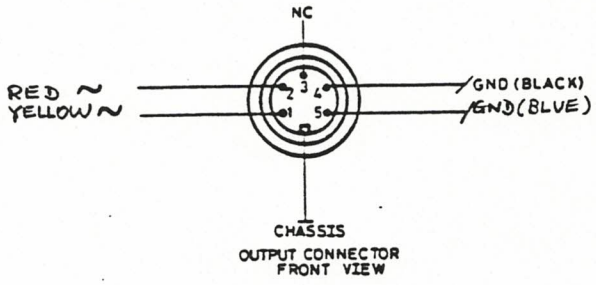
19.0 Connectors.

The connection at the input and output connectors are shown below.

CONNECTORS AT P400



VA1



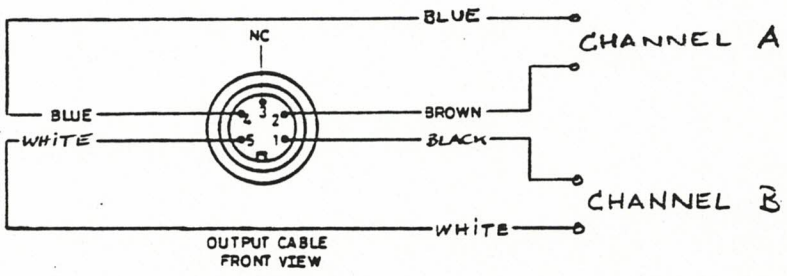
OUTPUT

NC = NO CONNECTION

Pin 2 and 4 are shorted internally

Pin 1 and 5 are shorted internally

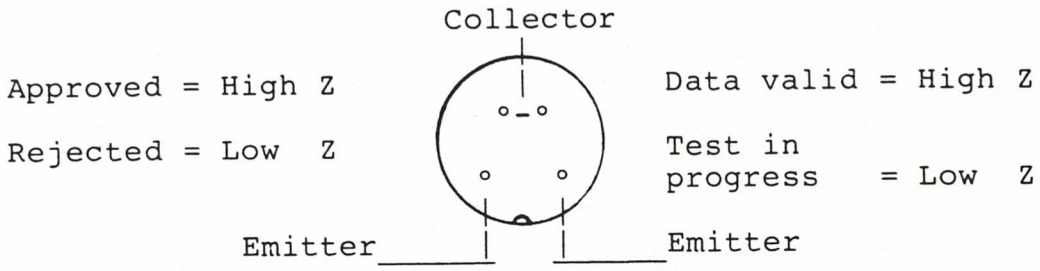
CVA2 (Including Impedance Module)



WARNING! CVA2 outputs are floating. Do not short output to ground.

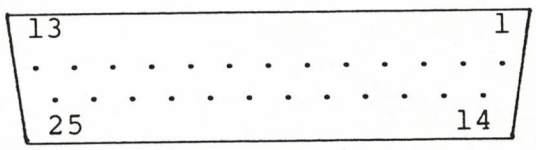
NC-NO CONNECTION

19.1 MULTIPLEXER OUTPUT (Front View)

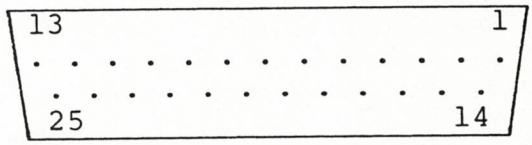


19.2 25 PINS CONNECTORS

PRINTER



ANALOG I/O



Pin No.	Signal	Printer	Analog I/O
1	No connection		
2	Transmitted data (TD)	x	
3	Received data (RD)	x	
4	Request to send (RTS)	x	
5	Clear to send (CTS)	x	
6	No connection		
7	RS 232 ground	x	
8	+ 15 volt		x
9	- 15 volt		x
10	Back panel setting "2"	x	x
11	Generator active (ON)	x	x
12	Filter OUT B-		x
13	Analog ground		x
14	Automatic mute		x
15	+ 5V DC		
16*	Generator OUT +		x
17*	Generator OUT -		x
18*	Generator IN +		x
19*	Generator IN -		x
20	External filter B-		x
21	External filter B+		x
22	Back panel setting "1"	x	x
23	Back panel setting "4"	x	x
24	Filter OUT B+		x
25	Digital ground		x

* Remember to use shorting plug when a compressor (or other option) is not connected. The shorting plug connects pin 16 to pin 18 and pin 17 to pin 19.

20.0 RELATIVE TOLERANCE BAND COMPENSATION CURVE (CO)

Some frequency response curves are irregularly shaped which can make it difficult to see deviations from a reference curve or a given tolerance band. Therefore it may be advantageous to convert the absolute tolerance band to a relative tolerance band and to display deviations as relative deviations from a reference.

In case two identical curves are deducted from each other, the resulting curve is a straight horizontal line. The measuring computer P400 can be programmed in such a way that a frequency response curve taken from a unit under test is automatically deducted from a reference curve and the relative deviations from a straight line displayed in a given tolerance band. To make use of this feature the following programming steps have to be carried out:

(1)
Run a frequency response curve in channel A and display it on the CRT as a green curve.

(2)
Draw a horizontal straight A reference line in the upper third of the CRT:

Enter reference menu.
Press key 6 (GENERATE REF CURVES WITH CURSOR).
Press key 1 (A REFERENCE).
Move the cursor to the upper third of the CRT
Press key 4 (ENTER KEYPOINT).
Make a note of the dB-value of the cursor.
Press REFERENCE KEY to exit the menu.

(3)
Subtract green frequency response curve from horizontal straight reference curve (yellow):

Enter CURVE MENU.
Press key 5 (SUM AND SUBTR OF CURVES).
Press key 2 (A - A REFERENCE STORED IN A).
The resulting curve of this subtraction is a compensation curve. It is used for subtraction from each response taken afterwards and changes the resulting response into a more or less straight line.
Press CURVE KEY to exit the menu.

(4)
Transfer of compensation curve into EE-PROM memory cassette:

Press REFERENCE KEY.
Press key 3 to change curve into a reference curve.
Press key 9 and save this reference curve in the memory cassette under the name CO (name).
Press REFERENCE KEY to exit the menu.

(5)
Draw the tolerance band for the relative response by going through the following steps:

Press REFERENCE KEY to enter the menu.
Press key 6 (GENERATE REF CURVES WITH CURSOR).
Press key 1 (A REFERENCE).
Press STATUS KEY to switch on display of cursor movement.
Move the cursor upwards until it reaches a chosen number of dB above the cursor value noted under item 2, e.g. + 2 dB.
Press key 4 (ENTER KEYPOINT) after which upper limit is stored.
Press STATUS KEY to bring the menu back on the display.
Press key 3 (switch to lower limit).
Press key STATUS to switch on display of cursor movement.
Move cursor downwards until it reaches the required distance from the upper limit.
Press key 4 (ENTER KEYPOINT) after which the relative tolerance band is gone.
Press (STATUS KEY) to bring menu back on the display.
Press (REFERENCE KEY) to exit the menu.

(6)
Transfer the relative tolerance band into the EE-PROM memory cassette:

Press (REFERENCE KEY) to enter the menu.
Press key 9 and save the tolerance band under H1 (name) in case of headphones or L1 (name) in case of loudspeakers.

The relative tolerance band and a compensation curve for the display of relative deviations have now been programmed. A manual test of the programme described above can be made by going through the following steps:

Make a frequency response.
Load the compensation curve from the cassette under its appropriate name CO (name).
Subtract the frequency response curve from the reference curve.
Load the tolerance band H1 (name) or L1 (name) from the memory cassette into the display.

The relative response is now displayed within the relative tolerance band.

In case the tolerance band needs modifications, it can be changed by entering the reference menu and activating key 3 or 4 respectively. Individual tolerance decreases or increases can be drawn this way. After the changes have been carried out, the original tolerance band H1 (name) or L1 (name) has to be deleted from the memory cassette and the modified tolerance band has to be programmed into the cassette. Further details, see operational manual item 2.4.

21.1.1 **CVA2 OUTPUT VALUE CROSS REFERENCE**
HIGH VOLTAGE RANGE
Max. 20 V RMS 4 Amp.

DB 0	VOLT 20	DB-20.2	VOLT 1.95
DB-.3	VOLT 19.3	DB-20.6	VOLT 1.86
DB-.7	VOLT 18.4	DB-21	VOLT 1.78
DB-1.1	VOLT 17.6	DB-21.3	VOLT 1.72
DB-1.5	VOLT 16.8	DB-21.7	VOLT 1.64
DB-1.8	VOLT 16.2	DB-22.1	VOLT 1.57
DB-2.2	VOLT 15.5	DB-22.5	VOLT 1.5
DB-2.6	VOLT 14.8	DB-22.8	VOLT 1.44
DB-3	VOLT 14.1	DB-23.2	VOLT 1.38
DB-3.3	VOLT 13.6	DB-23.6	VOLT 1.32
DB-3.7	VOLT 13.0	DB-24	VOLT 1.26
DB-4.1	VOLT 12.4	DB-24.3	VOLT 1.21
DB-4.5	VOLT 11.9	DB-24.7	VOLT 1.16
DB-4.8	VOLT 11.5	DB-25.1	VOLT 1.11
DB-5.2	VOLT 10.9	DB-25.5	VOLT 1.06
DB-5.6	VOLT 10.4	DB-25.8	VOLT 1.02
DB-6	VOLT 10.0	DB-26.2	VOLT .98
DB-6.3	VOLT 9.68	DB-26.6	VOLT .935
DB-6.7	VOLT 9.24	DB-27	VOLT .893
DB-7.1	VOLT 8.83	DB-27.3	VOLT .863
DB-7.5	VOLT 8.43	DB-27.7	VOLT .824
DB-7.8	VOLT 8.14	DB-28.1	VOLT .787
DB-8.2	VOLT 7.78	DB-28.5	VOLT .752
DB-8.6	VOLT 7.43	DB-28.8	VOLT .726
DB-9	VOLT 7.09	DB-29.2	VOLT .693
DB-9.3	VOLT 6.85	DB-29.6	VOLT .662
DB-9.7	VOLT 6.54	DB-30	VOLT .632
DB-10.1	VOLT 6.25	DB-30.7	VOLT .583
DB-10.5	VOLT 5.97	DB-31.5	VOLT .532
DB-10.8	VOLT 5.76	DB-32.2	VOLT .491
DB-11.2	VOLT 5.50	DB-33	VOLT .448
DB-11.6	VOLT 5.26	DB-33.7	VOLT .413
DB-12	VOLT 5.02	DB-34.5	VOLT .377
DB-12.3	VOLT 4.85	DB-35.2	VOLT .348
DB-12.7	VOLT 4.63	DB-36	VOLT .317
DB-13.1	VOLT 4.42	DB-36.7	VOLT .292
DB-13.5	VOLT 4.22	DB-37.5	VOLT .267
DB-13.8	VOLT 4.08	DB-38.2	VOLT .246
DB-14.2	VOLT 3.9	DB-39	VOLT .224
DB-14.6	VOLT 3.72	DB-39.7	VOLT .207
DB-15	VOLT 3.55	DB-40.5	VOLT .189
DB-15.3	VOLT 3.43	DB-41.2	VOLT .174
DB-15.7	VOLT 3.28	DB-42	VOLT .159
DB-16.1	VOLT 3.13	DB-43.5	VOLT .134
DB-16.5	VOLT 2.99	DB-45	VOLT .112
DB-16.8	VOLT 2.89	DB-46.5	VOLT .095
DB-17.2	VOLT 2.76	DB-48	VOLT .08
DB-17.6	VOLT 2.63	DB-51	VOLT .056
DB-18	VOLT 2.51	DB-54	VOLT .04
DB-18.3	VOLT 2.43	DB-57	VOLT .028
DB-18.7	VOLT 2.32	DB-60	VOLT .02
DB-19.1	VOLT 2.21	DB-66	VOLT .01
DB-19.5	VOLT 2.11		
DB-19.8	VOLT 2.04		

21.1.2 **CVA2 OUTPUT VALUE CROSS REFERENCE**
LOW VOLTAGE RANGE
Max. 5 V RMS 4 Amp.

DB 0	VOLT 5
DB-.3	VOLT 4.83
DB-.7	VOLT 4.613
DB-1.1	VOLT 4.405
DB-1.5	VOLT 4.207
DB-1.8	VOLT 4.064
DB-2.2	VOLT 3.881
DB-2.6	VOLT 3.707
DB-3	VOLT 3.54
DB-3.3	VOLT 3.42
DB-3.7	VOLT 3.266
DB-4.1	VOLT 3.119
DB-4.5	VOLT 2.978
DB-4.8	VOLT 2.877
DB-5.2	VOLT 2.748
DB-5.6	VOLT 2.624
DB-6	VOLT 2.506
DB-6.3	VOLT 2.421
DB-6.7	VOLT 2.312
DB-7.1	VOLT 2.208
DB-7.5	VOLT 2.108
DB-7.8	VOLT 2.037
DB-8.2	VOLT 1.945
DB-8.6	VOLT 1.858
DB-9	VOLT 1.774
DB-9.3	VOLT 1.714
DB-9.7	VOLT 1.637
DB-10.1	VOLT 1.563
DB-10.5	VOLT 1.493
DB-10.8	VOLT 1.442
DB-11.2	VOLT 1.377
DB-11.6	VOLT 1.315
DB-12	VOLT 1.256
DB-12.3	VOLT 1.213
DB-12.7	VOLT 1.159
DB-13.1	VOLT 1.107
DB-13.5	VOLT 1.057
DB-13.8	VOLT 1.021
DB-14.2	VOLT .975
DB-14.6	VOLT .931
DB-15	VOLT .889
DB-15.3	VOLT .859
DB-15.7	VOLT .82
DB-16.1	VOLT .783
DB-16.5	VOLT .748
DB-16.8	VOLT .723
DB-17.2	VOLT .69
DB-17.6	VOLT .659
DB-18	VOLT .629
DB-18.3	VOLT .608
DB-18.7	VOLT .581
DB-19.1	VOLT .555
DB-19.5	VOLT .53
DB-19.8	VOLT .512
DB-20.2	VOLT .489
DB-20.6	VOLT .467
DB-21	VOLT .446
DB-21.3	VOLT .43
DB-21.7	VOLT .411
DB-22.1	VOLT .393
DB-22.5	VOLT .375
DB-22.8	VOLT .362
DB-23.2	VOLT .346
DB-23.6	VOLT .33
DB-24	VOLT .315
DB-24.3	VOLT .305
DB-24.7	VOLT .291
DB-25.1	VOLT .278
DB-25.5	VOLT .265
DB-25.8	VOLT .256
DB-26.2	VOLT .245
DB-26.6	VOLT .234
DB-27	VOLT .223
DB-27.3	VOLT .216
DB-27.7	VOLT .206
DB-28.1	VOLT .197
DB-28.5	VOLT .188
DB-28.8	VOLT .182
DB-29.2	VOLT .173
DB-29.6	VOLT .166
DB-30	VOLT .158
DB-30.7	VOLT .146
DB-31.5	VOLT .133
DB-32.2	VOLT .123
DB-33	VOLT .112
DB-33.7	VOLT .103
DB-34.5	VOLT .094
DB-35.2	VOLT .087
DB-36	VOLT .079
DB-36.7	VOLT .073
DB-37.5	VOLT .067
DB-38.2	VOLT .062
DB-39	VOLT .056
DB-39.7	VOLT .052
DB-40.5	VOLT .047
DB-41.2	VOLT .044
DB-42	VOLT .04
DB-43.5	VOLT .033
DB-45	VOLT .028
DB-46.5	VOLT .024
DB-48	VOLT .02
DB-51	VOLT .014
DB-54	VOLT .01

21.2.1 CVA2 OUTPUT VALUE CROSS REFERENCE
HIGH CURRENT RANGE Max 2 Amp.

DB 0	AMP 2
DB-.3	AMP 1.9321
DB-.7	AMP 1.8451
DB-1.1	AMP 1.7621
DB-1.5	AMP 1.6828
DB-1.8	AMP 1.6257
DB-2.2	AMP 1.5525
DB-2.6	AMP 1.4826
DB-3	AMP 1.4159
DB-3.3	AMP 1.3678
DB-3.7	AMP 1.3063
DB-4.1	AMP 1.2475
DB-4.5	AMP 1.1913
DB-4.8	AMP 1.1509
DB-5.2	AMP 1.0991
DB-5.6	AMP 1.0496
DB-6	AMP 1.0024
DB-6.3	AMP .9683
DB-6.7	AMP .9248
DB-7.1	AMP .8831
DB-7.5	AMP .8434
DB-7.8	AMP .8148
DB-8.2	AMP .7781
DB-8.6	AMP .7431
DB-9	AMP .7096
DB-9.3	AMP .6855
DB-9.7	AMP .6547
DB-10.1	AMP .6252
DB-10.5	AMP .5971
DB-10.8	AMP .5768
DB-11.2	AMP .5508
DB-11.6	AMP .5261
DB-12	AMP .5024
DB-12.3	AMP .4853
DB-12.7	AMP .4635
DB-13.1	AMP .4426
DB-13.5	AMP .4227
DB-13.8	AMP .4083
DB-14.2	AMP .39
DB-14.6	AMP .3724
DB-15	AMP .3557
DB-15.3	AMP .3436
DB-15.7	AMP .3281
DB-16.1	AMP .3134
DB-16.5	AMP .2992
DB-16.8	AMP .2891
DB-17.2	AMP .2761
DB-17.6	AMP .2637
DB-18	AMP .2518
DB-18.3	AMP .2432
DB-18.7	AMP .2323
DB-19.1	AMP .2218
DB-19.5	AMP .2119
DB-19.8	AMP .2047
DB-20.2	AMP .1954
DB-20.6	AMP .1867
DB-21	AMP .1783
DB-21.3	AMP .1722
DB-21.7	AMP .1644
DB-22.1	AMP .157
DB-22.5	AMP .15
DB-22.8	AMP .1449
DB-23.2	AMP .1384
DB-23.6	AMP .1321
DB-24	AMP .1262
DB-24.3	AMP .1219
DB-24.7	AMP .1164
DB-25.1	AMP .1112
DB-25.5	AMP .1062
DB-25.8	AMP .1026
DB-26.2	AMP .098
DB-26.6	AMP .0935
DB-27	AMP .0893
DB-27.3	AMP .0863
DB-27.7	AMP .0824
DB-28.1	AMP .0787
DB-28.5	AMP .0752
DB-28.8	AMP .0726
DB-29.2	AMP .0693
DB-29.6	AMP .0662
DB-30	AMP .0632
DB-30.7	AMP .0583
DB-31.5	AMP .0532
DB-32.2	AMP .0491
DB-33	AMP .0448
DB-33.7	AMP .0413
DB-34.5	AMP .0377
DB-35.2	AMP .0348
DB-36	AMP .0317
DB-36.7	AMP .0292
DB-37.5	AMP .0267
DB-38.2	AMP .0246
DB-39	AMP .0224
DB-39.7	AMP .0207
DB-40.5	AMP .0189
DB-41.2	AMP .0174
DB-42	AMP .0159
DB-43.5	AMP .0134
DB-45	AMP .0112

21.2.2 CVA2 OUTPUT VALUE CROSS REFERENCE
LOW CURRENT RANGE Max 20 mA

DB 0	MAMP 20
DB-.3	MAMP 19.321
DB-.7	MAMP 18.4514
DB-1.1	MAMP 17.621
DB-1.5	MAMP 16.8279
DB-1.8	MAMP 16.2566
DB-2.2	MAMP 15.5249
DB-2.6	MAMP 14.8262
DB-3	MAMP 14.1589
DB-3.3	MAMP 13.6782
DB-3.7	MAMP 13.0626
DB-4.1	MAMP 12.4747
DB-4.5	MAMP 11.9132
DB-4.8	MAMP 11.5088
DB-5.2	MAMP 10.9908
DB-5.6	MAMP 10.4961
DB-6	MAMP 10.0237
DB-6.3	MAMP 9.6834
DB-6.7	MAMP 9.2476
DB-7.1	MAMP 8.8314
DB-7.5	MAMP 8.4339
DB-7.8	MAMP 8.1476
DB-8.2	MAMP 7.7809
DB-8.6	MAMP 7.4307
DB-9	MAMP 7.0963
DB-9.3	MAMP 6.8554
DB-9.7	MAMP 6.5468
DB-10.1	MAMP 6.2522
DB-10.5	MAMP 5.9708
DB-10.8	MAMP 5.7681
DB-11.2	MAMP 5.5085
DB-11.6	MAMP 5.2605
DB-12	MAMP 5.0238
DB-12.3	MAMP 4.8532
DB-12.7	MAMP 4.6348
DB-13.1	MAMP 4.4262
DB-13.5	MAMP 4.227
DB-13.8	MAMP 4.0835
DB-14.2	MAMP 3.8997
DB-14.6	MAMP 3.7242
DB-15	MAMP 3.5566
DB-15.3	MAMP 3.4358
DB-15.7	MAMP 3.2812
DB-16.1	MAMP 3.1335
DB-16.5	MAMP 2.9925
DB-16.8	MAMP 2.8909
DB-17.2	MAMP 2.7608
DB-17.6	MAMP 2.6365
DB-18	MAMP 2.5179
DB-18.3	MAMP 2.4324
DB-18.7	MAMP 2.3229
DB-19.1	MAMP 2.2183
DB-19.5	MAMP 2.1185
DB-19.8	MAMP 2.0466
DB-20.2	MAMP 1.9545
DB-20.6	MAMP 1.8665
DB-21	MAMP 1.7825
DB-21.3	MAMP 1.722
DB-21.7	MAMP 1.6445
DB-22.1	MAMP 1.5705
DB-22.5	MAMP 1.4998
DB-22.8	MAMP 1.4489
DB-23.2	MAMP 1.3837
DB-23.6	MAMP 1.3214
DB-24	MAMP 1.2619
DB-24.3	MAMP 1.2191
DB-24.7	MAMP 1.1642
DB-25.1	MAMP 1.1118
DB-25.5	MAMP 1.0618
DB-25.8	MAMP 1.0257
DB-26.2	MAMP .9796
DB-26.6	MAMP .9355
DB-27	MAMP .8934
DB-27.3	MAMP .863
DB-27.7	MAMP .8242
DB-28.1	MAMP .7871
DB-28.5	MAMP .7517
DB-28.8	MAMP .7262
DB-29.2	MAMP .6935
DB-29.6	MAMP .6623
DB-30	MAMP .6325
DB-30.7	MAMP .5835
DB-31.5	MAMP .5321
DB-32.2	MAMP .4909
DB-33	MAMP .4477
DB-33.7	MAMP .4131
DB-34.5	MAMP .3767
DB-35.2	MAMP .3476
DB-36	MAMP .317
DB-36.7	MAMP .2924
DB-37.5	MAMP .2667
DB-38.2	MAMP .2461
DB-39	MAMP .2244
DB-39.7	MAMP .207
DB-40.5	MAMP .1888
DB-41.2	MAMP .1742
DB-42	MAMP .1589
DB-43.5	MAMP .1337
DB-45	MAMP .1125
DB-46.5	MAMP .0946
DB-48	MAMP .0796
DB-51	MAMP .0564
DB-54	MAMP .0399
DB-57	MAMP .0283
DB-60	MAMP .02
DB-66	MAMP .01

APPENDIX A

QUICK FILE REFERENCE

Necessary and Optional Files

for

Programming of P400

LOUDSPEAKERS

HEADPHONES) NOT THE
MICROPHONES) L-VERSION

ORTOFON INSTRUMENTS A/S

June 1987

LOUDSPEAKERS

	Necessary Measurings	Necessary Files	File Types	Optional Operations	Connected Files	File Types
1st pass		L1xxxx.S	Status file			
	Sensi-tivity			Compensa-tion of freq.resp.	COxxxx.C	Relative reference curve
	Freq.resp.	L1xxxx.C	Ref.band			
	Rub&buzz	L2xxxx.C	Ref.curve			
2nd pass		L3xxxx.S	Status file			
	Polarity	(No curves needed)				
3rd pass					L4xxxx.S	Status file
				User defined freq.resp.	L4xxxx.C	Ref.band
				(or)		
				User defined rub/buzz	L4xxxx.C	Ref.curve

HEADPHONES

(NOT L-VERSION)

	Necessary Measurings	Necessary Files	File Types	Optional Operations	Connected Files	File Types
1st pass		H1xxxx.S	Status file			
	Sensitivity Freq.resp. Channel balance	H1xxxx.C	Ref.band	Compensation of freq.resp.	COxxxx.C	Relative reference curve
2nd pass		H2xxxx.S	Status file			
	Rub/buzz	H2xxxx.C	Reference curve			
3rd pass		H3xxxx.S	Status file			
	Polarity	(No curves needed)				
4th pass					H4xxxx.S	Status file
				User defined freq. response	H4xxxx.C	Reference band
				(or)		
				User defined rub/buzz	H4xxxx.C	Reference curve

MICROPHONES

(NOT L-VERSION)

	Necessary Measurings	Necessary Files	File Types	Optional Operations	Connected Files	File Types
1st pass		M1xxxx.S	Status file			
	Sensi-tivity			Compensa-tion of freq.resp.	COxxxx.C	Relative reference curve
	Freq.resp.	M1xxxx.C	Ref.band			
	Compressor overload test	M2xxxx.C	Ref.curve			
2nd pass		M3xxxx.S	Status file			
	Polarity	(No curves needed)				
3rd pass					M4xxxx.S	Status file
				User defined freq.resp.	M4xxxx.C	Reference band
				Compressor overload test	M2xxxx.C	Reference from 1st pass