5 January 2005 – This contact update page has been added to the Acrobat document you have downloaded. Please disregard any contact information printed within the document.

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Note: Repairs and packages should be shipped to Suite 202

Dear System 200 Owner:

CONGRATULATIONS'. You have purchased the most advanced Real Time Analysis System ever offered to the Audio Professional in this price range. As you become more familiar with its functions, we think you will agree that its performance and features approach and often exceed those of analyzers costing thousands of dollars more. We have done everything possible to make the operation of your new System 200 Signal Analyzer simple and cybernetically human. We sincerely hope you will take the time to thoroughly read and digest this manual as you become familiar with the System 200. If you have any questions concerning its operation or specifications, please feel free to write me or call me any time. Have a good day.

IMPORTANT NOTICE - REGISTRATION OF SYSTEM 200 SIGNAL ANALYZERS:

Features and functions of the System 200 Signal Analyzer are a result of its running COMPUTER PROGRAMS which tell it what to do as opposed to Hard Wired Circuitry.

Like any computer, these programs need to be maintained from time to time in order to increase their efficiency, correct errors, and add new routines.

White Instruments, Inc. intends to keep a file on each System 200 Signal Analyzer shipped.

It is therefore EXTREMELY IMPORTANT that we have current ownership information for each unit. This information should include:

1. Owner's Name
2. Owner's Mailing Address
3. Owner's Shipping Address
4. Owner's Telephone Number
5. System 200 Mainframe Serial Number

If you are the original owner, please fill out and return the OWNER'S SERVICE CARD packed with your analyzer. If you sell the unit, please be so kind as to pass along this manual to the new owner and send us the above information. Also, please let us know if you should change

your address or telephone number.

Your cooperation in this matter will assure your receiving application bulletins, notification of option availability and smooth system updating.

1 UNPACKING:

1.01 INBOUND INSPECTION AND DAMAGE CLAIMS:

Your System 200 Signal Analyzer has been carefully packaged to avoid damage in shipment. If the unit has been damaged in shipment, SAVE ALL PACKING MATERIALS and file an IMMEDIATE claim with the carrier.

Our instruments are shipped with full insurance unless the buyer instructs otherwise under his self-insurance. Prompt inspection should be made upon delivery and any necessary claims made against the carrier, NOT White Instruments, Inc.

If your unit is delivered damaged please notify us at once and we will be happy to cooperate in obtaining repairs or a replacement.

1.02 INCLUDED WITH YOUR SYSTEM 200 SIGNAL ANALYZER:

The following should be packed with your unit:

1. A System 200 Signal Analyzer Mainframe
2. Ordered Accessories and Options, Installed
3. This Instruction Manual
4. A.C. POWER CORD
5. Patch Cord as follows:

   0.25” 2-Conductor Phone to XLR Male

   Type #A 101381 (see drawing in appendix)

   Note: This noise cord is equipped with a 330 ohm resistor between pins 1 & 2 of the XLR connector. Without this resistor there would be considerable high frequency roll-off of the signal when the microphone level pink noise is fed to the microphone input. This is due to the 15 volt microphone powering circuit.
6. One package containing four #10-24 x 0.5” Machine Screws and four Nylon Finishing Washers
7. The attached Owner Service Card

   Please complete and return immediately so that we may keep you continually updated – Thanks.

1.03 WARRANTY:

1. LIMITED WARRANTY

All our products are guaranteed against defects in materials and workmanship for one year from date of shipment. Our warranty is limited to repairing or replacing any product which fails during the warranty period from normal use. White Instruments, Inc. will not be liable for any damage resulting from the use of this instrument.

2. DAMAGE IN SHIPMENT

Our instruments are shipped with full insurance unless the buyer instructs otherwise under his self-insurance. Prompt inspection should be made upon delivery and any necessary claims made against the carrier. Damage received during shipment is the buyer's responsibility. Please notify us at once, and we will cooperate in obtaining repairs or a replacement.

3. RETURN SHIPMENT

Any instrument returned for repair should be safely packed and shipped PREPAID to us. Collect shipments **WILL NOT** BE ACCEPTED unless previously authorized. An explanation of the type of trouble encountered should accompany the instrument, or be sent to us separately in writing, or be transmitted by phone. Repairs and checks will be made promptly. Return will be made collect by the best way, or by the owner's choice of method.

Address all inquiries to: Our current address found on our web site

http://www.whiteinstruments.com/

2 POWER – CONNECTIONS AND SPECIFICATIONS:

2.01 IMPORTANT CAUTION

BEFORE CONNECTING THE POWER CORD TO THE ANALYZER, CHECK THE MAINS VOLTAGE AND ADJUST THE POWER SELECTOR SWITCH LOCATED ON THE REAR PANEL TO THE APPROPRIATE VOLTAGE.

2.02 NOMINAL A.C. VOLTAGES AND POWER:

115 VAC at 50 or 60 Hz – .75 amps

230 VAC at 50 or 60 Hz – .375 amps

2.03 FUSES:

115 VAC = 1.5 amp Slo Blo

230 VAC = 0.75 amp Slo Blo

3 INPUT CONNECTIONS:

3.01 FRONT PANEL CONNECTIONS:

3.01.01 MICROPHONE INPUT CONNECTOR

TYPE:	XLR Female
Pin No. 1:	Shield
Pin No. 2:	Circuit Low or "-"
Pin No. 3:	Circuit High or "+"
Input Impedance:	800 Q, Nominal Transformer Isolated and Balanced.

3.01.02 MICROPHONE POWER

The *MICROPHONE INPUT CONNECTOR* is equipped with 15 Volt microphone power. Condenser microphones drawing 1 milliamp or less current at 15 VDC can be powered directly from the System 200 Signal Analyzer Mainframe.

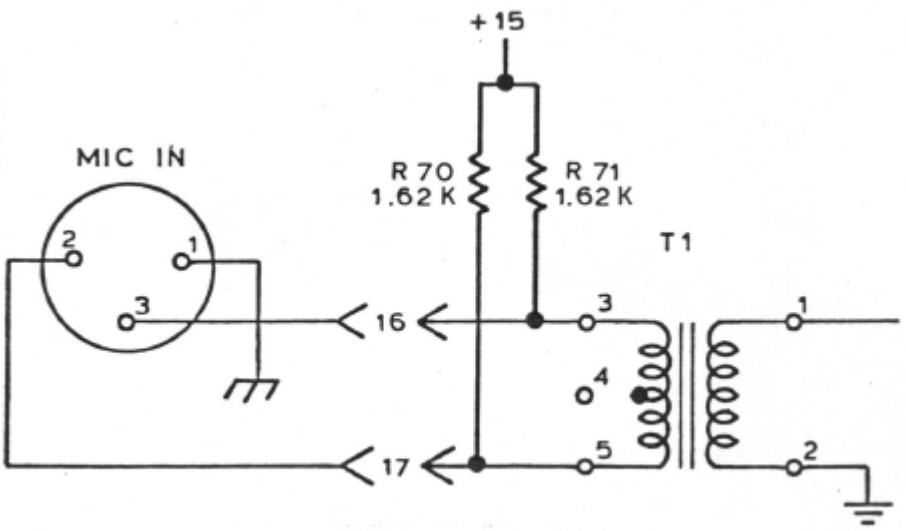


Figure 3.01

3.01.03 LINE LEVEL INPUT CONNECTOR

TYPE: .25” 2-Conductor Phone Jack with Normal Leaf

Tip: Circuit High or ”+” *LINE LEVEL INPUT*

Ring: See OUTPUT CONNECTIONS (Section 4)

Sleeve: Circuit Common

Input Impedance: 10k ohms, Minimum Unbalanced, Singled-Ended

Please refer to Figure 3.02

When a phone plug is inserted into the front panel *LINE LEVEL INPUT CONNECTOR*, the analyzer is switched from the *dB/spl MODE* to the *dBm MODE.*

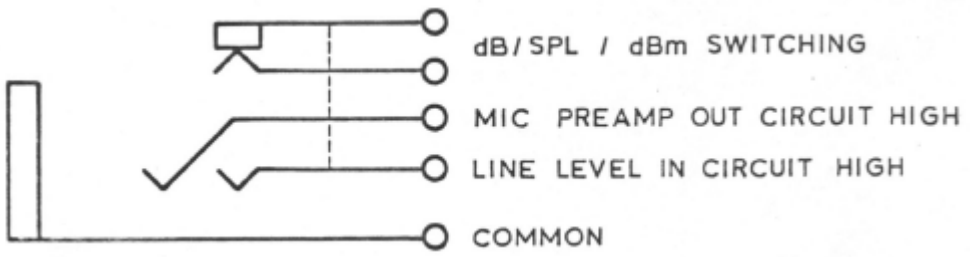


Figure 3.02

3.02 REAR PANEL CONNECTIONS:

3.02.01 LINE LEVEL INPUT CONNECTOR

TYPE: .25” 2-Conductor Phone Jack

Tip: Circuit High or ”+”

Ring: See OUTPUT CONNECTIONS (Section 4)

Sleeve: Circuit Common

Input Impedance: >10k ohms, Minimum. Unbalanced, Single-Ended

NOTE: When using this *INPUT,* insert a dummy plug into the front panel *LINE LEVEL INPUT CONNECTOR.* If this not done...

1. The analyzer’s *PREAMP OUTPUT* will be shorted to the *LINE LEVEL INPUT.*
2. The analyzer will be in the *dB/spL MODE* instead of the *dBm MODE.*
3. See Section 3.01.03 and Figure 3.02

4 OUTPUT CONNECTIONS:

4.01 FRONT PANEL CONNECTIONS

4.01.01 PINK NOISE OUTPUT CONNECTOR

TYPE: .25” 2-Conductor Phone Jack

Tip: Circuit High or ”+”
Line Level Output O.175 V, Nominal
0 ohms, Nominal

Ring: Circuit High or ”+”
Microphone Level Output 0.010 V, Nominal
300 ohms, Nominal

Sleeve: Circuit Common

4.01.02 MICROPHONE PREAMP OUTPUT

Location: Ring of *LINE LEVEL INPUT CONNECTOR*
Maximum Operating Level: 7.8 Volt, Nominal
Output Impedance: 0 ohms, Nominal

4.02.01 OSCILLOSCOPE SYNC OUTPUT

TYPE: Barrier Terminal
Function: Supplies Sync to Externally Triggered Oscilloscope.
PLOT MODE: Supplies Pen Lift for Plotter
Please refer to Section 15.

4.02.02 PINK NOISE OUTPUT

TYPE: Barrier Terminal
Function: Line Level Pink Noise Circuit High or ”+”
Level: 0.775 Volt, Nominal
Source Impedance: 0 ohms, Nominal Unbalanced Single-Ended
Connect between terminals *PINK NOISE OUT* and *COMMON*.

4.02.03 OSCILLOSCOPE AND/OR PLOTTER PEAK OUTPUT

TYPE: Barrier Terminal
Function: Supplies Peak Amplitude Drive
l. Oscilloscope Input
2. Plotter ”Y” Axis Input
Please refer to Section 15

4.02.04 OSCILLOSCOPE AND/OR PLOTTER AVERAGE OUTPUT

TYPE: Barrier Terminal
Function: Supplies Average Amplitude Drive
l. Oscilloscope Input
2. Plotter ”Y” Axis Input
Please refer to Section 15

4.02.05 PLOTTER HORIZONTAL OUTPUT

TYPE: Barrier Terminal
Function: ”X” Axis Plotter Drive
Please refer to Section 15

4.02.06 COMNON

TYPE: Barrier Terminal
Function: Circuit Common

4.02.07 MICROPHONE PREAMP OUTPUT

TYPE:	.25” 2-Conductor Phone Jack
Location:	Rear Panel *LINE LEVEL INPUT JACK*
Tip:	See INPUT CONNECTIONS (Section 3)
Ring:	Circuit High or ”+” 7.8 Volt, Nominal 0 ohms, Nominal
Sleeve:	Common

5 SYSTEM INITIALIZATION:

5. 01 GENERAL:

The System 200 Signal Analyzer will INITIALIZE or REINITIALIZE upon:

1. Turning the power on with the *POWER SWITCH.*

   An interruption of mains power (pulling the cord) will shut the analyzer down. After reestablishing mains current, the *POWER SWITCH* must be pressed.

2. Inserting a connector into the front panel *LINE LEVEL INPUT JACK* or pulling this connector out.

5.02 INITIALIZATION – THE dBm MODE:

The System 200 will INITIALIZE in the *dBm MODE* if a connector is inserted into the front panel *LINE LEVEL INPUT JACK.*

INITIALIZATION parameters are as follows:

1. *dBm MODE*

2. *BASE LINE LEVEL* or Input Preamp Setting -30 dBm

3. *BANDWIDTH* – One-Third Octave Filters selected

4. DISPLAY MODES

A. *REAL TIME MODE*

B. *AVERAGE MODE*

5. *SMOOTHKING TIME* – Slow

6. *MONITOR DISPLAY* – Level

7. *WEIGHTING – FLAT MODE*

If a input signal is being fed to the System 200 Mainframe through its rear panel *LINE LEVEL INPUT CONNECTOR,* a dummy plug must be inserted in the front panel *LINE LEVEL INPUT CONNECTOR* so that the *dBm MODE* will be selected. Please refer to Figure 3.02

5.03 INITIALIZATION – THE dB/spl MODE:

The System **200 will** INITIALIZE in the *dB/spl MODE* if a connector IS NOT inserted into the front panel *LINE LEVEL INPUT JACK*.

INITIALIZATION parameters are as follows:

1. *dB/spl MODE*

2. *BASE LINE LEVEL* or Input Preamp Setting 70 dB/spl

3. *BANDWIDTH* – One-Third Octave Filters selected

4. DISPLAY MODES

5. *REAL TIME MODE*

6. *AVERAGE MODE*

7. SMOOTHING TIME – *SLOW*

8. MONITOR DISPLAY – *LEVEL*

9. WEIGHTING – *FLAT MODE*

6 INPUT LEVELS:

6.01 CONTROL:

Both microphone and *LINE LEVEL INPUT* levels are adjusted in 10 dB steps by the ▲▼ *KEYS* located on the *12-KEY KEYBOABD.*

The result of adjustment is the *BASE LINE VALUE* which is displayed on the *POSITION DISPLAY.* The *BASE LINE VALUE* changes in 10 dB steps as the *INPUT GAIN* is changed.

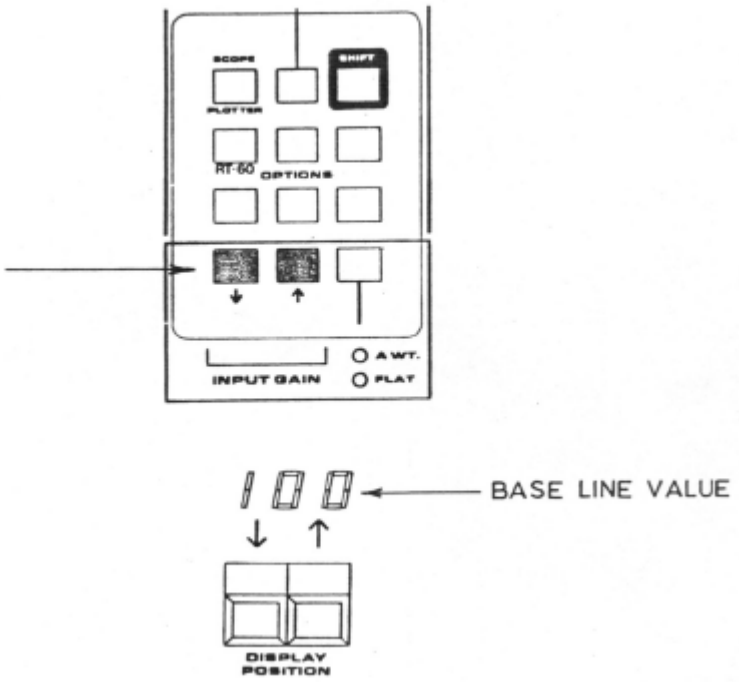


Figure 6.01

6.02 RANGE:

Line level inputs may be between...

-70 dBm and +40 dBm

BASE LINE VALUES are...

-70, -60, -50, -40, -30, -20, -10, 0 dBm

Microphone level inputs may be between...

30 dB/spl and 140 dB/spl

BASE LINE VALUES are...

30, 40, 50, 60, 70, 80, 90, 100 dB/spl

6.03 DYNAMIC RANGE (Processing):

The System 200 Signal Analyzer processes a dynamic range window of 46.5 dB.

Therefore...

If the *dBm BASE LINE VALUE* is adjusted to -10 dBm, the processing dynamic range is between -10 dBm and +36.5 dBm (-10 + 46.5 = 36.5).

Or...

If the *dB/spl BASE LINlE VALUE* is adjusted to 60 dB/spl, the processing dynamic range is between 60 dB/spl and 106.5 dB/spl (60 + 46.5 = 106.5).

For sake of simplicity we will refer to the dynamic range processing window as **45 dB** from this point forward.

6.04 OVER RANGE CONDITION

If the input signal is greater than the sum of the *BASE LINE VALUE* plus 45 dB, an OVER RANGE condition will exist. This is displayed on the *MONITOR DISPLAY* as…

OR

…or lights lit in the 0-R row of the *FILTER DISPLAY* and *BROADBAND DISPLAY.*

Adjust the *INPUT DISPLAY* ▼ to achieve an appropriately higher *BASE LINE VALUE.*

6.05 INPUT PREAMP OVERLOAD:

A LED. *PREAMP OVERLOAD INDICATOR* is located just below the *POWER SWITCH.*

This light indicates a clipping condition in the input preamplifier.

Clipping of the input preamplifier will occur at approximately 50 dB above the *BASE LINE VALUE.*

See Section 6.01 and 6.02

6.06 UNDER RANGE CONDITION:

If a signal equal to or less than the *BASE LINE VALUE* is input, an UNDER RANGE condition will exist. This is displayed on the *MONITOR DISPLAY* as…

UR

…Adjust the *INPUT GAIN KEY* ▲ to achieve an appropriately lower

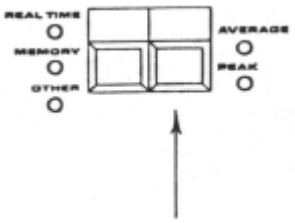
BASE LINE VALUE.

7 PROCESSING MODES:

7.01 GENERAL:

The System 200 Signal Analyzer processes in both *AVERAGE* and *PEAK MODES* simultaneously. Therefore, the *STORE IN MEMORY* and *ACCUMULATE IN MEMORY* functions as well as *REAL TZME* will be executed in both *AVERAGE* and *PEAK MODES* simultaneously.

The mode displayed is controlled by the *AVERAGE/PEAK CHANGE KEY*. The operation of this key is transient free since the System 200 is processing in both modes simultaneously.



Both the *PEAK MODE* and *AVERAGE MODE* may be simultaneously displayed.

Touch the *SHIFT KEY* located on the *12-KEY KEYBOARD.*

Touch the *PEAK/AVERAGE CHANGE KEY* until both the *PEAK* and *AVERAGE INDICATORS* are lit.

The analyzer will now toggle between *PEAK, AVERAGE* and *PEAK/AVERAGE.*

To exit this mode...

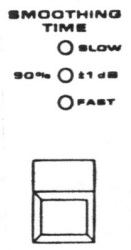
Touch the *SHIFT KEY*

Touch the PEAK/AVERAGE CHANGE KEY

7.02 AVERAGE MODE:

The *AVERAGE MODE* employs circuitry which smoothes or averages the signal according to one of the three time constants selected by the *SHOOTHING TIME CHANGE KEY.* See Section 8.

This smoothing, optimized for each frequency, provides a statistical probability of the signal's amplitude being ± a given number of dB from a light on the analyzer a given percentage of the time. The smoothing also provides a steady display, which may be easily read.



7.03 PEAK MODE:

The REAL TIME display in the *PEAE MODE* shows an almost instantaneous rise of the signal followed by a slow decay similar to many Peak Program Meters. The intended application of the *PEAK MODE* is program monitoring as opposed to acoustic analysis using *PINK NOISE.*

The signal's peaks or maximums are almost instantly stored by a capacitor in the circuitry. The capacitor's charge is slowly bled-off through a resistor to ground. The circuit, once charged, is immune to subsequent signal peaks unless they are greater than the capacitor's charge.

The decay or rate at which the capacitor's charge is bled-off may be selected with the *SMOOTHZNG TIME CHANGE KEY.* Selecting *SLOW* will result in a long decay which might be appropriate for monitoring Peak Program material. Selecting *FAST* will result in a very rapid decay.

9 FILTERS AND BANDWIDTH:

9.01 GENERAL:

The System **200** Mainframe will accommodate a total of 13 Filter cards. These cards carry the *ONE-THIRD OCTAVE, ONE-SIXTH OCTAVE, OCTAVE BAND,* or custom filters currently available.

The filter cards are coded with jumpers to tell the analyzer which filters they are. As a result, the cards need not be installed in any particular order as long as they are installed in the slots designated for filters. (See Drawing #B 101356 – Appendix).

Filter card slots 1 through 8 are powered separately from slots 9 through 13. It is therefore good practice to use the slots which allow a full set of filters to be powered from one power source (i.e. the switchable one-third octave/octave band, three-pole filter set, 200-01-00).

Presently the analyzer's software recognizes three filter sets as follows:

1. 30 *(1/3 OCTAVE FILTERS*)
2. 30 *1/6 OCTAVE FILTERS*
3. 10 *OCTAVE BAND FILTERS*

A maximum of 30 filters may be displayed on the *FILTER DISPLAY* at any one time.

The *1/3 OCTAVE* and the *1/6 OCTAVE FILTERS* are processing input data continuously when the analyzer is on. Thus, there is no settling time when switching the *FILTER DISPLAY* between them.

When the *OCTAVE BAND FILTERS* are selected, the program takes the *1/3 OCTAVE FILTERS* apart and uses some of their components to form the *OCTAVE BAND FILTERS*. As a result, the user must allow for settling when selecting in and out of the *OCTAVE BAND FILTER SET*.

9.02 200-01-00 OPTION: ONE-THIRD OCTAVE/OCTAVE BAND, THREE-POLE FILTER SET:

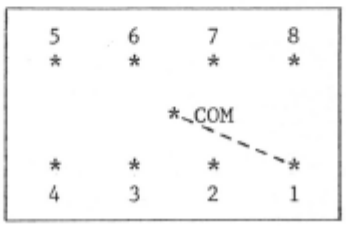
200-01-00 OPTION CHART

30 Three-Pole, One-Third Octave Filters (25 Hz thru 20 kHz, on I.S.O. centers)

SWITCHABLE TO –

10 Three-Pole, Octave Band Filters (31.5 Hz thru 16 kHz, on I.S.O. centers)

FILTER CARD PART NUMBER	RECOMMENDED FILTER CARD SLOT NUMBER	1/3 OCTAVE FREQUENCIES	OCTAVE BAND FREQUENCIES	JUMPER PATTERN
200-01-01	1	25 Hz - 50 Hz	31.5 Hz	COM to 1
200-01-02	2	63 Hz - 125 Hz	63 Hz, 125 Hz	COM to 2
200-01-03	3	160 Hz - 315 Hz	250 Hz	COM to 3
200-01-04	4	400 Hz - 800 Hz	500 Hz	COM to 4
200-01-05	5	1 kHz - 2 kHz	1 kHz, 2 kHz	COM to 5
200-01-06	6	2.5 kHz - 5.0 kHz	4 kHz	COM to 6
200-01-07	7	6.3 kHz - 12.5 kHz	8 kHz	COM to 7
200-01-08	8	16 kHz - 20 kHz	16 kHz	COM to 8



Example: JUMPER COM to 1

This is a set of 8 filter cards carrying 30 One-Third Octave, Three-Pole Filters from 25 Hz through 20 kHz on I.S.O. centers. In addition, there are 10 Octave Band, Three-Pole Filters on I.S.O. centers from 31.5 Hz through 16 kHz. The Octave Band Filters share some circuitry with the One-Third Octave Filters.

These filter cards are coded to respond when the *1/3* or *OCTAVE*

BANDWIDTH MODE is selected. They are factory installed in filter card slots 1 through 8.

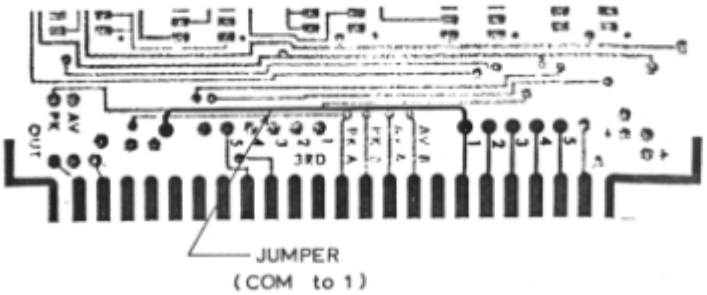
It should never be necessary to change the jumper pattern for this set of filters. (See Section 9.07). See the above 200-01-00 Option Chart.

9.03 200-02-00 OPTION: ONE-SIXTH OCTAVE, TWO-POLE FILTER SET:

200-02-00 OPTION CHART

30 Two-Pole, One-Sixth Octave Filters (40 Hz thru 1120 Hz, on I.S.O. centers)

FILTER CARD PART NUMBER	RECOMMENDED FILTER CARD SLOT NUMBER	1/6 OCTAVE FREQUENCIES	JUMPER PATTERN
200-02-02	9	40 Hz - 71 Hz	COM to 1
200-02-03	10	80 Hz - 140 Hz	COM to 2
200-02-04	11	160 Hz - 280 Hz	COM to 3
200-02-05	12	315 Hz - 560 Hz	COM to 4
200-02-06	13	630 Hz - 1120 Hz	COM to 5



This is a set of five filter cards carrying 30 One-Sixth Octave, Two-Pole Filters from 40 Hz through 1120 Hz on I.S.O. centers, corresponding to the White Instruments Models 4301 and 4303, One- Sixth Octave Equalizers.

These filter cards are coded to respond when the *1/6 MODE* is selected. If ordered, they are factory installed in filter card slots 9 through 13.

This filter set has three cards in common with the 200-03-00, 1/6 Octave filter option. When converting the analyzer between the two available 1/6 Octave options, it is necessary to re-jumper all five cards in the right order so that the filters displayed will correspond with the front panel nomenclature. (See Section 9.07).

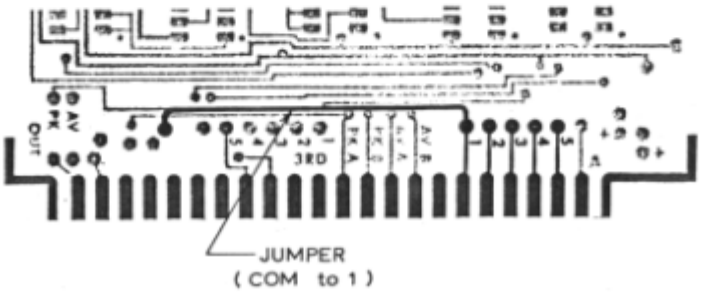
The above 200-02-00 Option Chart will specify the correct order and jumper patterns.

9.04 200-03-00 OPTION: ONE-SIXTH OCTAVE, TWO-POLE FILTER SET:

200-03-00 OPTION CHART

30 Two-Pole, One-Sixth Octave Filters (160 Hz thru 4.5 kHz, on I.S.O. centers)

FILTER CARD PART NUMBER	RECOMMENDED FILTER CARD SLOT NUMBER	1/6 OCTAVE FREQUENCIES	JUMPER PATTERN
200-02-04	9	160 Hz - 280 Hz	COM to [illegible]
200-02-05	10	315 Hz - 560 Hz	COM to [illegible]
200-02-06	11	630 Hz - 1120 Hz	COM to [illegible]
200-02-07	12	1250 Hz - 2240 Hz	COM to [illegible]
200-02-08	13	2500 Hz - 4500 Hz	COM to [illegible]



This is a set of five filter cards carrying 30 One-Sixth Octave, Two-Pole Filters from 160 Hz through 4500 Hz on I.S.O. centers corresponding to the White Instruments Models 4310 and 4311 One-Sixth Octave Equalizers. This filter set may also be used to tune the One-Sixth Octave section of the White Instruments Model 4240 Voice Range Equalizer.

These filter cards are coded to respond when the *1/6 MODE* is selected. If ordered, they are factory installed in filter card slots 9 through 13.

This filter set has three cards in common with the 200-02-00 One-Sixth Octave Filter option. When converting the analyzer between the two available One-Sixth Octave options, it is necessary to re-jumper all five cards in the right order so that the filters displayed will correspond with the front panel nomenclature, (See Section 9.07).

The above 200-03-00 Option Chart will specify the correct order and jumper patterns.

9.05 OTHER FILTER SETS:

The user may order custom filter sets from White Instruments which are uniquely suited to his particular application. In addition, other filter sets will become standard options in the future.

These filter sets will be delivered with new front panel overlays which are easily installed. New software may also be supplied.

When installed, the filters will respond as selected with the *BANDWIDTH CHANGE KEY* (See Section 9.06).

9.06 BANDWIDTH CHANGE KEY:

The *BANDWIDTH CHANGE KEY* selects the filter set(s) through which the signal passes for REAL TIME DISPLAY as well as MEMORY and TIME functions.

Upon INITIALIZATION the *BANDWIDTH CHANGE KEY* is set to toggle between *1/6, 1/3, OCTAVE,* etc., etc. As it toggles the appropriate *BANDWIDTH INDICATOR* L.E.D. lights up.

The *OTHER* position is reserved for future options such as large external filter sets. The use of these future options will require additional or updated software (Computer Programs). Therefore the *OTHER* position is locked out in the standard System 200 Mainframe.

A special mode which toggles only between *1/6* and *1/3* etc., etc. can be entered by touching the *SHIFT KEY* located on the *12-KEY KEYBOABD* then touching the *BANDWIDTH CHANGE KEY* twice.

Touch *SHIFT,* then *BANDWIDTH,* then *BANDWIDTH.*

Since the **1/6** and **1/3** filters are constantly processing and only the display is being changed, the switching will be transient free. The user will not have to wait for the filters to settle.

To exit this mode repeat the above steps and the System 200 will toggle between *1/6, 1/3,* and *OCTAVE.*

9.07 FILTER CARDS, CODES AND JUMPERS:

9.07.01 FILTER CARDS

At present, two types of filter cards are offered as options to the System 200 Signal Analyzer Mainframe.

l. One-Third Octave/Octave Band, Three-Pole, 200-01-01 through 200-01-08.

2. One-Sixth Octave, Two-Pole 200-02-01 through 200-02-08.

9.07.02 BANDWIDTH CODE

Each of these two basic types of filter cards are coded at the factory so that- the System 200 Signal Analyzer Mainframe will recognize them .when they are selected with the *BANDWIDTH CHANGE KEY.*

9.07.03 DISPLAY POSITION CODES AND JUMPERS

Each filter card is further coded with a jumper in order to sequentially position the filters properly on the *FILTER DISPLAY.* These jumper codes may be changed by the user.

In the case of the One-Third Octave/Octave Band filters, 200-01-00, it is not likely that the user will have an application which would require changing the jumpers to rearrange the *FILTER DISPLAY.*

In order to take economic advantage of the overlap in the filters included in the 200-02-00 and 200-03-00 One-Sixth Octave options it is necessary to re-jumper the cards when converting the analyzer from one One-Sixth Octave mode to the other.

Figure 9.01 illustrates the two One-Sixth Octave choices in light of the One-Sixth Octave equalizers currently available from White Instruments.

(See Figure 9.01).

60% or the 200-02-04, -05, -06 filter cards are common to both the 200-02-00 and 200-03-00 One-Sixth Octave options.

If the 200-02-00 One-Sixth Octave option was originally purchased, it is necessary only to purchase the 200-02-07 and 200-02-08 filter cards to convert the analyzer to the 200-02-00 option.

The analyzer does not care which slot a filter card is inserted in. Its software will cause the filters to be displayed on the *FILTER DISPLAY* from left to right, sequentially, according to the jumper pattern.

Example: The card jumpered, COM to 1 will occupy the FIRST six columns of the *FILTER D1SPLAY.*

Likewise...

The card jumpered COM to 5 will occupy the LAST six columns of the *FILTER DISPLAY.*

The tables in Sections 9.03 and 9.04 give the correct jumper patterns. Failure to jumper the cards correctly will cause the filters to be displayed out of order. Jumpering two cards alike will cause two filters to be displayed in the same column of the *FILTER DISPLAY.*

To facilitate jumper changes on the filter cards current production, the One-Sixth Octave cards are equipped with pin connectors. Retrofit kits containing these pin connectors are available for earlier analyzers upon request, or their installation will be routine when other factory retrofits are made to the analyzer.

10 WEIGHTING

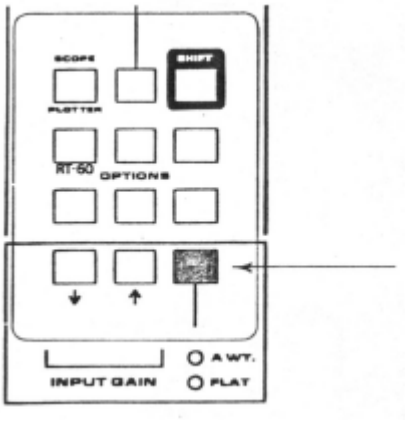
10.01 GENERAL

The System 200 Signal Analyzer Mainframe contains a built-in filter to ”A” weight a signal to meet A.N.S.I. specifications.

Other weighting filters in addition to ”A” may be obtained from White Instruments as options. They are used, outboard, in series with the analyzer’s inputs.

Upon *INITIALIZATI0N* the analyzer is set to the *FLAT WEIGHTING MODE* and the appropriate *WEIGHTING INDICATOR* is lit.

A WEIGHTING is selected with the WEIGHTING CHANGE KEY 1ocated on the 12-KEY KEYBOARD.



11 LEVEL AND AMPLITUDE DISPLAYS

11.01 SPECTRUM DISPLAY

The *SPECTRUM DISPLAY* is a matrix of high intensity LEDs 30 wide by 16 high (including over range).

The purpose of this display is to indicate the amplitude of thirty separate *FILTER CHANNELS* simultaneously.

Resolution and Dynamic Range:

The user may assign one of three resolution values to each vertical light on the *SPECTRUM DISPLAY* by using the *RESOLUTION CHANGE KEY.*

They are...

1. *3 dB/Light*

2. *2 dB/Light*

3. *1 dB/Light*

If *3 dB/Light* is selected, 45 dB dynamic range plus over range is the maximum dynamic range which may be displayed (15 lights **X** 3 dB/Light = 45).

Likewise, 30 dB dynamic range may be viewed if *2 dB/Light* is chosen, and 15 dB if *1 dB/Light* is chosen. When either *1 dB/Light* or *2 dB/Light RESOLUTION* is selected, the *SPECTRUM DISPLAY* may be rolled up or down to view the maxi- mum dynamic range which the analyzer processes. This is accomplished with the *DISPLAY POSITION KEYS.*

11. 02 BROADBAND COLUMN:

The *BROADBAND COLUMN* is a column of high intensity LEDs, 16 high (including over range).

Using Pink Noise, the energy in any *FILTER CHANNEL* will be less than the broadband energy. (See Section 17) The purpose of this display is to indicate the calibrated *BROADBAND LEVEL.*

The *BROADBAND COLUMN* follows the *SPECTRUM DISPLAY.* That **is,** its dynamic range is identical (45 dB). Its resolution **is** changed as the *SPECTRUM DISPLAY'S* is changed, and it rolls up or down with the *SPECTRUM DISPLAY.* (See 11.01)

11.03 POSITION DISPLAY:

The *POSITION DISPLAY* is a three digit, seven segment, LED indicator. It has two functions:

1. Display of the *BASE LINE VALUE*.
2. Display of **FREQUENCY** when the VERTICAL CURSER is used. (See Section 16)

The *BASE LINE VALUE* may be defined as the lowest amplitude or floor of the analyzer's 45 dB dynamic range processing window.

This value is set upon *INITIALIZATION* or with the ▲▼ *KEYS* located on the *12 KEY KEYBOARD.* (See Section 6) When the value of a light (see 11.01 and 11.02) on the *SPECTRUM DISPLAY* or *BROADBAND COLUMN* is added to the *BASE LINE VALUE* indicated on the *POSITION DISPLAY,* the sum is the level of the *FILTER CHANNEL* or the *BROADBAND LEVEL* in dBm or dB – spl.

For example...

The *POSITION DISPLAY* indicates 70 dB-spl. The fifth light on the *BROADBAND COLUMN* is lit. The *RESOLUTION* is set at *3 dB/Light.*

Multiply...

3 dB/Light X 5 (fifth light) = 15 dB-spl

Then Add...

15 dB-spl + 70 dB-spl *(BASE LINE VALUE)* = 85 dB-spl

When the *RESOLUTION* is set to 1 *dB/Light* or 2 *dB/Light,* the *SPECTRUM DISPLAY* and *BROADBAND COLUMN* may be rolled up or down in order to view the entire 45 dB dynamic range window. (See 11.01 and 11.02)

When this is done the *BASE LINE VALUE,* indicated on the *POSITION DISPLAY,* changes accordingly.

11.04 MONITOR DISPLAY:

The *MONITOR DISPLAY* is a four digit, seven segment, LED indicator. It has many functions, most of which are associated with future options White Instruments will offer for the System 200 Signal Analyzer.

11.04.01 LEVEL MODE

When in the *LEVEL MODE,* the *MONITOR DISPLAY* will indicate the *BROADBAND LEVEL* to the nearest 0.5 dB.

If the *VERTICAL CURSER* (see Section 16) is used to address the *BROADBAND COLUMN* or any of the 30 *FILTER CHANNELS* the *MONITOR DISPLAY* will indicate that level to the nearest 0.5 dB.

11.04.02 TIME MODE

When in the T_{60} *MODE,* the *MONITOR DISPLAY* will indicate extrapolated T_{60} Times. (See Section 17)

12 DISPLAY MODES

12.01 DISPLAY MODE CHANGE KEYS:

Two keys labeled *DISPLAY MODE* change the displays on the Analyzer. They are...

1. *REAL TIME* |

   MEMORY | -- ***CHANGE KEY***

   OTHER |

2. *AVERAGE* |

   | -- ***CHANGE KEY***

   PEAK |

When these keys are operated, the appropriate LED indicator will light, indicating the *DISPLAY MODE.*

12. 02 REAL TIME:

REAL TIME processing through the *FILTER SET(S)*, installed, is continuous as long as the Analyzer is on.

Upon *INITIALIZATION* the *REAL TIME MODE* is selected. To display *REAL TIME* step the *DISPLAY MODE CHANGE KEY* until the appropriate LED indicator lights.

During the *REAL TIME DISPLAY MODE*...

1. *REAL TIME* will be displayed on the *SPECTRUM DISPLAY* dynamically.
2. The *BROADBAND LEVEL* will be displayed on the *BROADBAND COLUMN* dynamically.
3. The *BASE LINE VALUE* will be displayed on the *POSITION DISPLAY.*
4. The *BROADBAND LEVEL* will be displayed on the *MONITOR DISPLAY,* to the nearest 0.5 dB, dynamically.

12.03 MEMORY:

The *MEMORY DISPLAY MODE* may be entered one of two ways:

1. By stepping the *DISPLAY MODE CHANGE KEY* until the *MEMORY INDICATOR* lights.

   In this case, the *LAST ACCESSED MEMORY* will be displayed. Upon *INITIALIZATION,* the *LAST ACCESSED MEMORY* is always *Memory #1.*

2. By selecting the memory (1 through 8) to be displayed. Touch one of the *MEMORY ADDRESS KEYS* located on the *MEMORY CONTROL KEYBOARD.* Then touch the *PLOTTER/DISPLAY KEY* located on the same keyboard.

   Touch **M3** then *PLOTTER/DISPLAY.*

   The selected memory now becomes the *LAST ACCESSED MEMORY.*

When a memory is displayed the Analyzer's indicators and displays change to show the exact conditions under which the response was originally stored. (See 13.03)

12.04 OTHER

The *OTHER DISPLAY MODE* is reserved for options which can either be included in the basic System 200 software or plug-in options. When the *OTHER DISPLAY MODE* is entered, one or more displays and keys are redefined.

12. 04.01 T_{60}

When the $\mathbf{T_{60}}$ *MODE* is entered, so is the *OTHER DISPLAY MODE.* Certain keys and displays are redefined. (See Section 17)

12.05 AVERAGE AND PEAK:

The System 200 Signal Analyzer processes in both *AVERAGE* and *PEAK MODES* simultaneously. Therefore, the *STORE IN MEMORY* and *ACCUMULATE IN MEMORY* functions as well as *REAL TIME* will be executed in both AVERAGE and PEAK when executed.

The *AVERAGE/PEAK CHANGE KEY* selects either the *Average* information or *Peak* information for display in either *REAL TIME* or ***MEMORY.***

Stepping the *AVERAGE/PEAK CHANGE KEY* will change the display mode as well; as all other appropriate indicators and displays from *AVERAGE* to *PEAK*, etc. Its operation is transient free.

13 MEMORY:

13.01 GENERAL
13.02 STORE IN MEMORY
13.03 DISPLAY IN MEMORY(IES)
13.04 ACCUMULATE IN MEMORY(IES) – STOP ACCUMULATION
13.05 LOAD IN MEMORY

13.01 GENERAL:

The following Memory Functions are programmed into the System 200 Mainframe. Other Memory Functions may be added in the future as options.

1. *STORE IN MEMORY*
2. *DISPLAY MEMORY(IES)*
3. *ACCUMULATE IN MEMORY(IES) – STOP ACCUMULATION*
4. *LOAD IN MEMORY*

13.02 STORE IN MEMORY

The *STORE IN MEMORY* function takes a snapshot of 45 dB of dynamic range from *REAL TIME*, simultaneously in both *PEAK* and *AVERAGE* and stores it in a selected memory along with the following data:

1. *dBm* Or *dB/spl MODE* selected
2. *BASE LINE VALUE*
3. *BROADBAND LEVEL*
4. *SMOOTHING TIME* selected
5. *FLAT* Or *"A" .WEIGHTING* selected
6. *FILTER SET* used

Touch a *MEMORY ADDRESS KEY* located on . the *MEMORY CONTROL KEYBOARD.* Then, at the exact moment you wish to store the response you are viewing on the *FILTER DISPLAY,* touch the *STORE KEY* located on the same keyboard.

Touch ***M2*** then *STORE.*

13.03 DISPLAY MEMORY(IES):

The contents of one to three different memories may be displayed as follows:

1. Step the *DISPLAY MODE CHANGE KEY* to the *MEMORY DISPLAY MODE*.

The contents of the *LAST ACCESSED MEMORY* along with the conditions under which the data was stored will be displayed on the *SPECTRUM DISPLAY* and other indicators in either the *AVERAGE* or *PEAK MODES* depending on the condition of the ***AVERAGE/PEAK CHANGE KEY.***

2. Touch up to three *MEMORY ADDRESS KEYS* located on the *MEMORY CONTROL KEYBOARD.* Then touch the *MEMORY DISPLAY KEY* located on the same keyboard.

Touch *M2* then *M3* then *M4* then *DISPLAY*

The cont ents of three memories will be displayed on the *SPECTRUM DISPLAY* in *AVERAGE* or *PEAK MODE* depending on the condition of the *AVERAGE/PEAK CHANGE KEY.*

The conditions under which the data was stored are displayed on the analyzer's other indicators only for the *LAST ADDRESSED MEMORY.* In the above example, the *LAST ADDRESSED MEMORY* was *MEMORY #4.*

45 dB Dynamic window range of *AVERAGE MODE* data as well as 45 dB dynamic window range of *PEAK MODE* data is always stored in a memory.

If the *RESOLUTION* selected is *3 dB/Light,* the entire 45 dB dynamic range window is displayed on the *SPECTRUM DISPLAY.* The user may select either *2 dB/Light* or *1 dB/Light* using the *RESOLUTION CHANGE KEY* and roll the *SPECTRUM DISPLAY* up or down using the *DISPLAY POSITION KEYS.*

13.04 ACCUMULATE IN MEMORY(IES) – STOP ACCUMULATION:

The System 200 Signal Analyzer can simultaneously accumulate signal maximums in two different memories in both *AVERAGE* and *PEAK MODES.*

When an accumulation function is in progress a L.E.D. indicator located under the *MEMORY CONTROL KEYBOARD* is lit.

The *ACCUMULATION FUNCTION* is completely independent from the data and responses being displayed on the System 200's *SPECTRUM DISPLAY, POSITION DISPLAY,* or *MONITOR DISPLAY*

During an *ACCUMULATION FUNCTION* the user may:

1. View *REAL TIME* in *AVERAGE* or *PEAK MODES* using the *DISPLAY MODE CHANGE KEY* and *AVERAGE/PEAK CHANGE KEY.*

2. View the *ACCUMULATION FUNCTION* in progress in *AVERAGE* or *PEAK MODES* by displaying the memory in which the *ACCUMULATION FUNCTION* is being stored.

3. View the contents of any other memory in *AVERAGE* or *PEAK MODES* by displaying that memory.

In the above cases the user may select *1, 2* or *3 dB/Light RESOLUTION* and roll the *SPECTRUM DISPLAY* up or down to view the entire 45 dB dynamic range window.

The user MAY NOT, however, change the *BANDWIDTH, SMOOTHING TIME, WEIGHTING* or *BASE LINE VALUE* selection during an *ACCUMULATION FUNCTION(S)*. To. do so will ABORT the *ACCUMULATION FUNCTION(S)*, but the analyzer **will not** catch fire.

An *ACCUMULATION FUNCTION* is started by touching a *MEMORY ADDRESS KEY* located on the *MEMORY CONTROL KEYBOARD*, and then touching the *ACCUMULATE KEY* located on the same keyboard. The *ACCUMULATE INDICATOR* light will come on.

Touch *M5* then *ACCUMULATE*.

To begin a second *ACCUMULATION FUNCTION*, choose another memory and repeat the above steps.

If the user starts a third *ACCUMULATION FUNCTION*, the first *ACCUMULATION FUNCTION* will be terminated and the data will remain stored as of the moment of termination.

If the user starts a fourth *ACCUMULATION FUNCTION*, the second *ACCUMULATION FUNCTION* will be terminated as above, etc., etc.

While either one or two *ACCUMULATION FUNCTIONS* are in progress, the user may *STORE IN MEMORY* in any unused memory (See Section 13.02).

The STOP ACCUMULATE command will stop ALL *ACCUMULATE FUNCTIONS*. To execute this command, touch the *SHIFT KEY* located on the *12-KEY KEYBOARD*, then touch the *ACCUMULATE/STOP KEY* located on the *MEMORY CONTROL KEYBOARD*

Touch *SHIFT* then *ACCUMULATE/STOP*.

The data will remain stored as of the moment the *ACCUMULATE/STOP KEY* was touched.

13.05 LOAD IN MEMORY

In order to expedite delivery of the new System 200 Signal Analyzer, this function was omitted to allow further software development.

This feature will be added at a later date by exchanging personality cards. Complete instructions will be included.

14 OPTIONS

14. 01 200-16-00 Intelligent, Internal I/O Controller
- **14.01.01** Load Memory Mode
- **14.01.02** Clear Memory Function
- **14.01.03** Transfer Memory Function
- **14.01.04** Dual Display, Real Time & Memory(ies)
- **14.01.05** Accumulate ≥|≤ A Reference Mode
- **14.01.06** Window Functions

14.02 200-17-00 Function Generator
- **14.02.00** Operating Summary

14 OPTIONS

14.01 200-16-00 Intelligent, Internal I/O Controller

14.01.01 LOAD MEMORY MODE

OPERATING SUMMARY

A user specified curve may be loaded into any of the EIGHT MEMORIES to a precision of 0.5 dB (dB-spl or dBm). An existing response in MEMORY may be modified. The user has control of all analyzer status parameters.

1. DISPLAY the MEMORY you wish to Load or Modify. For this example MEMORY 1 will be used.

   A. Touch *M1* (16-key)

   B. Touch *DISPLAY* (16-key)

2. Check to make certain that all analyzer status parameters are what you desire. If not you must reenter the REAL TIME MODE, reset the status parameters, then STORE in MEMORY l.

3. Enter the LOAD MEMORY MODE

   A. Touch *M1* (16-key)

   B. Touch *SHIFT* (12-key).

   C. Touch *LOAD* (16-key).

4. LOAD or MODIFY the MEMORY

   A. Position the VERTICAL CURSOR just to the right of the FILTER CHANNEL you wish to LOAD or MODIFY.

      Manipulate ◀ and/or ▶ (16-key)

   B. Adjust the FILTER CHANNEL'S amplitude.

      Manipulate ▼ and/or ▲ (16-key)

      To LOAD or MODIFY. another FILTER CHANNEL…

      Go To Step 4A.

      NOTE: Amplitude is adjusted in 0.5 dB steps each time either key is touched. Holding either key in causes continuous adjustment.

5. Exit the LOAD MEMORY MODE

   A. Touch .SHIFT (12- key)

   B. Touch STOP (12-key)

      The analyzer will reinitialize and the loaded or modified response will be saved in MEMORY.

      IMPORTANT It is important for the user to remember to exit the LOAD MEMORY MODE. Failure to do this might cause a memory to be inadvertently modified.

14.01.02 CLEAR MEMORY FUNCTION

OPERATING SUMMARY

The FILTER DISPLAY data stored in any of the EIGHT MEMORIES can be set to ”zero”.

NOTE: This function does not effect analyzer status data stored in a MEMORY.

1. DISPLAY the MEMORY you wish to CLEAR. For this example MEMORY 1 will be used.

A. Touch *M1* (16-key)

B. Touch *DISPLAY* (16-key)

2. CLEAR MEMORY

A. Touch *M1* (16-Key)

B. Touch *CLEAR* (12-Key)

Observe that all FILTER DISPLAY LIGHTS extinguish.

14. 01. 03 TRANSFER MEMORY FUNCTION

OPERATING SUMMARY

The contents of any MEMORY may be duplicated in any other MEMORY. This includes all analyzer status data. For this example MEMORY 1 will be duplicated in MEMORY 8.

1. DISPLAY both MEMORIES.

A. Touch *M1* (16-key)

B. Touch *M8* (16-key)

C. Touch *DISPLAY* (16-key)

2. ENTER the TRANSFER FUNCTION.

A. Address the MEMORY to be copied.

Touch *M1* (16-Key)

B. Tell the analyzer what it is about to do.

Touch *TRANS* (12-Key)

C. Address the MEMORY to receive the data.

Touch *M8* (16- key)

A. EXECUTE the TRANSFER FUNCTION.

A. Touch *SHIFT* (12-key)

B. Touch *LOAD* (16-key)

Observe the analyzer’s displays and indicators change to reflect only one MEMORY (Ml).

4. EXIT the TRANSFER FUNCTION.

A. Touch *SHIFT* (12-Key}

B. Touch *STOP* (16-Key)

The analyzer will reinitialize. A duplicate of MEMORY 1 is stored in MEMORY 8.

IMPORTANT It is important for the user to exit the TRANSFER MEMORY MODE. Failure to do this might cause a MEMORY to be inadvertently modified.

14.01.04 DUAL DISPLAY, REAL TIME & MEMORY(ies) OPERATING SUMMARY

Dynamic REAL TIME is shunted through a ”SCRATCH” MEMORY. It may be viewed along with up to two ”STATIC” MEMORIES using the analyzer’s Multiple Memory Display Feature.

For this example let...

MEMORY 1 (*M1*) = ”Static” Memory #1 to be displaye d. MEMORY 2 (*M2*) = ”Static” Memory #2 to be displayed. MEMORY 8 (*M8*) = The ”Scratch” Memory through which REAL TIME will be shunted and displayed.

1. DISPLAY all three MEMORIES

A. Touch *M1* (16-key)

B. Touch *M2* (16-key)

C. Touch *M8* (16-key)

D. Touch *DISPLAY* (16-key)

2. ENTER the DUAL DISPLAY, REAL TIME 4 MEMORY(ies) MODE

1) Tell the analyzer what it is about to do.

2) Touch *SHIFT* (12-key)

3) Touch *RT/M* (16-key)

3. DEFINE MEMORY Parameters

A. Address <u>either</u> ”STATIC” MEMORY

Touch *M2* (16-key)

B. Address the ”SCRATCH” MEMORY

Touch *M8* (16-Key)

4. EXECUTE the DUAL DISPLAY, REAL TIME 4 MEMORY(ies) FUNCTION

A. Touch ACCUM (16-Key)

The ACCUMULATE INDICATOR will light. Observe two ”static” and one ”dynamic” displays.

5. EXIT the DUAL DISPLAY, REAL TIME & MEMORY(ies) FUNCTION

A. Touch SHIFT (12-Key)

B. Touch STOP (16-Key)

The ACCUMULATE INDICATOR will extinguish. The analyzer will reinitialize.

IMPORTANT It is important for the user to remember to exit the DUAL DISPLAY, REAL TIME& MEMORY(ies) MODE. Failure to do this might cause a memory to be inadvertently modified.

While in this mode the user may display any MEMORY(ies) involved, either one, two or three at a time.

A. Address MEMORY(ies)

Touch *MEMORY KEY*(S) (16-Key)

B. Touch *DISPLAY* (16-Key)

14.01.05 ACCUMULATE ³½£ A REFERENCE MODE

OPERATING SUMMARY

The user designates one of the analyzer's MEMORIES a "Reference Memory". A second MEMORY is designated an "Accumulator Memory". The analyzer can be made to accumulate in the "Accumulator Memory" REAL TIME amplitude maximums which are:

A. Greater than or equal to the "Reference Memory"

OR

B. Less than or equal to the "Reference Memory"

For this example let...

MEMORY 1 (Ml) = The "Reference Memory"

MEMORY 2 (M2) = The "Accumulator Memory"

1. DISPLAY both MEMORIES.

A. Touch *M1* (16-key)

B. Touch *M2* (16-key)

C. Touch *DISPLAY* (16-key)

2. ENTER the ACCUMULATE ³½£ A REFERENCE MODE and DEFINE the MEMORY parameters.

A. Tell the analyzer what it is about to do.

a) Touch *SHIFT* (12-Key)

b) Touch *³M* (16-key)

To accumulate maximums greater than or equal to the "Reference Memory".

OR

Touch *£M* (16-Key)

To accumulate maximums less than or equal to the "Reference Memory".

B. Tell the analyzer the address of the "Reference Memory".

Touch *M1* (16-key)

C. Tell the analyzer the address of the "Accumulator Memory".

Touch *M2* (16-key)

3. EXECUTE the ACCUMULATE ³½£ A REFERENCE FUNCTION.

A. Touch *ACCUM* (16-Key)

The ACCUMULATE INDICATOR will light.

In most cases two displays may be observed.

4. EXIT the ACCUMULATE ³½£ A REFERENCE MODE.

A. Touch *SHIFT* (16-key)

B. Touch *STOP* (16-key)

The ACCUMULATE INDICATOR will extinguish.

The analyzer will reinitialize.

IMPORTANT: It is important for the user to remember to exit the ACCUMULATE ³½£ A REFERENCE MODE. Failure to do this might cause a memory to be inadvertently modified.

NOTE: While in this mode the user may display either or both of the MEMORY(ies) involved.

14.01.06 WINDOW FUNCTIONS

OPERATING SUMMARY

For this function a WINDOW is the amplitude difference between two reference responses stored in two of the analyzer's MEMORIES. REAL TIME maximum amplitudes are compared with both reference responses and accumulated in a third MEMORY according to one of two options; INSIDE WINDOW or OUTSIDE WINDOW.

For this example let...

MEMORY 1 (Ml) = "Lower Window Limit" (reference response)

MEMORY 2 (M2) = "Upper Window Limit" (reference response)

MEMORY 3 (M3) = "Accumulator Memory"

NOTE: The software for this function specifies that the "accumulator memory's" address (M1 – M8) must be one plus the address of the "upper window limit". Therefore, the "upper window limit" may not have an address of M8 since there are not 9 MEMORIES.

1. DISPLAY all three MEMORIES.

A. Touch *M1* (16-key)

B. Touch *M2* (16-key)

C. Touch *M3* (16-key)

D. Touch *DISPLAY* (16-Key)

Check to make certain that the contents of M2 are higher in amplitude than Ml.

2. ENTER either the INSIDE WINDOW or OUTSIDE WINDOW MODE.

A. Touch *SHIFT* (12-key)

B. Touch *M£* (16-key)

For the INSIDE WINDOW MODE

OR

Touch *M³* (16-key)

For the OUTSIDE WINDOW MODE

C. Touch *WINDOW* (16-Key)

3. DEFINE MEMORY parameters.

A. Address the ”Lower Window Limit” MEMORY

Touch *M1* (16-key)

B. Address the ”Accumulator” MEMORY.

Touch *M3* (16-key)

(The ”Upper Window Limit” MEMORY is defined by the software after the ”Accumulator” MEMORY **is** addressed.)

4. EXECUTE the WINDOW FUNCTION.

A. Touch *ACCUM* (16-key)

The ACCUMULATE INDICATOR will light.

Either the INSIDE WINDOW or OUTSIDE WINDOW INDICATOR will light.

Two static ”reference responses” and one dynamic ”accumulation response” should be displayed.

5. EXIT the WINDOW MODE.

A. Touch *SHIFT* (12-Key)

B. Touch *STOP* (16-Key)

The ACCUMULATE INDICATOR will extinguish.

The INSIDE WINDOW or OUTSIDE WINDOW INDICATOR will extinguish.

The analyzer will reinitialize.

I M P O R T A N T
It is important for the user to remember to exit the WINDOW MODE. Failure to do this might cause a memory to be inadvertently modified.

14.02.00 200-17-00 FUNCTION GENERATOR

OPERATING SUMMARY

W A R N I N G

The 200-17-00 FUNCTION GENERATOR can produce band limited signals as low as 25 Hz and as high as 20 kHz.

Be certain your sound system gain is UNDER CONTROL before using the FUNCTION GENERATOR to prevent damage to the sound system.

GENERAL

The 200-17-00 FUNCTION GENERATOR produces six signals at the analyzer's NOISE OUTPUT CONNECTORS as follows...

Monitor Display Indicator	Function
S1	PINK NOISE
S2	One- Third Octave BAND LIMITED NOISE on I.S.O. standard one-third octave frequency centers.
S3	SINE WAVE on I.S.O. standard one-third octave frequency centers.
S4	SQUARE WAVE on I.S.O. standard one- third octave frequency centers.
S5	TRIANGLE WAVE on I.S.O. standard one- third octave frequency centers.
S6	WHITE NOISE

1. TURN ON

A. Touch *DISP* (12-key)

B. Touch *GEN* (12-key)

A signal will appear at the analyzers NOISE OUTPUT CONNECTORS.

2. IDENTIFY THE SIGNAL MODE

Before the VERTICAL CURSOR is brought out the code for the signal being generated will be displayed on the MONITOR DISPLAY. (see GENERAL)

NOTE: If the VERTICAL CURSOR is out when the FUNCTION GENERATOR is turned on the identification code will not appear on the MONITOR DISPLAY.

3. CHANGE THE FUNCTION or SIGNAL MODE

A. Touch *DISP* (12-key)

B. Touch *GEN* (12-key)

Function selection is a ”rolling block” which indexes to the next function each time the above key sequence is executed.

4. CHANGE THE FREQUENCY OF THE SIGNAL

The frequency of 1) Band Limited Noise, 2) Sine Wave, 3) Square Wave and 4) Triangle Wave functions follow the VERTICAL CURSOR.

A. Touch ◀ (16-key)

Note that the VERTICAL CURSOR jumps to the one-third octave, 1000 Hz FILTER CHANNEL.

B. Manipulate ◀ and ▶ (16-key)

The frequency of’ the signal will change.

IMPORTANT

The FUNCTION GENERATOR only produces signals on one-third octave centers. If the one-sixth octave FILTERS are selected some confusion as to the frequency of the signal being generated could arise.

5. TURN OFF

A. Touch *SHIFT* (12-key)

B. Touch *STOP* (12-key)

The signal will turn off. However, the analyzer will remember the signal mode until it is changed or the analyzer is powered down. Thus the user may freely turn the FUNCTION GENERATOR on and off without having to reselect the signal mode.

If the VERTICAL CURSOR is out when the FUNCTION GENERATOR is turned off and on the frequency of the signal will also be remembered until the cursor is moved or the analyzer is powered down.

15 OSCILLOSCOPE AND PLOTTER FEATURES

15.01 GENERAL

The System 200 Signal Analyzer is equipped with a SYNC SIGNAL to trigger an externally triggered oscilloscope, as well as necessary circuitry to drive an X – Y plotter.

WARNING

DO NOT ENTER THE *OSCILLOSCOPE MODE* WHEN A PLOTTER IS CONNECTED UNLESS YOUR PLOTTER IS SET TO STAND-BY, AND YOUR PLOTTER'S PEN IS SET TO LIFT. TO DO SO MAY CAUSE DAMAGE TO THE PEN AS. THE OSCILLOSCOPE SWEEP SENT BY THE ANALYZER IS ORDERS OF MAGNITUDE FASTER THAN THE SIGNAL INTENDED FOR THE PLOTTER.

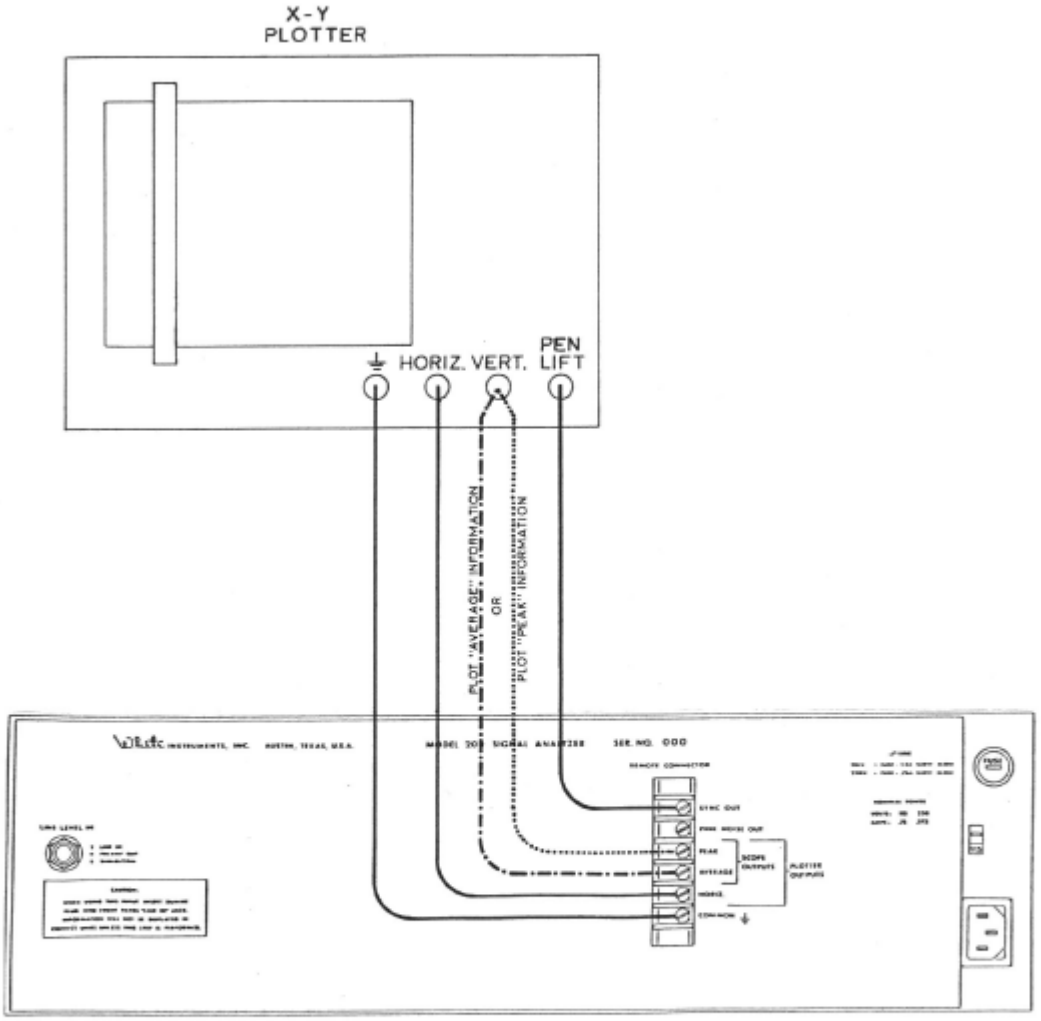


FIGURE 15.1

15. 02 PLOTTER HOOK-UP

Please refer to Picture 15.1 Prepare a set of leads of suitable length. One end of the set should have connectors suitable to connect to your plotter. The other end may be bare wire or crimp -on #6 barrier lugs for connection to the analyzer.

NOTE

The oscilloscope and plotter share common outputs. They are:

1. **PEAK output**
2. **AVERAGE output**
3. **COMMON**
4. **SYNC**

The oscilloscope and plotter may, however, be connected to the analyzer at the same time, but their use may not be simultaneous.

The pin lift signal for the plotter is sent from the *SYNC OUTPUT*.

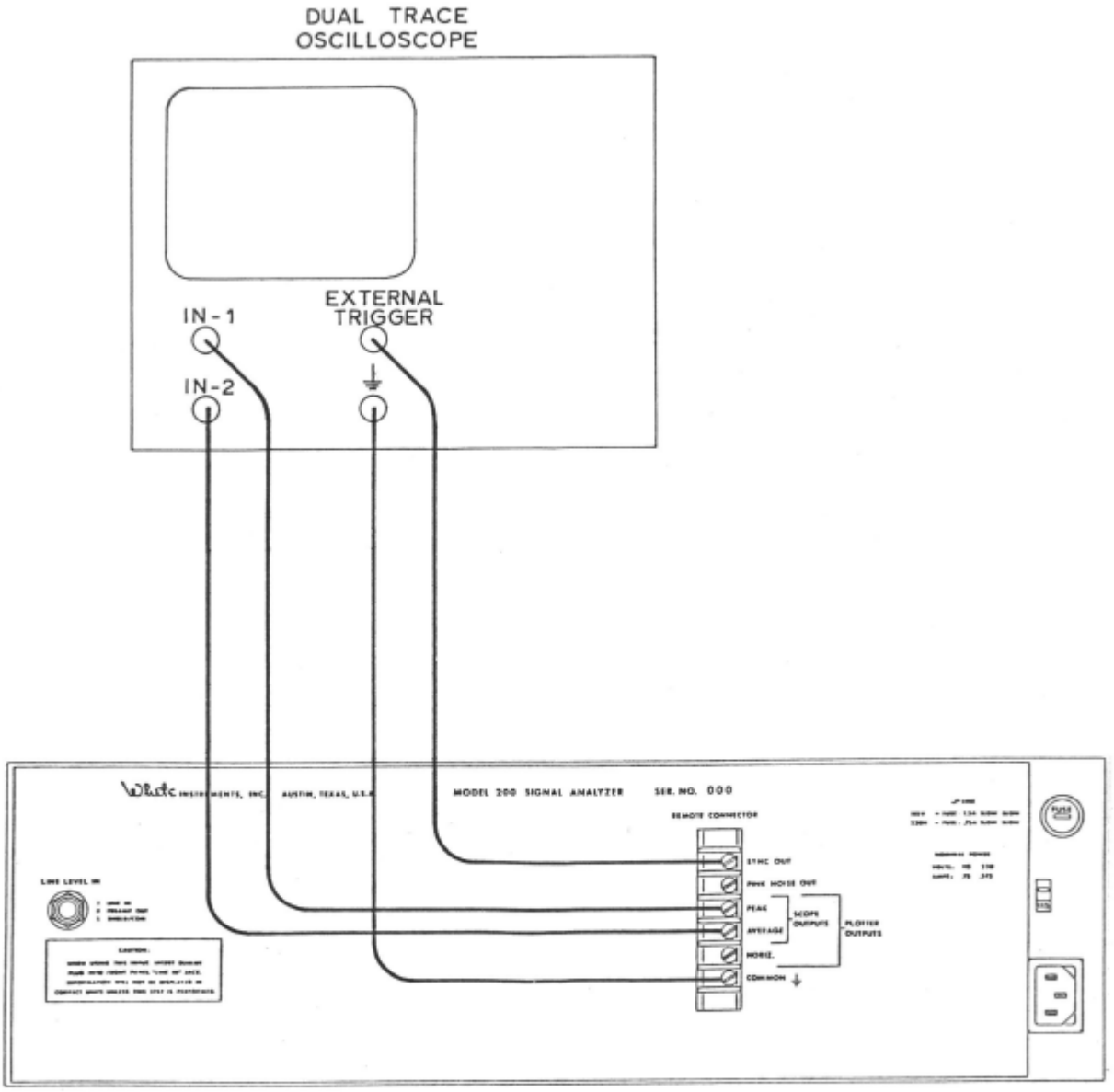

DUAL TRACE
OSCILLOSCOPE
IN-1
IN-2
EXTERNAL
TRIGGER
MODEL 200 SIGNAL ANALYZER
SER. NO. 000
REMOTE CONNECTOR
SYNC OUT
PEAK
AVERAGE
COMMON
SCOPE OUTPUTS
PLOTTER OUTPUTS

FIGURE 15.2

15.03 OSCILLOSCOPE HOOK-UP:

Please refer to Figure 15.2 Prepare a set of leads of suitable length. One end of the set should have connectors appropriate to connect to your oscilloscope. The other end may be bare wire or crimp-on #6 barrier lugs for connection to the analyzer.

NOTE

The oscilloscope and plotter share common outputs. They are:

1. PEAK output
2. AVERAGE output
3. COMMON
4. SYNC

The oscilloscope and plotter may, however, be connected to the System 200 at the same time, but their use may not be simultaneous.

In the case of a dual trace oscilloscope, both PEAK and AVERAGE data may be viewed simultaneously. If your oscilloscope has only one input, you must choose between a PEAK display or an AVERAGE display by connecting the appropriate lead from the System 200. This is also the case with the plotter. You may find it convenient, as we have, to assemble a switch into the PEAK and AVERAGE leads to facilitate instant selection between the two outputs.

15. 04 PLOT FUNCTION:

15. 04. 01 GENERAL

The contents of any of the *MEMORIES* may be plotted on an X – Y plotter in either *PEAK* or *AVERAGE MODE*. The *PEAK/AVERAGE CHANGE KEY* selection has nothing to do with which mode is plotted.

PEAK MODE amplitude data is available at the *PEAK TERMINAL* on the analyzer's back panel.

AVERAGE MODE data at the *AVERAGE TERMINAL*.

The *PLOT FUNCTION* is a dedicated routine. No other analyzer functions can be executed during a plot.

15.04.02 FORMAT

The analyzers plot program will supply tick marks to calibrate both the X and Y plot axis. Thus plain paper may be used. The user may appropriately scale the X and Y axis of his plotter to match his preprinted paper with the plotters vernier X and Y axis controls. In this case, the user need not wait for the analyzer to draw the X and Y axis scales. He can directly plot his data.

15.04.03 PLOTTING X AND Y AXIS SCALES

1. Load a sheet of paper into the plotter.
2. Set the plotter to Ready.
3. Set the plotter's pin lift to Record.
4. Touch the *PLOT KEY* located on the *12 Key Keyboard*.

The analyzer will drive the plotter to produce a scale on the X and Y axis.

See Figure 15.3

When the analyzer is sending information to the plotter "p-p-p" appears in both the *MONITOR* and *POSITION DISPLAYS.* During this time, the analyzer <u>will not</u> recognize any commands from its keys.

If the user wishes to abort the *PLOT FUNCTION*, he must turn the power to the analyzer <u>off</u> with the *POWER SWITCH.*

15.04.04 PLOTTING DATA: FROM *MEMORY*

After plotting the scale or when using preprinted paper, the user may plot data as follows:

1. Load paper into the plotter.

2. Set the plotter to *Ready.*

3. Set the plotters pin lift to *Record.*

4. Make certain the desired amplitude *(PEAK/AVERAGE)* lead is connected to the plotter.

5. Address the memory to be plotted.

Touch *M2* through *MS*

6. Enter the plot command.

Touch *Shift* then *Plot/Display* The analyzer will send the data from the *ADDRESSED MEMORY* to the plotter.

See Figure 15.4

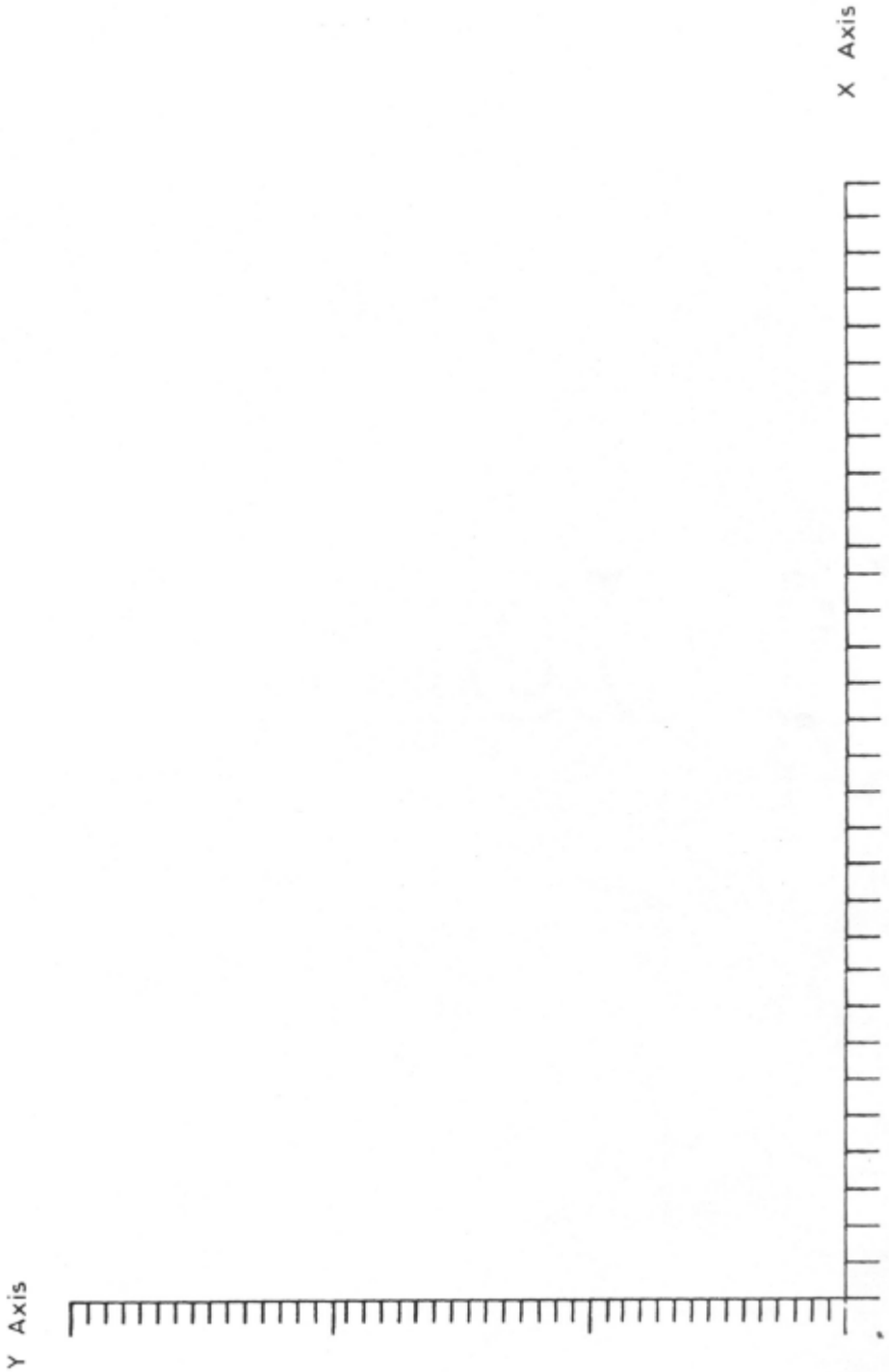


FIGURE 15.03

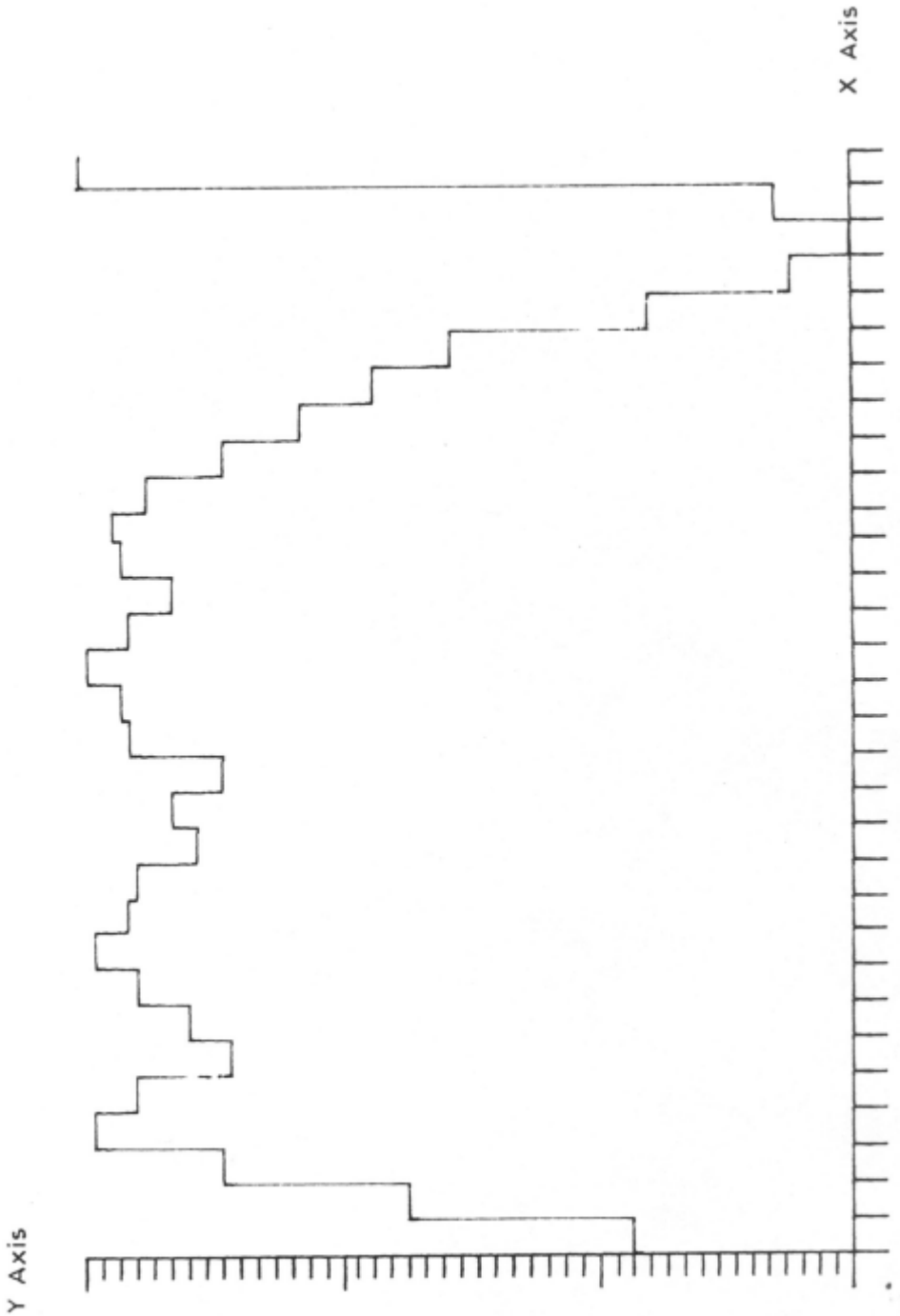


FIGURE 15.04

When the analyzer is sending information to the plotter ”p-p-p” appears in both the *MONITOR* and *POSITION DISPLAYS*. During this time, the analyzer will not recognize any commands from its keys.

If the user wishes to abort the *PLOT FUNCTION*, he must turn the power to the analyzer off with the *POWER SWITCH*.

15.05 OSCILLOSCOPE MODE: WARNING

DO NOT ENTER THE *OSCILLOSCOPE MODE* WHEN A PLOTTER IS CONNECTED UNLESS YOUR PLOTTER IS SET TO STAND-BY AND YOUR PLOTTER'S PEN IS SET TO LIFT. TO DO SO MAY DAMAGE THE PEN AS THE OSCILLOSCOPE SWEEP SENT BY THE ANALYZER IS ORDERS OF MAGNITUDE FASTER THAN THE SIGNAL INTENDED FOR THE PLOTTER.

15.05.01 GENERAL

When in the *OSCILLOSCOPE MODE,* the analyzer sends data through its back panel which mimics the *SPECTRUM DISPLAY* on the front panel. If the user is viewing *REAL TIME* on the front panel *SPECTRUM DISPLAY,* the same information appears on the back panel to drive the oscilloscope. Likewise, a *MEMORY* may be viewed on the oscilloscope.

15. 05. 02 ENTERING OSCILLOSCOPE MODE

To enter the *OSCILLOSCOPE MODE*...

Touch *SHIFT* then *SCOPE/PLOTTER KEYS,* located on the 1*2 KEY KEYBOARD.*

15.05.03 EXITING THE OSCILLOSCOPE MODE

To EXIT the *OSCILLOSCOPE MODE* Touch the *SCOPE/PLOTTER KEY*. The *OSCILLOSCOPE MODE* will be exited.

NOTE

The user may not enter the *PLOTTER MODE* after exiting the *OSCILLOSCOPE MODE* until he has touched ONE other key (any key) on the analyzer.

16 CURSORS

16.01 GENERAL:

The System 200 Signal Analyzer has two cursors...

1. VERTICAL CURSOR
2. HORIZONTAL CURSOR

The cursor is either a column or row of lights which is manipulated from the *MEMORY CONTROL KEYBOARD*.

16.02 VERTICAL CURSOR:

The purpose of the *VERTICAL CURSOR* is to point to a *FILTER CHANNEL* or the *BROADBAND COLUMN*. It is controlled by the ◀ and ▶ KEYS located on the *MEMORY CONTROL KEYBOARD*. When the ◀ KEY is touched once, the *VERTICAL CURSOR* positions itself over the *BROADBAND COLUMN*.

If the ◀ KEY is held down, the *VERTICAL CURSOR* will move across the *FILTER DISPLAY* from right to left until it reaches the lowest filter channel, where it will stop.

To move the VERTICAL CURSOR from left to right...

Touch or hold down the ▶ KEY.

When the *VERTICAL CURSOR* is pointing to a *FILTER CHANNEL*, the *MONITOR DISPLAY* will indicate the level of that channel instead of the *BROADBAND LEVEL*. The *POSITION DISPLAY* will indicate the frequency of the filter the cursor is pointing to if it is either a one-third or octave band filter. If the filter is a one-sixth octave filter, the *POSITION DISPLAY* will indicate channel 1-30**.**

The *VERTICAL CURSOR* has other functions in the *RT MODE*. (See Section 17)

16.03 HORIZONTAL CURSOR:

The *HORIZONTAL CURSOR* is used in the LOAD program. At present it is locked out by the software.

17 SYSTEM 200 T_{60} MEASUREMENTS – OPERATING SUMMARY

1. SET UP SYSTEM 200

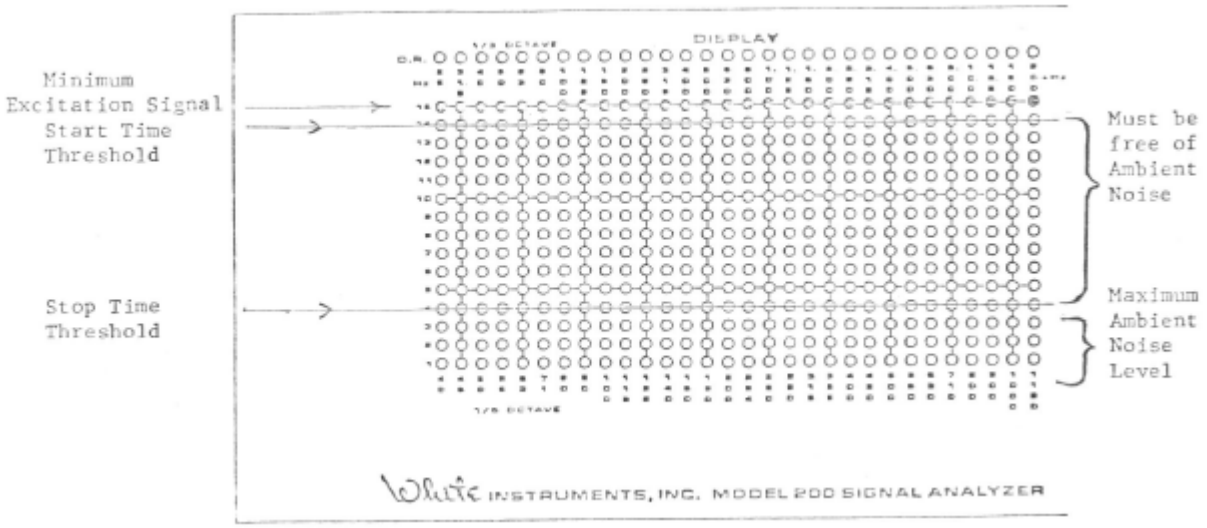
1.1 Select BANDWIDTH (1 octave, 1/3 octave, 1/6 octave)

1.2 Select SMOOTHING TIME (FAST preferred)

1.3 Select AVERAGE mode

1.4 Select 3 dB RESOLUTION

2. ESTABLISH STOP TIME AND START TIME THRESHOLDS



2.1 Internal noise source excitation of room from System 200.

2.1.1 Feed noise from System 200 to room sound system.
Noise will be gated of f automatically when measurement is made.

2.1.2 Set noise level in room and PREAMP GAIN of System 200 so that:

2.1.2.1 System 200 DISPLAY is driven solidly to ROW 15 to assure START TIME THRESHOLD is exceeded.

2.1.2.2 With room excitation turned OFF, make certain ambient room noise is below ROW 4 so that STOP TINE THRESHOLD is never exceeded.

2.1.2.3 Adjust noise excitation level in room and System 200 PREAMP GAIN until above two conditions are met.

2.2 Other excitation of room (gun shot, balloon, etc.) 2. 2. 1 Adjust PREAMP GAIN so that the ambient room noise is just below the STOP TINE THRESHOLD (ROW 4).

2.2.2 Set up ACCUMULATE MODE in System 200.

2.2.3 Excite room and ACCUMULATE maximum excitation levels in memory.

2.2.4 Excitation level must be at least in ROW 15 in the band of interest.

2.2.5 If necessary, adjust PRE AMP GAIN and excitation levels so that STOP TIME THRESHOLD and START TIME THRESHOLD conditions as described above are met.

3. MEASUREMENT OF T_{60}

3.1 Select BANDWIDTH. Should be same as selected in 1.0 above.

3.2 Enter T mode: Press T key once.

3.3 The System 200 will initialize in the FAST SMOOTHING TIME and AVERAGE mode. If this is different than those modes selected in 1.0 above, they may be changed at this time.

3.4 Move the CURSOR to the filter through which the T_{60} measurement is to be made.

3.5 ARM the System 200: Press T_{60} key once more.

3.5.1 If internal noise source is being used to excite room, it will automatically be gated off at this instant and the T_{60} measurement will be made. The noise will be gated on as soon as the STOP TIME THRESHOLD is crossed.

3.5.2 If external excitation is used, the CURSOR column will collapse to one light at bottom of display. Room ambient noise will cause CURSOR column to ”bounce” up – thus indicating the level of ambient noise. This should not exceed the STOP TIME THRESHOLD. (ROW 4)

3.5.3 Excite the room using the external source.

3.6 The decay of the room may be observed as the CURSOR LED moves down the column through the START TINE THRESHOLD and through the STOP TINE THRESHOLD.

3.7 The T time is displayed in the MONITOR DISPLAY.

3.8 Measurement may be repeated. The System 200 will compute average T_{60} based on previous measurements. Up to 16 measurements may be averaged.

3.9 The System 200 will reset the MONITOR DISPLAY when the CURSOR is shifted to a new filter.

4. TO EXIT T_{60} ROUTING PRESS: REAL TIME KEY.

17. 01 INTRODUCTION

The System 200 Signal Analyzer can be programmed via the front panel keys to perform Reverberation Time (T_{60}) Measurements. The following is a technical description of the steps required to accurately measure the T_{60} times of a room or enclosure using the System 200.

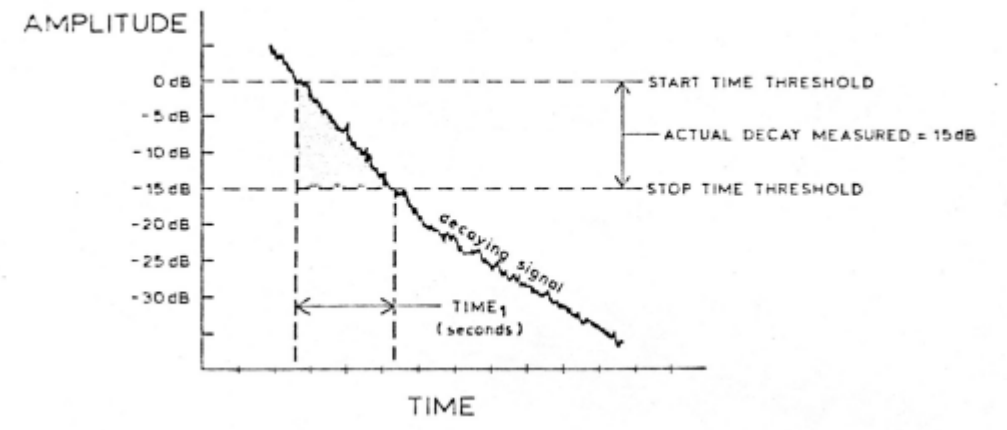
17.02 BACKGROUND

Reverberation Time "T_{60}" is a measure of the time it takes a sound pressure level to decay 60 dB from a predetermined threshold. This decay time is effected by such things as Room Acoustics, Electronic Noise, Externally Induced Noise, Ambient Noise, Sympathetic Radiators, Room Modes and Excitation Level. All are contributors to the overall time measured. The System 200 is designed to present to the user an accurate measure of decay time, provided the necessary prerequisites are accomplished by the operator prior to the actual measurement. This setup requirement is mandatory to ensure that the data taken reflects the characteristics of the environment under test. Extreme care should be taken when arming the System 200 in the "T_{60}" Mode. The selection of the exact modes of operation for the particular environment under test is a necessity.

17.03 THEORY OF OPERATION

The System 200 makes three separate measurements each time it is armed. The instrument measures the decay time of the first 15 dB of decay, the second 15 dB of decay and finally the time of the full 30 dB decay. From these three decay times three separate "T_{60}" times are extrapolated by the microprocessor. The three times may be different depending on the environment under test and the resolution being read by the operator. The times stored by the microprocessor are averaged as successive measurements are made. A limit of 16 averages may be taken. The following plots and associated calculation show how the System 200 arrives at its "T_{60}" times.

1. A T_{60} extrapolation based on the first 15 dB of decay



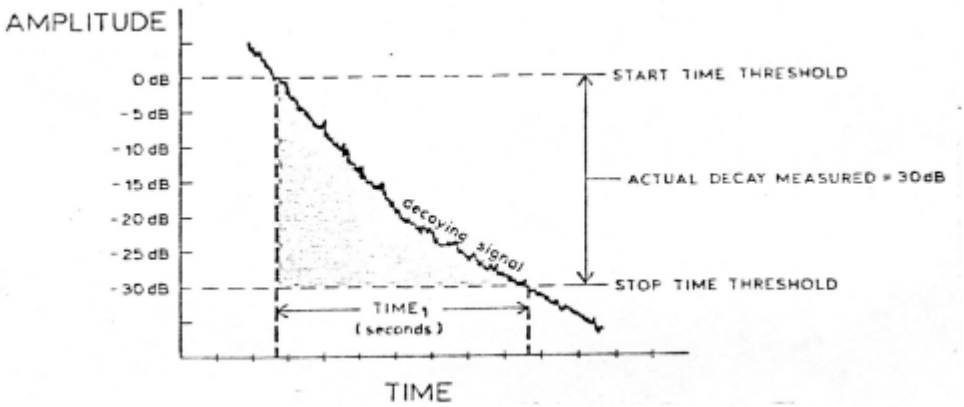
The actual time in seconds the signal takes to decay 15 dB is measured.

T_{60} is then extrapolated as follows…

$T_{60} = \text{Time}_1 \times 4$

where... $TIME_1$ is the actual time it took to signal to pass between the START and STOP THRESHOLDS.

2. A T_{60} extrapolation based on the first 30 dB of decay.



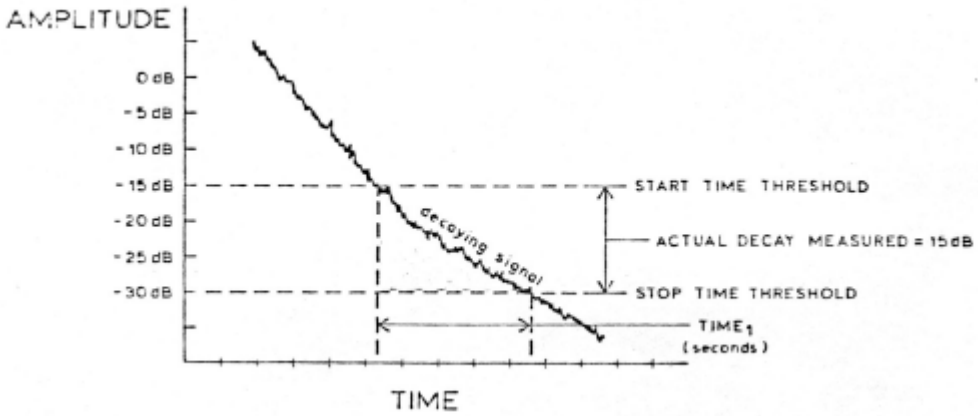
The actual time in seconds the signal takes to decay 30 dB is measured.

T_{60} is then extrapolated as follows...

T_{60} = $TIME_1$ X 2

where... $TIME_1$ is the actual time it took the signal to pass between the START and STOP TIME THRESHOLDS.

3. A T_{60} extrapolation based on the decay between 15 dB and 30 dB. (second 15 dB Decay Time)



The actual time in seconds the signal takes to decay the second 15 dB is measured (shaded area).

T_{60} is then extrapolated as follows…

T_{60} = $TIME_1$ X 4

where... $TIME_1$ is the actual time it took to signal to pass between the START and STOP TIME THRESHOLDS.

Successive T_{60} measurements through the same filter are automatically averaged with the previous measurements to a limit of 16 consecutive ”shots.” The user may select either AVERAGE or PEAK response modes for his T_{60} measurements.

The unit defaults to the AVERAGE response mode when the T_{60} mode is entered. The filter time constants are best suited for T_{60} measurements in this mode of operation.

He may also select one of the three SMOOTHING TIME CONSTANTS available in the analyzer. The FAST smoothing time constants is suggested for best results.

The extrapolated T_{60} measurements and averages of multiple measurements if applicable are displayed in the MONITOR DISPLAY. Multiple T_{60} measurements should be made at each frequency to average out any non-linearities induced by outside transients. The user may select any of the three simultaneous measurements for display with the RESOLUTION CHANGE KEY.

They are...

l. A T_{60} Time extrapolation based on the FIRST 15 dB of decay.

   This time may be displayed on the MONITOR DISPLAY by selecting the 1 dB RESOLUTION INDICATOR.

2. A T_{60} extrapolation based on the FULL 30 dB of decay.

   This time may be displayed as above by selecting the 2 dB RESOLUTION INDICATOR.

3. A T_{60} extrapolation based on the SECOND 15 dB of decay.

   This time may be displayed as above by selecting both the 1 dB and 2 dB RESOLUTION INDICATORS.

It is suggested that the user record his T_{60} TIMES on a graph as he moves from filter to filter. The result will be a T_{60} TIME curve of the room.

During a T_{60} measurement, amplitude data is available on the REAR PANEL to drive a strip chart recorder or storage oscilloscope. (See section 17.08.04)

The analyzer's PINT NOISE SOURCE or optional FUNCTION GENERATOR is gated off, automatically, at the start of T_{60} measurement and gated on again at the end. This signal can be used to excite the room to be measured.

CAUTION

The T_{60} program uses the RAM locations of MEMORIES 5 through 8 as a "scratch pad" when the unit is not fitted with the 200–16-00 INTELLIGENT, INTERNAL I/O CONTROLLER. Therefore, data in these memories will be destroyed the moment the T_{60} MODE is entered.

17.04 START TIME THRESHOLD

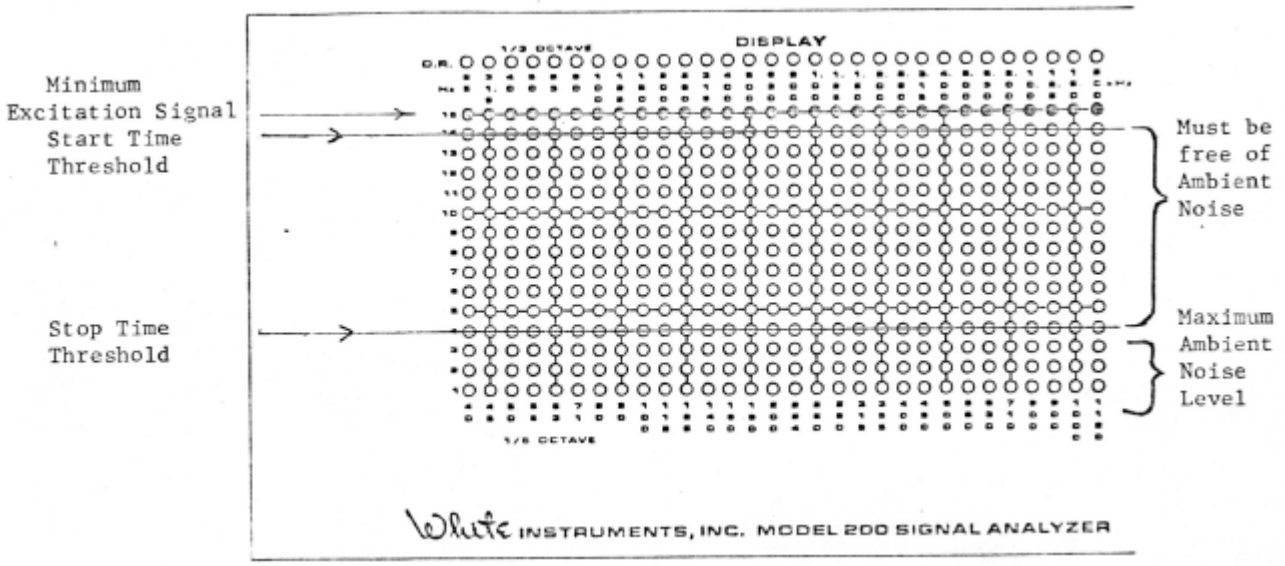
The System 200 makes the T_{60} extrapolation based on the time that the excitation signal takes to decay or fall through the START TIME THRESHOLD to the STOP TINE THRESHOLD 30 dB below. The START TIME THRESHOLD is ROW 14 on the display. The STOP TIME THRESHOLD is ROW 4 on the display, ten rows or 30 dB below Row 14.

The following two conditions must be met in order for a successful T measurement to be made:

1. The excitation signal must exceed the START TIME THRESHOLD (row 14).
2. The ambient noise in the room must be BELOW the STOP TIME THRESHOLD (row 4).

If these two conditions are met, then as the room decays through the START TIME THRESHOLD and continues its decay through the STOP TIME THRESHOLD, a successful T_{60} measurement will be made.

If, during the course of measurement, the ambient noise level momentarily exceeds the STOP TIME THRESHOLD, the System 200 will indicate probable error in the measurement by causing its CURSOR to flash. The flashing CURSOR indicates that the second 15 dB of decay was at least twice as long as the first dB of decay and thus is likely to be in error.

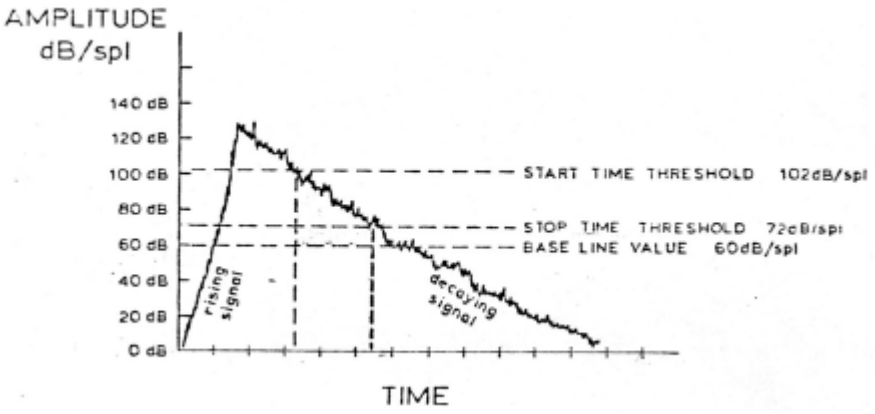


Example: If the BASE LINE VALUE (indicated in the POSITION DISPLAY) is 60 (60 dB/spl), the START TIME THRESHOLD will be set at 102 dB/spl when the T_{60} MODE is entered.

60 dB/spl + 3 dB X 14(rows) = 102 dB/spl

The user must set a START TIME THRESHOLD which is lower in level than the signal with which the room is excited in order to assure that the START TINE THRESHOLD will be crossed by the decaying signal when the noise source is keyed – off. If the selected START TIME THRESHOLD is higher in amplitude than the signal exciting the room, the analyzer will be unable to make a measurement. The decaying LEDs visible on the front panel will fall to the bottom of the column selected and just sit there.

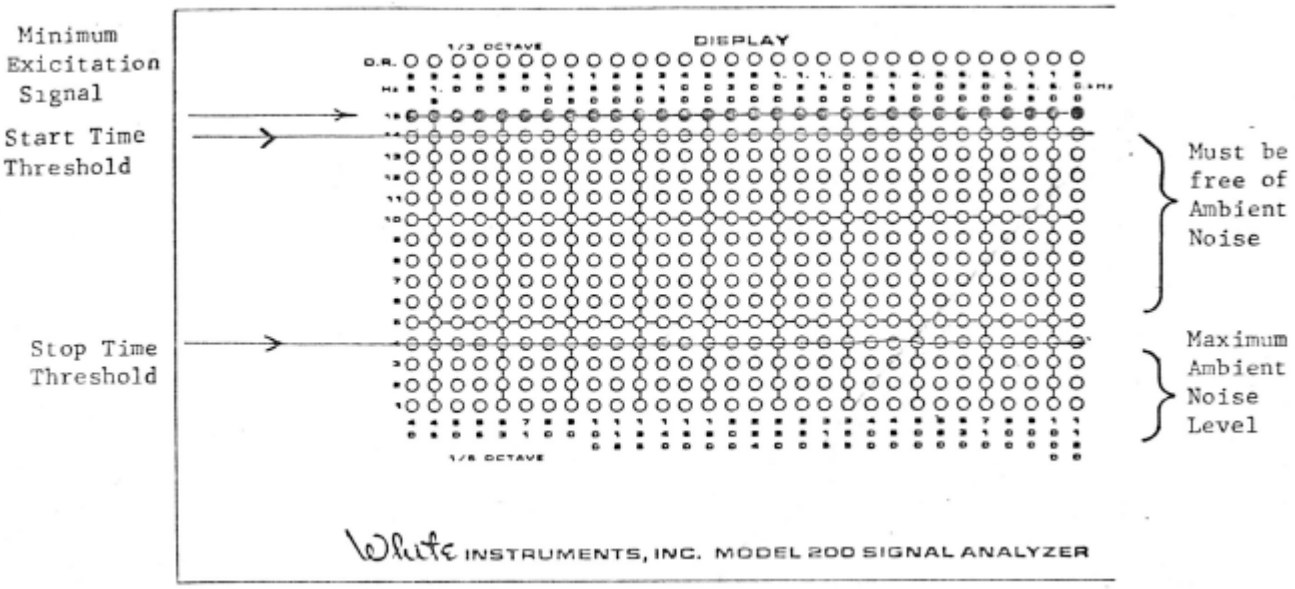
The only exit from this error is to re-enter the REAL TIME MODE and reset the PREAMP gain to the correct level. The T_{60} program has the necessary logic built-in to distinguish between a rising signal and a decaying signal.



Consider the above illustration of a room excited by a gun shot. The analyzer's BASE LINE VALUE is set at 60 (60 dB/spl). This sets the START TIME THRESHOLD at 102 dB/spl. After the unit is setup in the REAL TIME MODE to establish the START TIME THRESHOLD based on ambient noise level, the T_{60} :MODE is entered by pressing the T_{60} key. The unit defaults to the average, fast mode and is ready to be armed. Pressing the T_{60} key a second time arms the unit and it remains ready until a signal greater than the START TIME THRESHOLD is seen by the analyzer. When the gun is discharged the signal rises to a peak of about 130 dB/spl. It crosses the START TIME THRESHOLD, but from the wrong direction. The program recognizes this and waits for the signal to decay back through the START TIME THRESHOLD before starting the T_{60} measurement. After the signal passes the STOP TIME THRESHOLD the System 200 calculates the T_{60} time selected by the FRONT PANEL switch setting and displays it on the Monitor Display. If the other two T_{60} times are desired the RESOLUTION DISPLAY SELECTOR can be changed and the unit will display any of the three times desired. It should be explained that each time the selector key is changed the program must calculate the extrapolated T_{60} time from the measured decay time stored. Often this takes a few seconds if a long decay time is stored.

When the analyzer's PINK NOISE is used to excite the room, the REAL TINE MODE is helpful in setting the START TIME THRESHOLD. The levels of the entire spectrum may be viewed at once.

1. Select REAL TIME MODE.
2. Select the FILTER SET to be used for the T_{60} measurement.
3. Select the SMOOTHING TIME to be used for the T_{60} measurement. (Fast is suggested)
4. Select AVERAGE OR PEAK MODE. (Average is suggested)
5. Select 3 dB/Light RESOLUTION.
6. Excite the room with PINK NOISE from the analyzer.
7. Observe the FILTER DISPLAY.



At any given BASE LINE VALUE, at least the 15th light of the filter(s) to be used for the T_{60} measurement must be lit. This indicates an excitation level greater than the START TIME THRESHOLD (42 dB above the BASE LINE VALUE). This upper threshold must be at least 34 dB above the ambient noise level of the room to yield a correct T_{60} time. In many cases it is possible to excite the room up to the level of the 15th row of LEDs and still not trigger the analyzer to make a measurement at the instant the T_{60} Key is pressed. The reason for this miscue is that the sound pressure level in a given band is continually changing in REAL TIME. This change is often great enough to cause the signal to pass above and below the START TINE THRESHOLD. If, at the instant the T_{60} key is pressed to arm the unit, the sound pressure level is only slightly below the START TIME THRESHOLD the unit will gate-off the noise source and the sound will decay. Thus the START TIME THRESHOLD is never exceeded and no measurement will be made. Moving the PREAMP gain up 10 dB will often help this situation.

CAUTION

With PINK NOISE, it is often not possible to make some sound systems loud enough for T_{60} measurements without causing serious damage to the system itself. In this case it is advisable to choose another method of excitation. The BAND LIMITED NOISE SOURCE of the optional System 200 FUNCTION GENERATOR is suggested for this application. BAND LIMITED NOISE permits a higher level ”in band” signal to be induced into the room. When a gun, balloon or similar device is being used for excitation, the System 200’s ACCUMULATE NODE is helpful in setting the START TIME THRESHOLD.

ACCUMULATING PEAK LEVELS:

1. Select the FILTER SET to be used for the T_{60} measurement. (Octave)

2. Select the SMOOTHING TIME. (Fast)

3. Select AVERAGE.

4. Select 3 dB/Light RESOLUTION.

5. Display a MEMORY (Ml-M8). (See section 12.03 and 13.03)

6. ACCUMULATE in that same MEMORY. (See section 13.04)

7. Excite the room and allow the signal to decay.
8. STOP ACCUMULATE.
9. Display ACCUMULATED MEMORY. You now have a snap-shot of the maximum levels each filter reached when the room was excited.

As before, at least the 15th row of filter LEDs to be used in T_{60} measurements must be lit.

Adjust the BASE LINE VALUE appropriately so that row 15 is lit and the level is 34 dB above the ambient NOISE LEVEL of the room.

The ambient noise level of the room is often too high to allow good measurement conditions. In this case the first 15 dB measurement can be used to determine the T_{60} time even though a flashing cursor is displayed. The second 15 dB decay time is greater than twice the first due to the high background level but if it is assumed that a linear decay exists then the extrapolated T_{60} TIME based on the first 15 dB decay time is an accurate measure. This high background effect usually comes into the picture when a 30 dB baseline is selected by gaining the PREAMP up very high. A 40 dB baseline setting is usually the maximum gain that will provide the best measurement results.

17.05 T_{60} MODE – SELECTION:

Before entering the T_{60} MODE the user must make two selections which can not be modified while in the T_{60} MODE.

1. Establish the appropriate START TIME THRESHOLD.
2. Select the desired FILTER SET.

If the unit contains the optional 200-17-00 FUNCTION GENERATOR the NOISE SOURCE to be used must also be selected. (Band Limited Noise, Sine, Square, Triangle, Pink, White)

Default will be to the current state of the analyzer.

To enter the T_{60} MODE Touch T_{60} (key located on the 12-KEY KEYBOARD).

The T_{60} MODE is entered and the following initialization parameters prevail.

1. The program selects the AVERAGE MODE.
   This may be changed by the user while in the T_{60} MODE but is not recommended.
2. The program selects FAST SMOOTHING TIME.
   This may be changed by the user while in the T_{60} MODE but is not recommended.
3. MEMORIES 5 through 8 are used by the program as a ”scratch pad” if the unit is not fitted with the optional 200-16-00 INTELLIGENT., INTERNAL I/O CONTROLLER.
   Thus data in them will be destroyed the moment the T_{60} MODE is entered.
4. The VERTICAL CURSOR appears in the BROADBAND COLUMN.
   It may be moved by the user to point to the desired filter for the measurement. If the FUNCTION GENERATOR option is used the cursor will not appear when the T_{60} Node is entered. This allows the noise source to be automatically turned off when the mode is entered and the cursor moved to the frequency to be measured prior to enabling the noise source. The cursor is brought out using the position key. It jumps first to the 1kHz channel and can be moved in either direction up or down the spectrum to the desired channel for measurement. The noise source can be turned on at anytime by pressing the key sequence DISP, GEN.

5. The STATUS INDICATOR for the MONITOR DISPLAY will indicate TIME.
6. The DISPLAY MODE INDICATOR will indicate OTHER.
7. The STATUS INDICATOR for the RESOLUTION CHANGE KEY will indicate 2 dB, thus selecting the T_{60} time based on the 30 dB time of decay.
   This may be changed by the user while in the T_{60} NODE.

   If the user changes…

   1. PEAK/AVERAGE
   2. SMOOTHING TIME
   3. VERTICAL CURSOR

   …between T_{60} measurements, his averaged series will be reset. (See section 17.06.03)

At this point it is advised that the user check to assure that the PEAK/AVERAGE and SMOOTHING TIME conditions are the same as when the START TIME THRESHOLD was established. If not, make the appropriate changes. If this is not done the START TIME THRESHOLD may not be 42 dB above the baseline or 34 dB above the ambient NOISE LEVEL.

17.06 T_{60} MODE – VERTICAL CURSOR:

17.06.01 GENERAL

In the T_{60} MODE the VERTICAL CURSOR serves the following functions

1. It points to the filter through which a T_{60} measurement will be made.

2. It resets the analyzer for a new set of averages.

3. It counts the number of ”shots” in a series of measurements which are averaged together, automatically, by the program.

4. It indicates the possibility of an error caused by outside noises during a measurement.

5. It follows the signal in REAL TIME by showing the signal’s rise and decay.

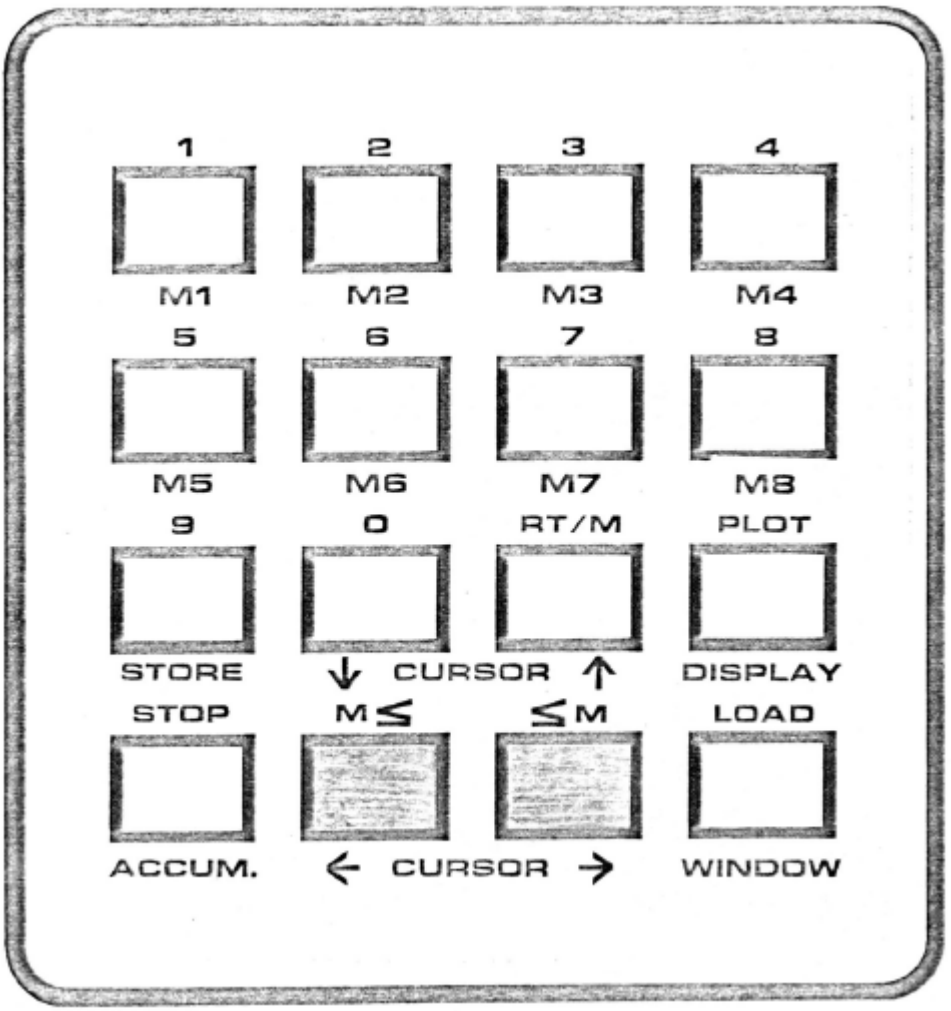
6. It selects the center frequency of the optional 200-17-00 FUNCTION GENERATOR, when installed in the System 200.

17.06.02 MANIPULATION – VERTICAL CURSOR

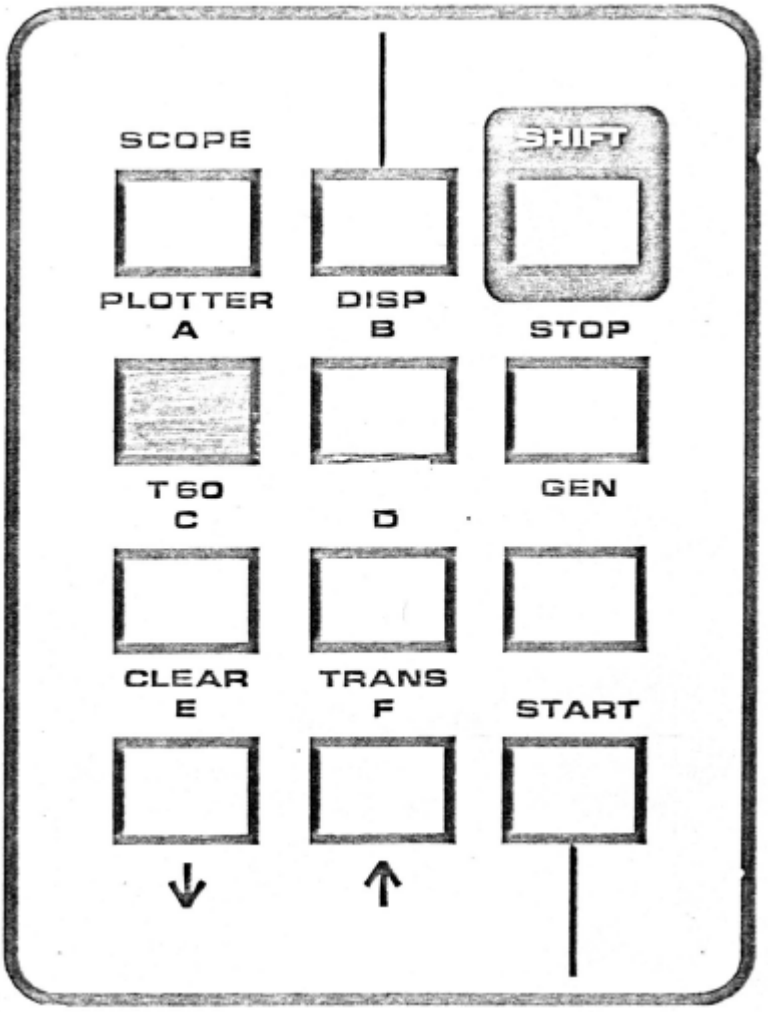
The VERTICAL CURSOR is moved in the T_{60} MODE the same way it is moved in the REAL TIME or MEMORY MODES.

The ◀ and ▶ KEYS located on the 16 KEY KEYBOARD move the CURSOR to the LEFT and RIGHT on the FILTER DISPLAY respectively.

After entering the T_{60} MODE the CURSOR should be set on the desired FILTER before making a measurement.



16 KEY KEYBOARD



12 KEY KEYBOARD

17.06.03 RESETTING THE ANALYZER TO TAKE A NEW SET OF AVERAGES OF T_{60} MEASUREMENTS.

When, for any reason, the VERTICAL CURSOR is moved the registers containing the T_{60} measurements and/or averages of multiple T measurements are reset to zero.

This feature facilitates, for example, the ”sweeping” of a room on OCTAVE, 1/3 OCTAVE or 1/6 OCTAVE centers. After each measurement or series of measurements the user need only move the VERTICAL CURSOR to the next filter in the series. The program automatically resets the analyzer.

If a mistake is made the user may reset his registers to zero by simply moving the VERTICAL CURSOR to an adjacent filter and back again.

The analyzer will also reset if the PEAK/AVERAGE or SMOOTHING TIME CHANGE KEYS are touched between T_{60} measurements.

CAUTION

If the unit contains the FUNCTION GENERATOR option it is advisable to turn off the NOISE SOURCE before rapidly moving the cursor. Since the NOISE SOURCE center frequency tracks

the CURSOR position it is possible to sweep from 25 Hz to 20 kHz by pressing the CURSOR key multiple times.

17.06.04 COUNTING THE NUMBER OF MEASUREMENTS IN AN AVERAGED SERIES

Upon entering the T_{60} MODE or upon resetting the registers to zero by moving the VERTICAL CURSOR, the VERTICAL CURSOR will be a column of lights 16 high.

After each T_{60} measurement one light in the column will be extinguished until a maximum of 16 measurements are made.

The lights are extinguished from top to bottom.

Counting the number of extinguished lights yields the number of measurements made in the series.

17.06.05 ERROR POSSIBILITY – FLASHING VERTICAL CURSOR

If after a measurement the VERTICAL CURSOR flashes, a possible error in the T_{60} measurement is indicated.

This condition is an indication only and in no way effects the actual measurement.

If the actual time measured during the second 15 dB of signal decay is equal to or greater than twice the actual time measured during the first 15 dB of decay the possible error will be indicated.

In addition, if the decaying signal does not cross the STOP TIME THRESHOLD (located 30 dB below the START TIME THRESHOLD) the program will time out and the possible error will be indicated.

These error conditions result when the START TIME THRESHOLD is not 34 dB above the AMBIENT NOISE LEVEL. The possible error does not effect the decay time of the first 15 db, thus the T_{60} time selected by the 1 dB resolution LED is the correct time of decay.

Lowering the PREAMP gain 1 step (10 dB) will often allow the System 200 to make the measurement, especially if a 30 dB/spl baseline was selected. However, the signal level must still light the 15th row of LEDs in order to pass the START TINE THRESHOLD.

17.06.06 OTHER VERTICAL CURSOR INDICATIONS

1. The VERTICAL CURSOR will track a signal's rise and decay in REAL TINE during a normal T_{60} measurement.
2. At the moment of "ARMING" the analyzer for a T_{60} measurement, the VERTICAL CURSOR shrinks to its bottom most light or it may indicate the ambient noise in the room if that noise is greater than the BASE LINE VALUE and less than the START TIME THRESHOLD. This condition indicates that the program is waiting for a signal to decay through the START TIME THRESHOLD and initiate the T_{60} measurement.

   If for some reason it is impossible for a signal to decay through the START TIME THRESHOLD the user must exit the T_{60} MODE, correct the problem, then re-enter the T_{60} MODE.

17.07 MAKING T I'1F4SUREIIENTS:

17.07.01 GENERAL

To make a T_{60} measurement the user must

1. Establish the appropriate START TINE THRES HOLD
2. Select the FILTER SET to be used
3. Enter the T MODE
4. Select the appropriate SNOOTHING TINE CONSTANT (fast)
5. Select PEAK or AVERAGE MODES (average)
6. Select the FILTER through which the T measurement will be made.
7. ARM" the analyzer
8. Excite the room (Only when an external signal source is used)
9. View the results.

To this point Steps 1 through 6 have been covered in detail.

17.07.02 "ARMING" THE ANALYZER FOR A T_{60} MEASUREMENT

After performing Steps 1 through 6 (see section 17.07.01) the user may "ARM" the analyzer as follows…

Touch the T_{60} KEY located on the 12-KEY KEYBOARD.

17.07.03 T_{60} MEASUREMENTS USING THE ANALYZER'S BUILT-IN PINK NOISE SOURCE

CAUTION

Using PINK NOISE it may not be possible to make some sound systems loud enough to make T_{60} measurements without causing serious damage to the sound system itself. In this case. it is advised to choose another method of excitation. BANDLIMITED NOISE is suggested for the application if available.

The System 200 Signal Analyzer's PINK NOISE SOURCE is connected to the sound system via either the front panel PINK NOISE OUTPUT CONNECTOR or the rear panel BARRIER STRIP CONNECTORS.

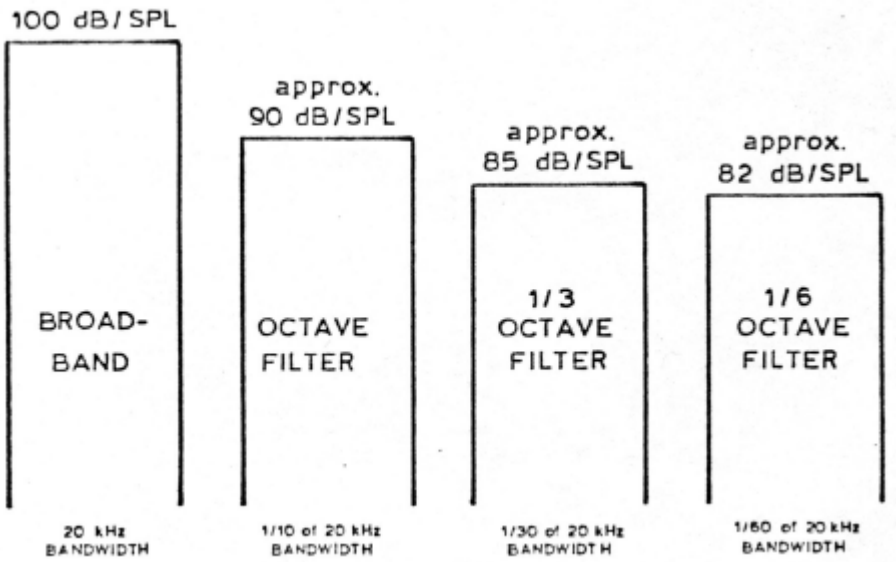
If the analyzer contains the FUNCTION GENERATOR option the NOISE OUTPUT can be turned off by pressing the SHIFT then STOP keys on the 12-KEY KEYBOARD. The noise in this case is automatically gated off when T_{60} is entered to allow the operator to select the center frequency of the output signal prior to turning on the generator. The noise is enabled by pressing DISP, GEN on the 12 Key Keyboard. If the Model 200 does not contain a FUNCTION GENERATOR then PINK NOISE is continuously sent to the sound system.

The moment the analyzer is "ARMED", the NOISE SIGNAL to the sound system is gated-off and the T_{60} measurement is automatically made.

After the measurement is made the analyzer automatically gates-on the NOISE SIGNAL to the sound system.

At this point the user may make another T_{60} measurement by touching the T_{60} -KEY again. The NOISE will be gated-off and the measurement automatically made. This second measurement will be averaged with the first measurement by the program.

The user may continue to make successive measurements as above until a maximum of 16 is reached or he may move the VERTICAL CURSOR to another FILTER and begin again.



Consider the above illustration. A room is excited with the continuous PINK NOISE. Approximately 100 dB/spl is measured in the BROADBAND COLUMN which is looking at a bandwidth of approximately 20 kHz (25 Hz through 20 kHz) .

The user selects the OCTAVE BAND FILTER SET. Observing the 1000 Hz FILTER, for example, he notices that the amplitude is approximately 90 dB/spl. There are 10 octave bands in the 20 kHz bandwidth. Thus the 1000 Hz FILTER contains approximately [1 over the square root of 10] of the energy or approximately 90 dB/spl.

Likewise the 1000 Hz ONE-THIRD OCTAVE FILTER will contain approximately [1 over the square root of 30] of the energy in the 20 kHz bandwidth, reading approximately 85 dB/spl.

The 1000 Hz ONE – SIXTH OCTAVE FILTER will contain approximately [1 over the square root of 60] the energy in the 20 kHz bandwidth indicating a level of approximately 82 dB/spl.

From this, one can quickly realize why PINK NOISE is often an inappropriate excitation medium, and how a BANDLIMITED NOISE SOURCE is an excellent solution for channeling the required power into the band selected for measurement.

17.07.04 T_{60} MEASUREMENTS USING AN OUTBOARD EXCITATION SOURCE

These sources include.

1. Pistol or cannon shots.

2. Balloons

3. Clap Boards

The user must control these sources to have the excitation signal decay through the START TIME THRESHOLD.

Aside from frequency response and repeatability considerations the signal must have enough energy to begin decaying from anamplitude ABOVE the selected START TIME THRESHOLD.

To make a measurement using an outside excitation source follow Steps 1 though 6 (see section 17.05.01).

Next, "ARM" the analyzer by touching the T_{60} KEY.

The VERTICAL CURSOR will shrink to its bottom light or follow in REAL TIME the ambient noise in the room.

Excite the room with a signal which will decay through the START TIME THRESHOLD.

The moment the signal decays through the START TIME THRESHOLD the T_{60} measurement will automatically be made.

REARM the analyzer for another measurement, as above, by touching the T_{60} KEY then allow the signal to decay through the START TINE THRESHOLD. The next measurement will be automatically averaged with the previous measurements until a maximum of 16 measurements are made.

As before, moving the VERTICAL CURSOR or touching the PEAK/AVERAGE and/or SMOOTHING TIME KEYS will reset the analyzer for a new series of averages.

17.08 DISPLAYING T_{60} MEASUREMENTS AND DECAY CURVES

17.08.01 GENERAL

The extrapolated T_{60} TINES are displayed as seconds to a one millisecond resolution on the analyzer's MONITOR DISPLAY.

Decay curves may be displayed on a strip chart recorder or storage oscilloscope, via the rear panel connections on the terminal strip. The measurement accuracy of the System 200 can be checked by comparing these decay curves to the actual filter decay times measured by feeding the NOISE SOURCE of the System 200 directly into the MIC input and performing T_{60} measurements on each frequency across the spectrum.

A chart of SMOOTHING TIME CONSTANTS for the entire spectrum is shown in section 17.10 for comparison to actual measured SMOOTHING TIME CONSTANTS.

The System 200 measures time to a 1ms resolution and amplitude to a 0.5 dB resolution.

This fine resolution is often confusing due to the variation between measurements. It is suggested that at least 5 measurements should be made to form a close approximate average.

17.08.02 THE MONITOR DISPLAY

The MONITOR DISPLAY is the 7-segment LED display located above the 12-KEY KEYBOARD. While in the T_{60} MODE the MONITOR DISPLAY STATUS INDICATOR indicates TINE displayed in seconds.

The RESOLUTION CHANGE KEY is located above the 7-segment LED POSITION DISPLAY. While in the T_{60} MODE its function is redefined. Instead of changing the resolution of the FILTER DISPLAY, it selects one of the three T_{60} TIME extrapolations for display on the MONITOR DISPLAY.

As mentioned (17.03), three DECAY TIME measurements are made, averaged and stored each time a T_{60} measurement is made. Each time the RESOLUTION key is pressed the new T_{60} time is extrapolated and displayed.

They are

1. A T_{60} TIME extrapolation based on the first 15 dB of decay.

This time may be displayed on the MONITOR DISPLAY when selecting the 1 dB RESOLUTION INDICATOR by manipulating the RESOLUTION CHANGE KEY.

2. A T_{60} TIME extrapolation based on 30dB of decay.

This time may be displayed as above by selecting the 2 dB RESOLUTION INDICATOR.

3. A T_{60} TIME extrapolation based on the second 15 dB of decay.

This time may be displayed as above by selecting both the 1 dB and 2 dB RESOLUTION INDICATORS.

It is suggested that the user record his T_{60} TIMES on a graph as he moves from filter to filter. The result will be a T_{60} TIME curve of the room.

17.08.03 STORAGE OSCILLOSCOPE

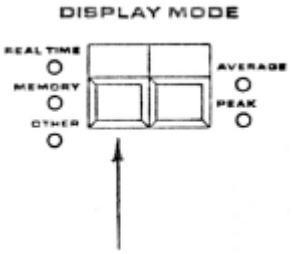
The T_{60} decay for a particular channel can be saved on a storage oscilloscope by connecting the AVERAGE OUTPUT on the back panel of the System 200 to one channel of the oscilloscope. The amplitude and sweep time of the oscilloscope must be adjusted so that the height and width of the display is easily read.

17.08.04 STRIP CHART RECORDER

A STRIP CHART RECORDER can be used to record the decay curve in REAL TIME by connecting the recorder input to the System 200 BACK PANEL, AVERAGE OUTPUT. The speed and amplitude of the recorder must be adjusted to accommodate the decay time of the particular frequency selected. The AVERAGE output of the System 200 is suggested so as to match the Mode normally selected for measurement. Should the ”Peak” mode be used then the RECORDER INPUT must be changed to the PEAK back panel output of the System 200. If the chart speed is known and the vertical scale is calibrated, the 30 dB decay curve can accurately be recorded and the slope measured. This BACK PANEL OUTPUT is a Digital to Analog Converter (DAC) output of the logarithmic Analog to Digital Converter (ACD) data. Therefore the granularity of the plot is due to the resolution of the ADC.

17.09 EXITING THE T_{60} NODE:

The T_{60} NODE may be exited at any time as follows Touch the DISPLAY MODE CHANGE KEY.



The T_{60} MODE will be exited to either the REAL TIME MODE or the MEMORY MODE depending upon which mode the analyzer was in before the T_{60} MODE was entered. In the case of the MEMORY MODE the LAST ADDRESSED MEMORY before the T_{60} MODE was entered will be displayed.

The DISPLAY MODE INDICATOR will also change from OTHER to either REAL TIME or MEMORY.

17. 10 EFFECTS OF THE ANALYZER ' s FILTERS, SMOOTHING TIME CONSTANTS AND PEAK/AVERAGE MODES ON T_{60} MEASUREMENTS:

In the System 200 Signal Analyzer the delay times of the filters are less than the smoothing times of the rectifier/smoothing networks following them. Therefore, the delay of the filters, themselves, may be ignored,.

The delay caused by the rectifier/smoothing networks can be considerable. When making T_{60} measurements some attention must be paid to the expected response times of the room in light of the delayed response times of the filters smoothed by the rectifier/smoothing networks.

In order for a reverberation time analyzer to accurately measure the delay in a room through filters, the room's delay must be greater than the delay of the filter through which the measurement is made. If the delay of the room is less than the delay of the filter, the resulting measurement will be of the filter – not the room.

The T_{60} measurement is a measurement of the time a signal takes to decay 60 dB.

Please refer to the charts at the end of this section. They illustrate the delay caused by the rectifier/smoothing network for each filter currently available for the System 200 Signal Analyzer. These times have been extrapolated for 60 dB of signal decay and may be considered ABSOLUTE MINIMUM T_{60} measurements which may be made through the filter.

The user has control over the filter's response time by appropriately selecting the SMOOTHING TINE CONSTANT and either PEAK or AVERAGE MODES for his measurements.

It is suggested that the user select a combination of SMOOTHING TIME and PEAK or AVERAGE which will produce a filter response (filter's T_{60}) of at least HALF of the expected T_{60} of the room being measured. In most cases the average, fast mode is suggested for T_{60} measurements. The filter responses in this mode have been tailored to suite T_{60} measurements.

For Example: If the room's 1000 Hz T_{60} is expected to be approximately 0.5 seconds and the user wished to use his 1000 Hz, one-third octave filter for the measurement he should choose the analyzer's FAST SMOOTHING TIME and AVERAGE. This combination would yield a filter delay of approximately 0.10 seconds for 60 dB of decay.

If, however, the user chooses the 90% SMOOTHING TIME and the AVERAGE MODE, the delay in his 1000 Hz, one-third octave filter would be greater than the 0.5 second expected room response. In this case the System 200 would measure the filter instead of the room and the result would be approximately 0.7 seconds.

When making a series of T_{60} measurements through the System 200 Signal Analyzer's filters it is always a good practice to compare the measurements with the charts at the end of this section. These charts represent the T_{60} TIMES of the filters and SMOOTHING TIME CONSTANTS. If your measurements approach those on the chart there is an excellent chance that the combination of SMOOTHING TIMES and PEAK/AVERAGE MODES selected produced a filter decay time which was greater than the rooms T_{60} TIME. In this case your measurements are of the filters – not the room.

Based on our discussion thus far, one might look at the curves we have presented of the smoothing times of the rectifiers and elect to ALWAYS use the combination of FAST SMOOTHING TIME and AVERAGE MODE to yield the shortest yet smoothed filter decay time.

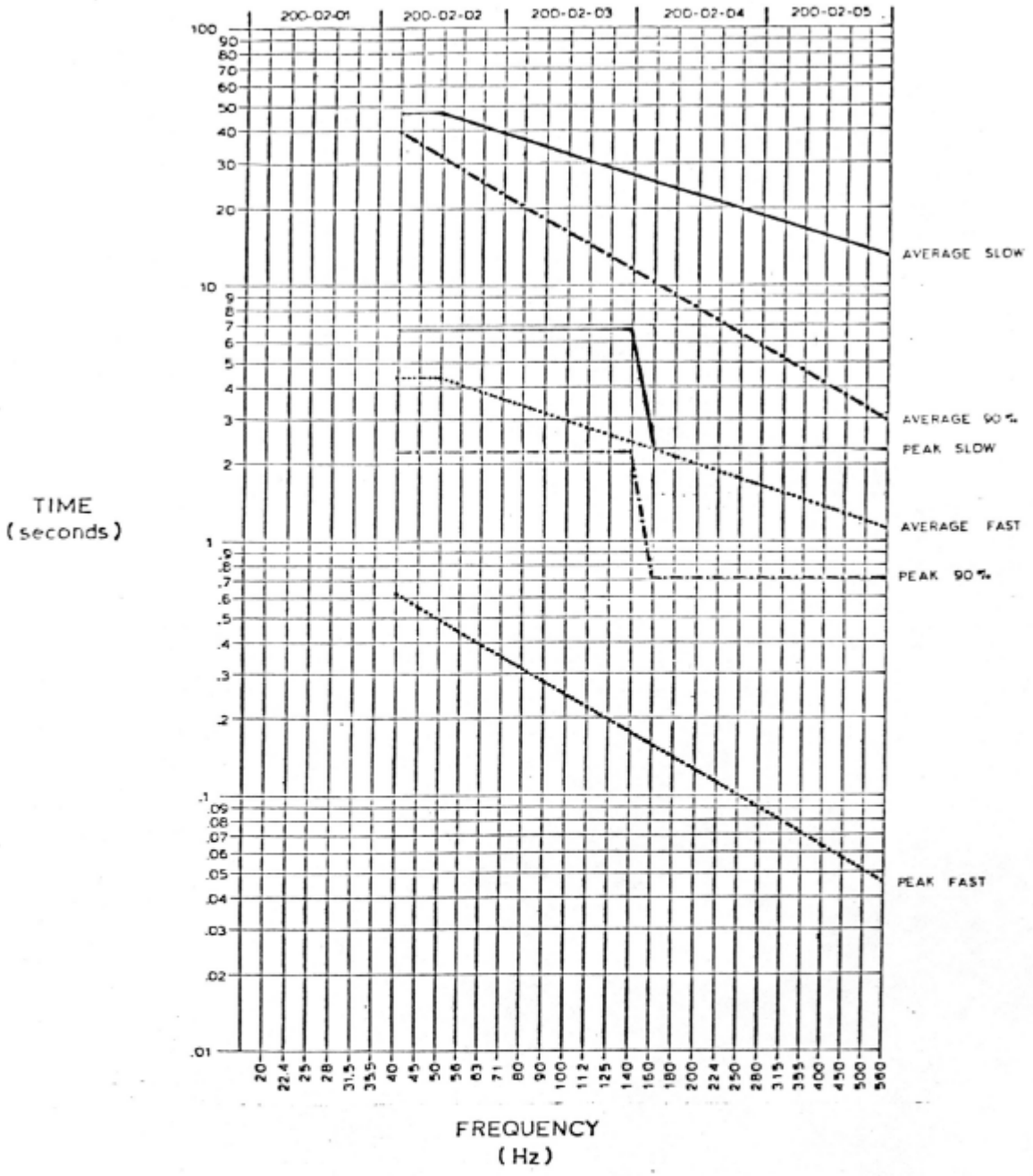
In a great number of cases this is the best selection, especially where short T_{60} room response times are expected. For this reason we have written the software to automatically select this combination when the T_{60} MODE is entered.

Some rooms will exhibit wild decay curves with peaks and valleys in excess of 15 dB. In the time domain these excursions happen quite rapidly.

Since the System 200 Signal Analyzer's T_{60} measurement window (distance between the START and STOP TIME THRESHOLDS) is both 15 dB and 30 dB it is possible that the decaying signal on one of these wild excursions can cross one of the STOP TIME THRESHOLDS which will end the T_{60} measurement prematurely.

For this reason some smoothing on the response of the filter is needed. This smoothing will cause the filter to average these wild excursions and provide a more realistic T_{60} measurement.

Six different combinations of smoothing time and peak or average responses are provided by the System 200 Signal Analyzer and can be used for this purpose. However, the average, fast mode of operation has proven to be the best in capturing accurate T_{60} TIMES.

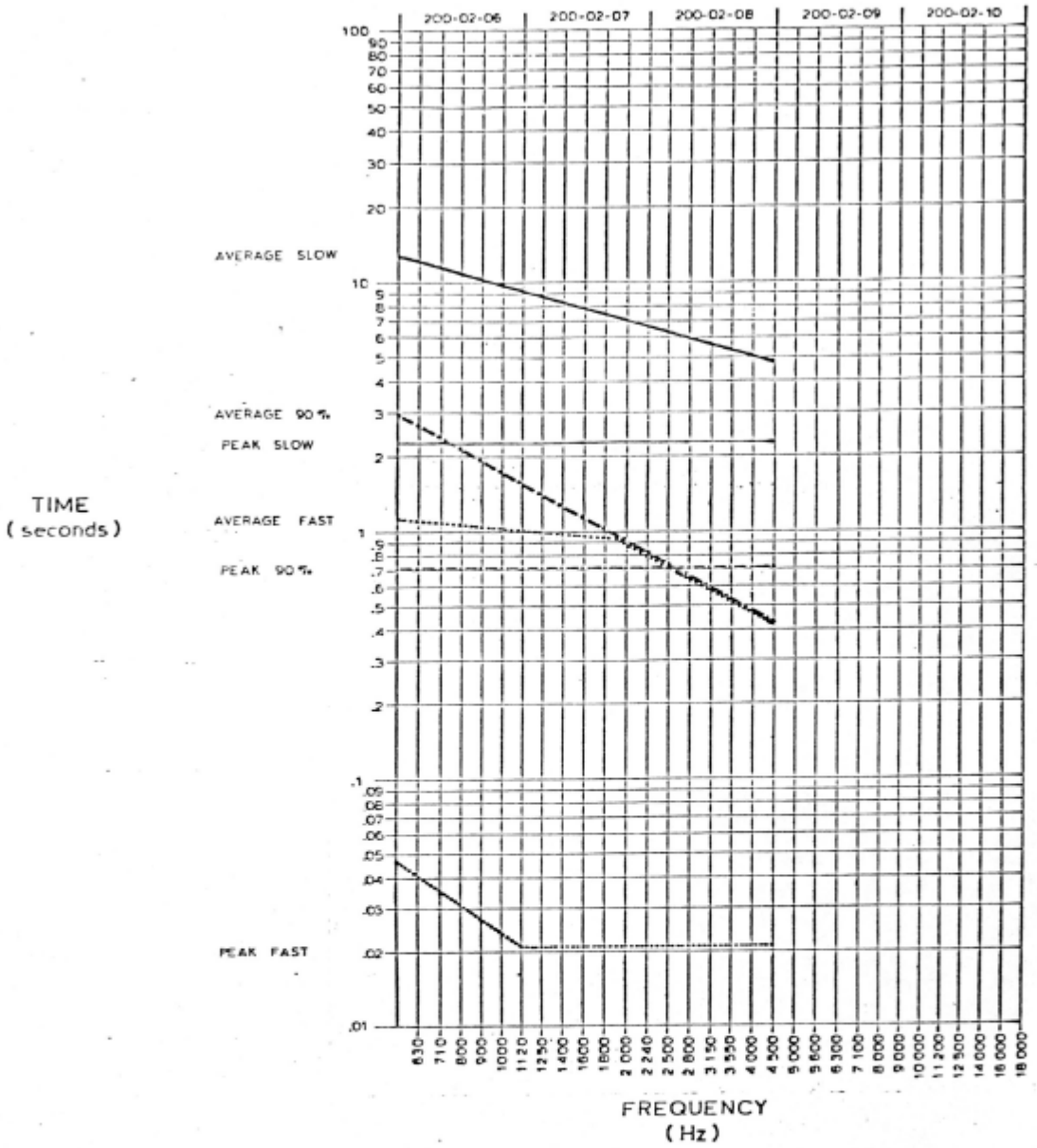


BROADBAND FILTER RESPONSE TIME

	Average	Peak
SLOW	12.384	6.919
90 %	2.204	2.213
FAST	0.261	0.082

1/6 OCTAVE FILTER
SMOOTHING TIME
MEASURED T_{60} MODE

A 101390
Rev. A



BROADBAND FILTER RESPONSE TIME

	Average	Peak
SLOW	12.384	6.919
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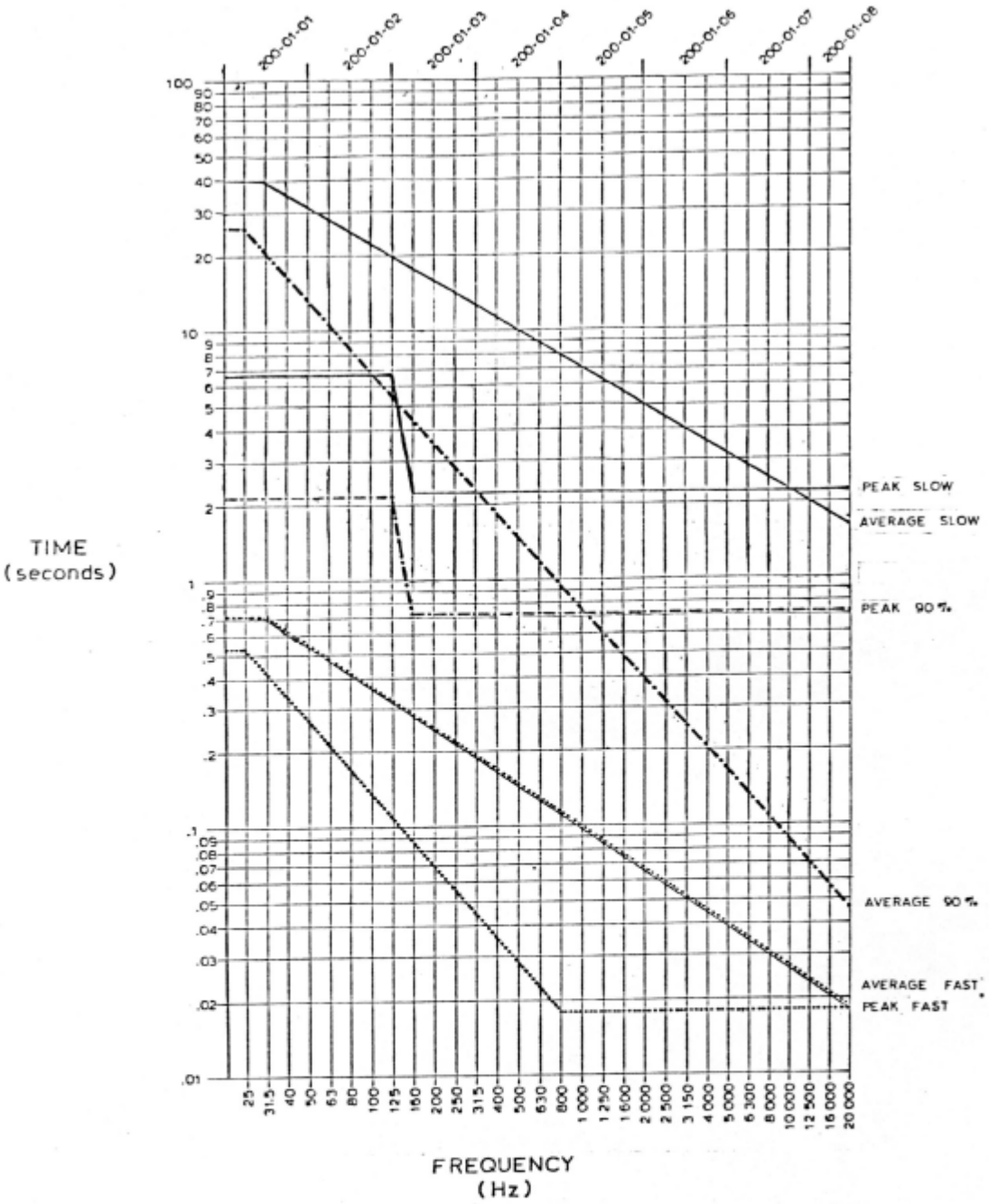
1/6 OCTAVE FILTER
SMOOTHING TIME
MEASURED T_{60} MODE

A 101390
Rev. A

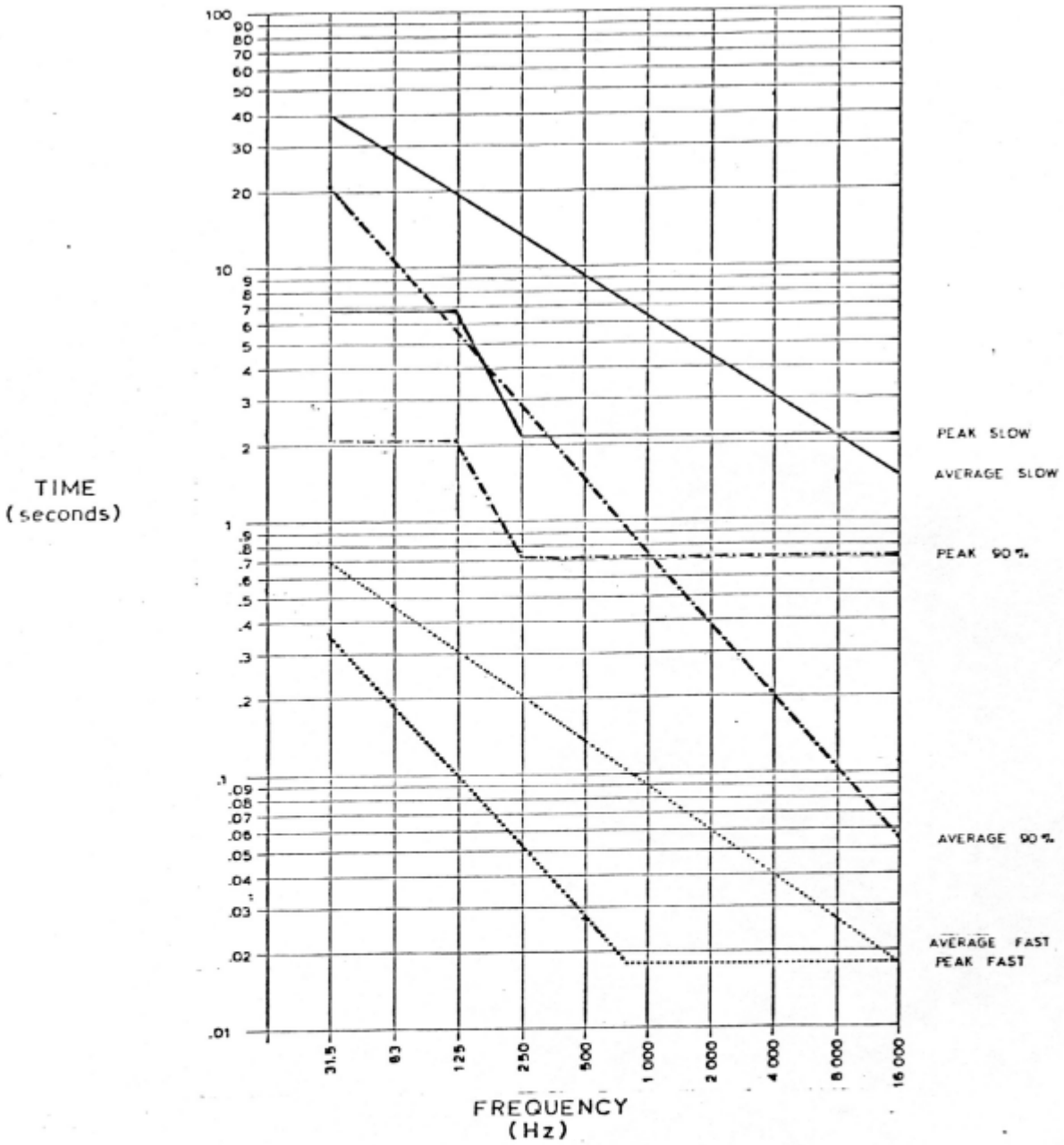


BROADBAND FILTER RESPONSE TIME

	Average	Peak
SLOW	12.384	6.919
90 %	2.204	2.213
FAST	0.261	0.082

Rev. A

1/3 OCTAVE FILTER
SMOOTHING TIME
MEASURED T_{60} MODE



BROADBAND FILTER RESPONSE TIME

	Average	Peak
SLOW	12.384	6.919
90 %	2.204	2.213
FAST	0.261	0.082

OCTAVE FILTER
SMOOTHING TIME
MEASURED T_{60} MODE

A 101390
Rev. A

18 SERVICE NOTES

18. 00 Manual Revisions and Additions

SYSTEM 200 SIGNAL ANALYZER
MANUAL REVISIONS and ADDITIONS

18.00
Rev. 5/80

REV. DATE	SECTION	DESCRIPTION	CURRENT REV.
5/23/80	INDEX	Addition of index to section 18	Rev. 5/80
5/23/80	15.05.03	Revised to correct error	Rev. 5/80
5/23/80	18	Addition to index to section 18	Rev. 5/80
5/23/80	18.01.02	Addition of A101252 pages 1-5 of 5	A101252 1-5
5/23/80	18.01.02	Addition of B101251-D	B101251-D
5/23/80	18.02.01	Addition of A101411-C pages 1-3 of 3	A101411-C 1-3
5/23/80	18.03.01	Addition of A101405-B	A101405-B
5/23/80	18.04.03.12	Addition of B101356 Pages 1-3 of 3	B101356-B 1-3
5/23/80	18	Delete B101251	
5/23/80	18	Delete B101356	
8/31/81	17	Delete Entire Section Text Rev. 1-80	Rev. 8-81
8/31/81	17	Supply New Text Rev. 8-81	Orig. 8-81
9/15/81	14	Rename Section - Options	Orig. 9-81
9/15/81	14	Supply Index	Orig. 9-81
9/15/81	14.01	Supply Text	Orig. 9-81
9/15/81	14.02	Supply Text	Orig. 9-81
9/15/81	Index	Supply New Index	Rev. 9-81

11/30/00 Create Word2000 and PDF of Manual from last revisions.

18. 01 Retrofit Procedures
18.01.02 Assembly Instructions

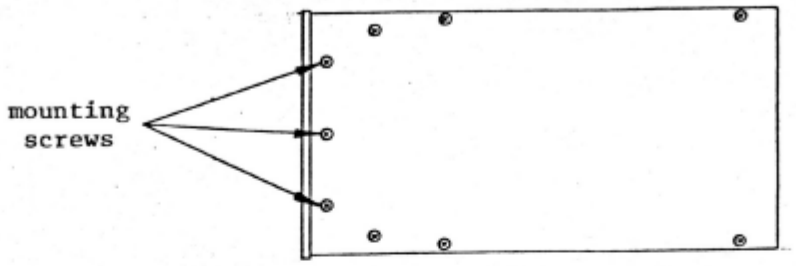
A 101252
Page 1 of 5
18.01.02

MODEL 200

FRONT PANEL REMOVAL

TO REMOVE THE FRONT PANEL:

1. Remove the three (3) mounting screws from each side of the unit.*



2. Carefully pull the Front Panel about 5" away from the chassis.

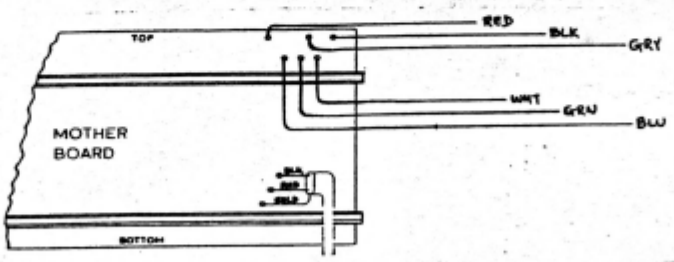
3. Disconnect the ribbon cable from the Mother Board (located in the chassis portion of the unit).

4. Disconnect the nine (9) color coded wires from the Mother Board.

TO RECONNECT THE FRONT PANEL:

1. Place the Front Panel about 5" away from the chassis.

2. Connect the nine (9) color coded wires to the Mother Baord.



White INSTRUMENTS, INC. AUSTIN, TEXAS	MODEL 200 ASSEMBLY INSTRUCTIONS		BY	DATE	SCALE
		DRAWN	EAD	4-29-80	FRAC.
		CHECK	JHL	4-30-80	DEC.
		APP'D.	CLR	4-30-80	TOLERANCES
REV.	DESCRIPTION	REV.		APP.	DWG NO. A 101252
					REV

3. Connect the ribbon cable to the Mother Board making sure the dark blue strip on the ribbon cable is DOWN.

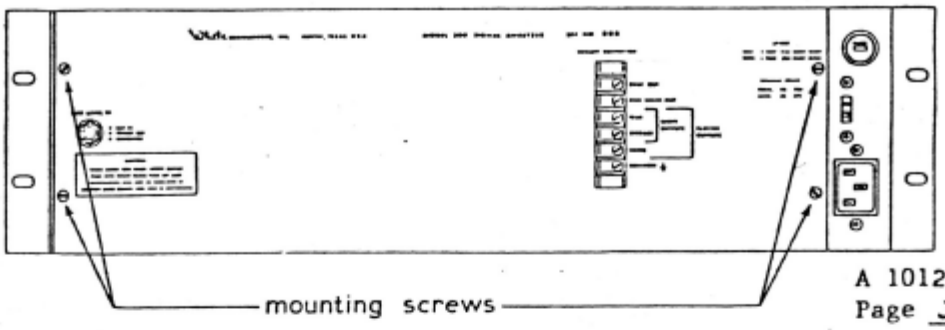
4. Carefully slide the Front Panel back into the chassis making sure as much of the excess ribbon cable as possible is placed between the circuit boards of the Front Panel.

5. Replace the six (6) mounting screws, three (3) on each side.*

* (For S/N 201-210, three (3) mounting screws are on the Top and Bottom Panels respectively).

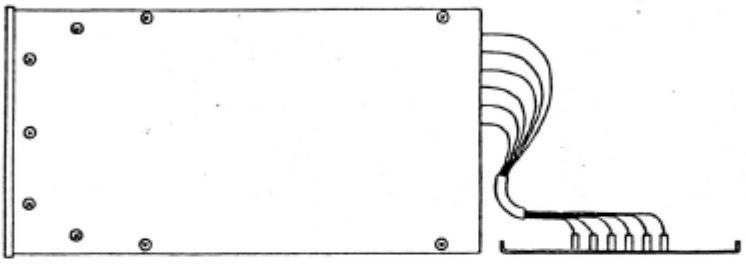
White INSTRUMENTS, INC. AUSTIN, TEXAS	MODEL 200 ASSEMBLY INSTRUCTIONS		BY	DATE	SCALE	TOLERANCES FRAC. DEC.	DWG NO A 101252
		DRAWN	EAD	4-29-80			
		CHECK	JHC	4-30-80			
		APP'D.	CR	4-30-80			
REV.	DESCRIPTION	REV.	APP.				REV

1. Remove the four (4) mounting screws from the back panel of the unit.

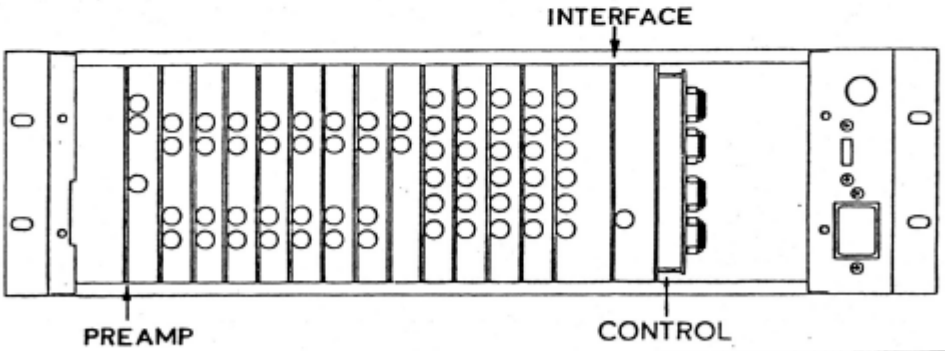


A 101252
Page 3 of 5
18.01.02

2. Lay the back panel down, being careful not to pull the wire connections.



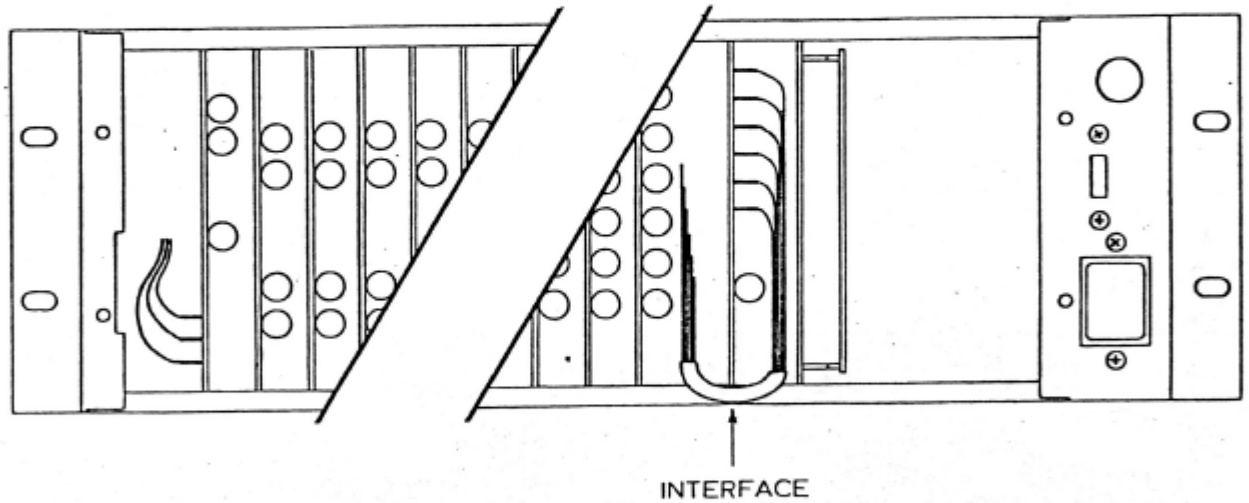
3. Pull Interface Board out approximately 1" to allow disconnecting of wires. Disconnect wires from Preamp Board also and remove panel. Push Interface Board back into edge connector.



White INSTRUMENTS, INC. AUSTIN, TEXAS	MODEL 200 ASSEMBLY INSTRUCTIONS		BY	DATE	SCALE	TOLERANCES FRAC. DEC.	DWG NO A 101252
		DRAWN	JHL	4-30-80			
		CHECK					
		APP'D.	CJC	4-30-80			
REV.	DESCRIPTION		REV.	APP.			REV

4. Connect wires to Preamp Board. Pull Interface Board out approximately 1" and connect wires. Push Interface Board back into edge connector.

5. Replace the back panel by carefully placing the wires as shown, looping them under the INTERFACE Board. Replace the four (4) mounting screws.

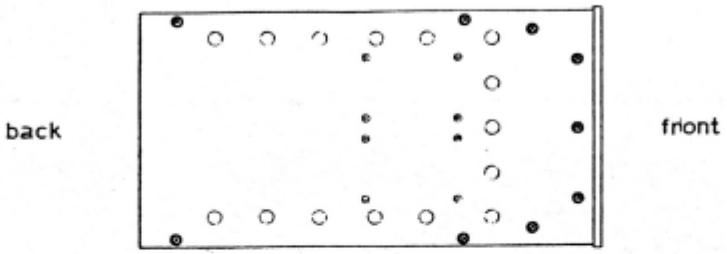


White INSTRUMENTS, INC. AUSTIN, TEXAS	MODEL 200 ASSEMBLY INSTRUCTIONS		BY	DATE	SCALE	DWG NO A 101252
		DRAWN	JHL	4-30-80		
		CHECK				
		APP'D.	CR	4-30-80		
REV.	DESCRIPTION	REV.	APP.		FRAC. ,DEC. TOLERANCES	REV

TO REMOVE THE POWER SUPPLY:

1. Remove the Back Panel (See Back Panel Removal).

2. Remove the nine (9) mounting screws of the left side panel from back to front.



3. Carefully pull the Power Supply Module straight back.

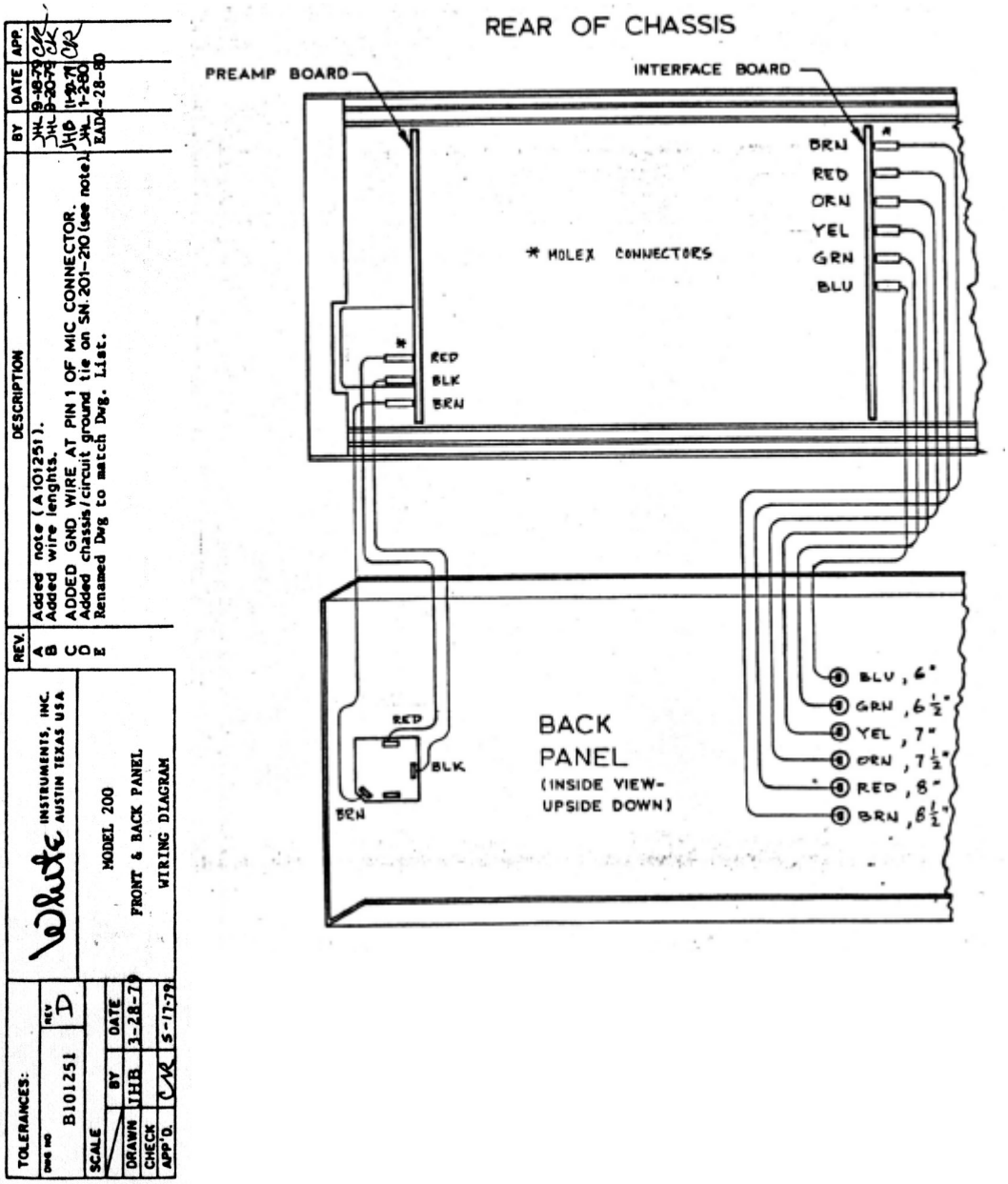
CAUTION: DO NOT move the unit while the Power Supply Module is disconnected as it will cause damage to the unit.

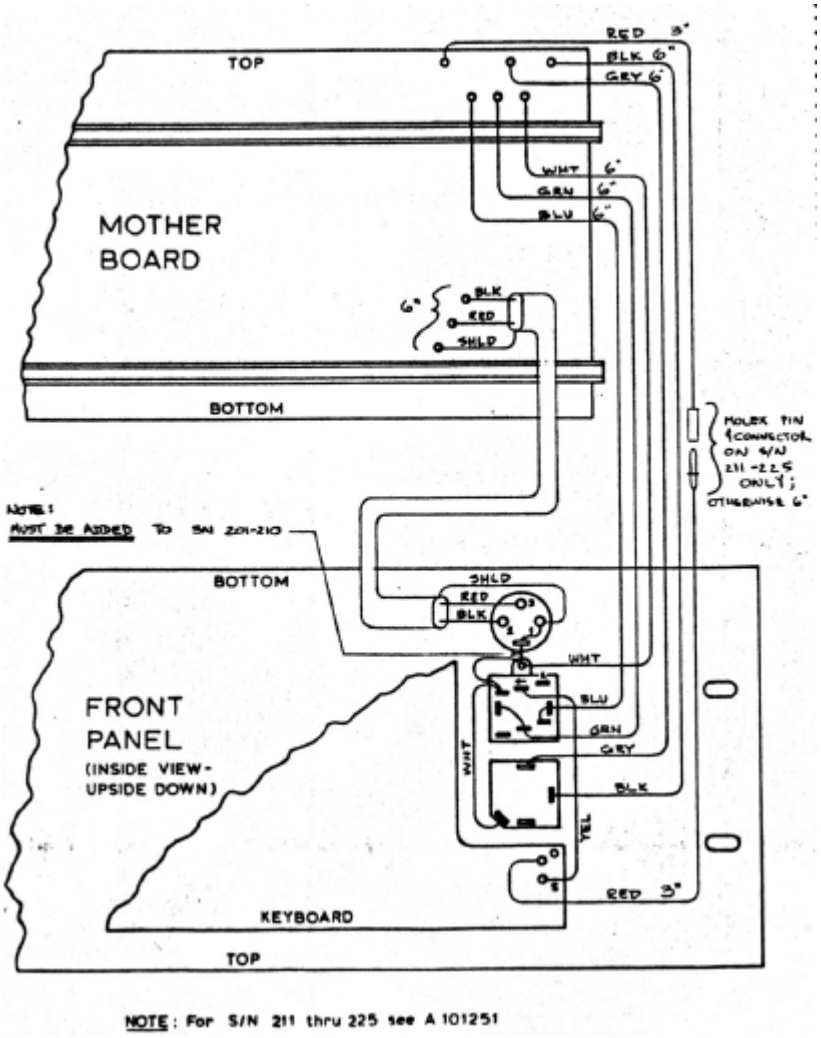
TO REINSTALL THE POWER SUPPLY:

4. Slide the Power Supply Module straight along its card guides until it engages the connector on the Mother Board.

5. Replace the nine (9) mounting screws of the left side panel from back to front.

6. Replace the back panel (See Back Panel Removal).


REAR OF CHASSIS
PREAMP BOARD
INTERFACE BOARD
BRN
RED
ORN
YEL
GRN
BLU
* MOLEX CONNECTORS
RED
BLK
BRN
BACK PANEL
(INSIDE VIEW-UPSIDE DOWN)
BLU, 6"
GRN, 6 1/2"
YEL, 7"
ORN, 7 1/2"
RED, 8"
BRN, 8 1/2"
TOLERANCES:
DWG NO B101251
REV D
SCALE
BY DATE
DRAWN THB 3-28-79
CHECK
APP'D. CR 5-17-79
Wahlke INSTRUMENTS, INC. AUSTIN TEXAS USA
MODEL 200
FRONT & BACK PANEL
WIRING DIAGRAM
REV. DESCRIPTION BY DATE APP.
A Added note (A101251). JHL 9-18-79
B Added wire lengths. JHL 9-20-79
C ADDED GND WIRE AT PIN 1 OF MIC CONNECTOR. JHB 11-12-79
D Added chassis/circuit ground tie on SN 201-210 (see note) JHL 1-2-80
E Renamed Dwg to match Dwg. List. EAD 1-28-80



NOTE: For S/N 211 thru 225 see A 101251

18.02 Performance Tests

18.02.01 Checkout Procedure

PAGE 001 CKOUT200.SA:0 A 101411-C

DWG. #A101411 - REV C Page 1 of 3

MODEL 200 CHECKOUT PROCEDURE 18.02.01

I. CONNECT UNIT TO 115 VAC POWER. (CHECK AC LINE SWITCH TO 115).

II. PUSH POWER SWITCH. POWER INDICATOR SHOULD LIGHT. THE FRONT PANEL INDICATORS LISTED BELOW SHOULD BE ILLUMINATED:

3DB	RESOLUTION
SPL	MODE
70.0	DISPLAY POSITION
1/3 OCT	FILTER SELECTION
SLOW	RESPONSE
REALTIME	MODE
AVERAGE	RESPONSE
UR	MONITOR DISPLAY
FLAT	RESPONSE

III. CYCLE THE FOLLOWING SWITCHES TO CHECK THE REST OF THE INDICATORS. AWT/FLAT, AVE/PK, RT/MEM, BANDWIDTH, SMOOTHING, RESOLUTION. PRESS M1, ACC TO CHECK ACC LIGHT, INSERT PHONE PLUG INTO LINE INPUT TO CHECK DBM/SPL LIGHT, THIS WILL ALSO CHANGE THE DISPLAY POSITION TO READ -30 DB. REMOVE PHONE PLUG. SET RESOLUTION INDICATOR TO 1 DB. PRESS ARROW LEFT KEY OF THE MEMORY KEYBOARD AND CHECK ALL DISPLAY LIGHTS. PRESS ARROW RIGHT KEY TO REMOVE CURSOR. PRESS RT-60, BROADBAND COLUMN SHOULD LIGHT, RESOLUTION ON 2 DB, DISPLAY MODE WILL LIGHT OTHER, AND MONITOR DISPLAY WILL LIGHT TIME. PRESS ARROW LEFT AND 20 KHZ COLUMN WILL LIGHT. PRESS REALTIME/MEM KEY AND 200 WILL RETURN TO REALTIME.

IV. NOISE SIGNAL CHECK.

A. CONNECT THE MIC INPUT PLUG OF THE NOISE CORD(#A101381) TO THE MICROPHONE INPUT JACK OF THE MODEL 200. VERIFY THAT THE INNER MOST LED OF THE NOISE CORD PLUG LIGHTS AT THIS TIME.

B. CONNECT THE PHONE PLUG OF THE NOISE CORD TO THE PINK NOISE OUTPUT JACK OF THE MODEL 200. THE OUTER LED OF THE NOISE CORD PLUG SHOULD LIGHT AT THIS POINT ALLONG WITH THE INNER LED.

C. A HORIZONTAL LINE SHOULD BE DISPLAYED AT THIS TIME ACROSS THE LED MATRIX DISPLAY ON APPROXIMATELY ROW 8 + OR - 3DB. THE BROADBAND COLUMN SHOULD LIGHT ROW 13 + OR - 3DB AND THE MONITOR DISPLAY SHOULD INDICATE APPROXIMATELY 109DB,THE BROAD BAND SPL. PRESS THE PEAK/AVERAGE DEY AND THE DISPLAY SHOULD MOVE UP APPROXIMATELY 3 ROWS OR 9 DB. THE BROADBAND COLUMN SHOULD LIGHT THE OVERRANGE LIGHT. ITS LEVEL IS 12 TO 15 DB HIGHER THAN THAT OF THE NARROW BAND FILTERS.

D. PRESS M1, M2, STORE, M3, M4 ACC, SHIFT STOP, M5, M6 STORE, M7, M8 ACC, SHIFT, STOP. AFTER M3, M4 ACC IS PUSHED, ACCUMULATE LIGHT SHOULD BE LIT. AFTER PRESSING SIFT-STOP, ACC LIGHT SHOULD GO OUT. POWER DOWN, POWER UP,AND ADJUST THE DISPLAY POSITION FOR 1DB/DIV.

E. PRESS M1, DISP AND NOTE DISPLAY, PRESS M2, DISP, NONE OF THE STATUS INDICATORS OR DISPLAY INDICATORS SHOULD CHANGE. CHECK FOR PEAK & AVERAGE. REPEAT FOR (M3, M4), (M5, M6) AND (M7, M8).

PAGE 002 CKOUT200.SA:0

F. CHANGE BAND WIDTH TO OCTAVE. ONLY OCTAVE COLUMNS SHOULD BE LIT ON ROW 10 + OR - 3DB. PRESS M1 STORE. CHANGE BANDWIDTH TO 1/6 OCT, A ROW ACROSS SCREEN AT ROW 7 + OR - 3DB SHOULD BE BE LIT. PRESS M2 STORE. RETURN TO 1/3 OCT BANDWIDTH.

G. PRESS A/WT KEY. RESPONSE SHOULD DROP OFF ON BOTH ENDS OF DISPLAY AND THE MONITOR DISPLAY SHOULD DROP 3 TO 5 DB.

H. PRESS M3 STORE.

I. PRESS INPUT GAIN ↑ . OBSERVE A CHANGE OF 10 DB ON DISPLAY AND "POSITION DISPLAY" READS 60 DB. MONITOR SHOULD NOT CHANGE. PRESS ↑ AGAIN AND "POSITION DISPLAY" SHOULD READ 50 DB.

J. STEP 3 TIMES AND "POSITION DISPLAY" SHOULD READ 80 DB AND MONITOR SHOULD STAY THE SAME, 107.

K. STEP AGAIN AND "POSITION DISPLAY" SHOULD READ 90 DB. PRESS AGAIN AND "POSITION DISPLAY" SHOULD READ 100 DB. RETURN TO 70DB.

V. PLOTTER CHECK: IF AVAILABLE CONNECT A XY PLOTTER TO THE MODEL 200 BACKPANEL OUTPUT FOR AVERAGE CURVE PLOTTING, AS DISCRIBED IN THE OPERATIONS MANUAL FOR THE MODEL 200. INSERT THE PEN AND PAPER AND PREPARE TO PLOT A CURVE.

A. PRESS "PLOTTER" AND ALL 7-SEG DISPLAYS SHOULD DISPLAY A CHARACTER "P". THE PLOTTER SHOULD PLOT BOTH HORIZONTAL AND VERTICAL AXIS AT THIS TIME.

B. AFTER THE AXIS IS COMPLETE PRESS M1,STORE. PRESS M1,DISPLAY. NOTE THE CURVE STORE IN MEMORY ONE TO VERIFY THE PLOT TO BE MADE.

C. PRESS M1,SHIFT,PLOT. THE PLOTTER SHOULD PLOT THE CURVE PREVIOUSLY STORED IN MEMORY ONE. DISCONNECT THE PLOTTER.

VI. RT60 CHECK: SET THE PREAMP GAIN FOR 40.0 DISPLAY POSITION USING THE ↑ KEY.

A. PRESS "RT60" AND VERIFY THE FOLLOWING INDICATORS:

1. 2DB RESOLUTION
2. SPL MODE
3. 30.0 DISPLAY POSITION
4. ALL LEDS IN THE BROADBAND COLUMN ARE LIT.
5. 1/3 OCT BANDWIDTH
6. FAST RESPONSE
7. "OTHER" MODE
8. PEAK MODE
9. TIME MODE
10. FLAT RESPONSE

B. POSITION THE CURSOR ON THE 1KHZ COLUMN FOR RT60 MEASUREMENT. PRESS THE RT60 KEY. THE UNIT SHOULD GATE OFF THE PINK NOISE SOURCE AND MEASURE AN RT60 TIME OF APPROXIMATELY 18 MS. THE VERTICAL COLUMN OF LEDS SHOULD BE DECREMENTED BY ONE LED FOR EACH SUCESSIVE MEASUREMENT UNTIL THE LIMIT OF 16 TESTS HAVE BEEN DONE.

C. PRESS THE REALTIME KEY AND THE UNIT SHOULD RETURN TO THE REALTIME MODE. THIS CONCLUDES THE MODEL 200 CHECKOUT.

****

REVISIONS, CHANGES APPR

A. ENTER 200 CHECKOUT PROCEDURES INTO FILE. EAD 4-07-80
B. REWORKED AND ADDED PLOTTER/RT60 CHECKOUT. WRI 4-29-80
C. REVISED NOISE SIGNAL CHECK; DELETE THE RESOLUTION CHANGE IN SEC. C, CHANGE PREAMP GAIN DISPLAY FROM APPROX 3DB TO 9DB. RT60 CHECK; CHANGED DISPLAY POSITION FROM 40 TO 30. RESEQUENCED. EAD 5-23-80

18.03 Calibration

18.03.01 Filter Board Calibration Procedure

PAGE 001 FILCAL .SA:0

FILTER CALIBRATION PROCEDURE
MODEL 200 SIGNAL ANALYZER
DWG #A101405-B

I. EQUIPMENT NEEDED:

SINE WAVE GENERATOR; FREQUENCY RANGE 20-20KHZ,
AMPLITUDE LEVEL > OR = TO 1DBM.

FREQUENCY COUNTER
AC VOLTMETER
EXTENDER CARD FOR S/N 201-210

II. CONNECTIONS AND EQUIPMENT SETUP:

CONNECT THE GENERATOR TO THE MODEL 200 THROUGH THE LINE INPUT. THE HIGH SIDE CONNECTS TO THE TIP AND THE LOW SIDE TO THE BARREL. ADJUST THE GENERATOR FOR 0.5 DBM + OR - 0.1 DBM. APPLY POWER TO THE MODEL 200. SET THE RESOLUTION TO 1.0 DBM/DIV. AND ADJUST THE ↑ KEYS UNTIL THE DISPLAY POSITION READS -10 DBM. CAUTION: TURN OFF POWER BEFORE REMOVING ANY BOARDS.

III. FILTER CALIBRATION:

ADJUST THE GENERATOR FREQUENCY TO 1.0 KHZ.
ADJUST THE BROADBAND FILTER GAIN CONTROL (DWG# B101350) UNTIL THE BROADBAND COLUMN LIGHT TOGGLES BETWEEN THE 10TH AND 11TH ROWS. IF BALANCE CONTROL IS TURNED BY MISTAKE THE FOLLOWING PROCEDURE CAN BE USED TO REBALANCE CONVERTOR. CONNECT SCOPE TO PIN 8, U5 OF PREAMP BOARD (OP AMP BEHIND POT). SET GENERATOR TO 1 KHZ. ADJUST BALANCE CONTROL UNTIL PEAKS ARE THE SAME HEIGHT. THE MONITOR DISPLAY SHOULD READ +0.5 DB. ADJUST THE 1 KHZ FILTER GAIN CONTROL (DWG #B101135) UNTIL ITS LIGHT TOGGLES BETWEEN THE 10TH AND 11TH ROWS. REPEAT THIS PROCEDURE FOR ALL REMAINING FILTERS BY SETTING THE GENERATOR TO THE CORRECT CENTER FREQUENCY AND ADJUSTING THE GAIN CONTROL TRIM POTS FOR THE SAME OUTPUT LEVEL AS THE 1 KHZ FILTER. (THE GAIN OF THE 1 OCTAVE AND 1/3 OCTAVE FILTERS ARE ADJUSTED SIMULTANEOUSLY WITH THE SAME CONTROL.)

****

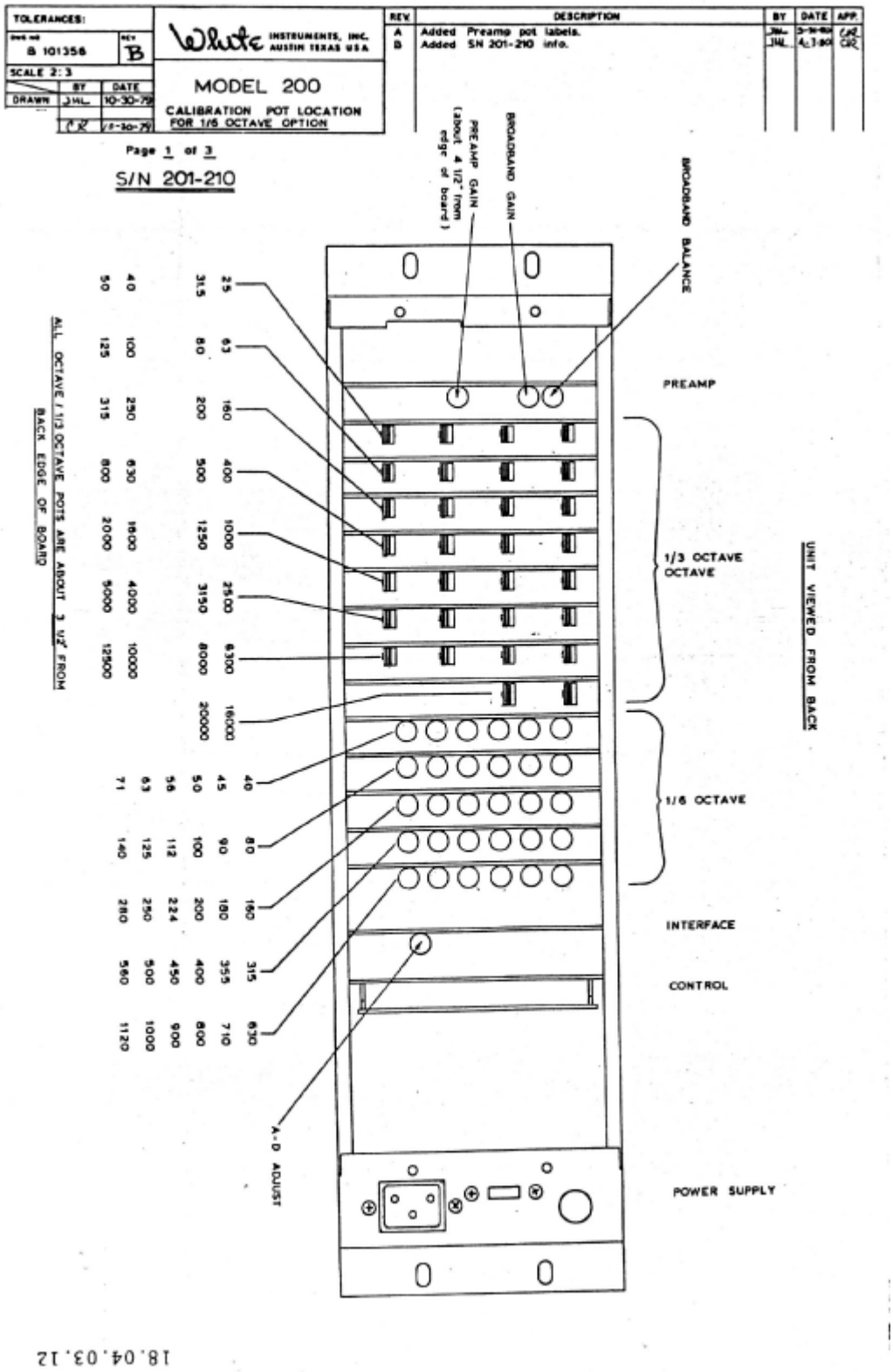
REVISIONS & CHANGES APPR

A. ADD EXTENDER CARD TO EQUIP. ADD CAUTION NOTE TO STEP II.
ADD INFO REFERRING TO BALANCE, STEP III. EAD 4-8-80 CK
B. ADDED LAST SENTENCE TO #3. WRI 4-29-80 CK

18.04 Documentation

18.04.03 Wiring Diagrams & Connection Tables

18.04.03.12 Calibration Pot Location



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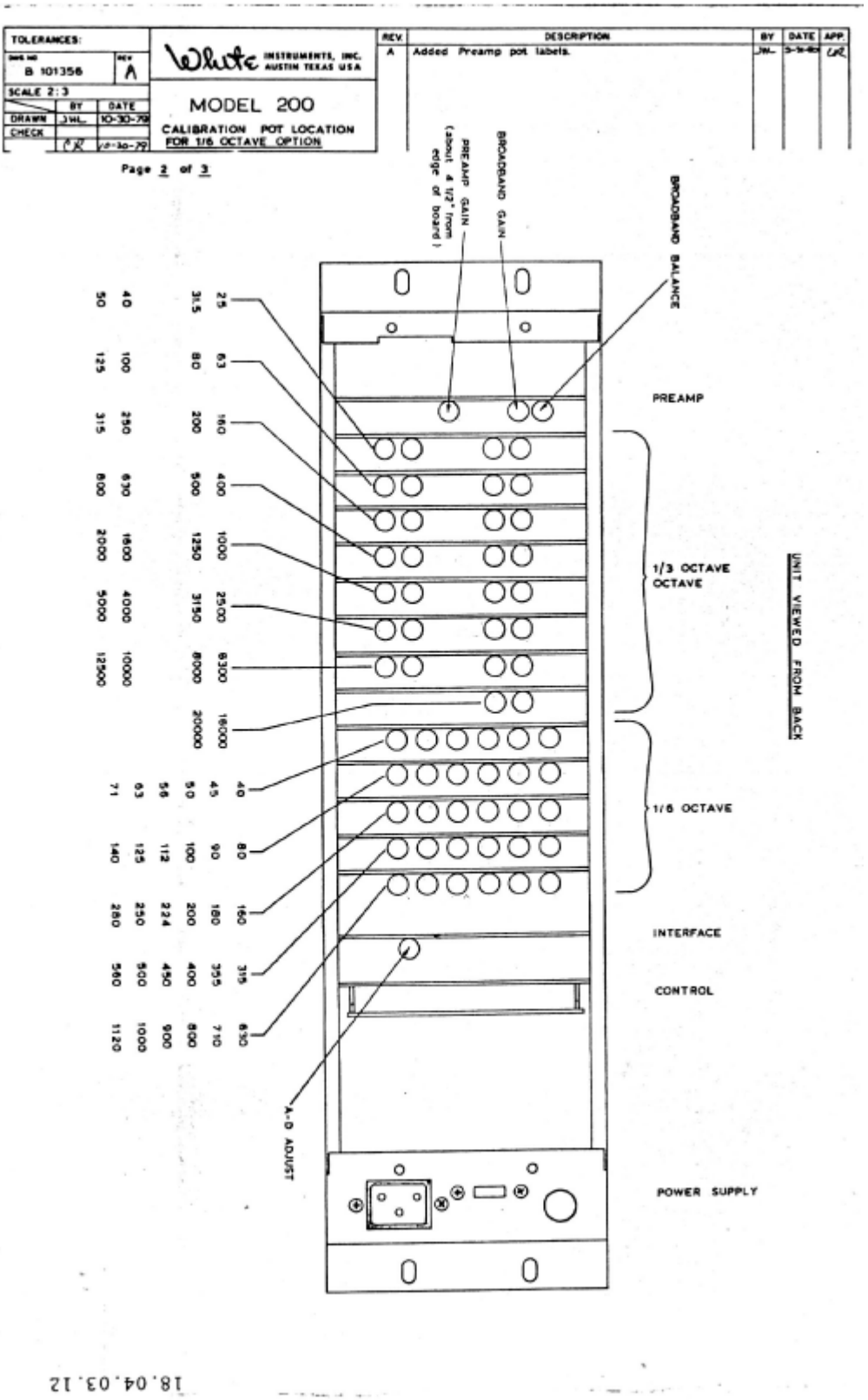
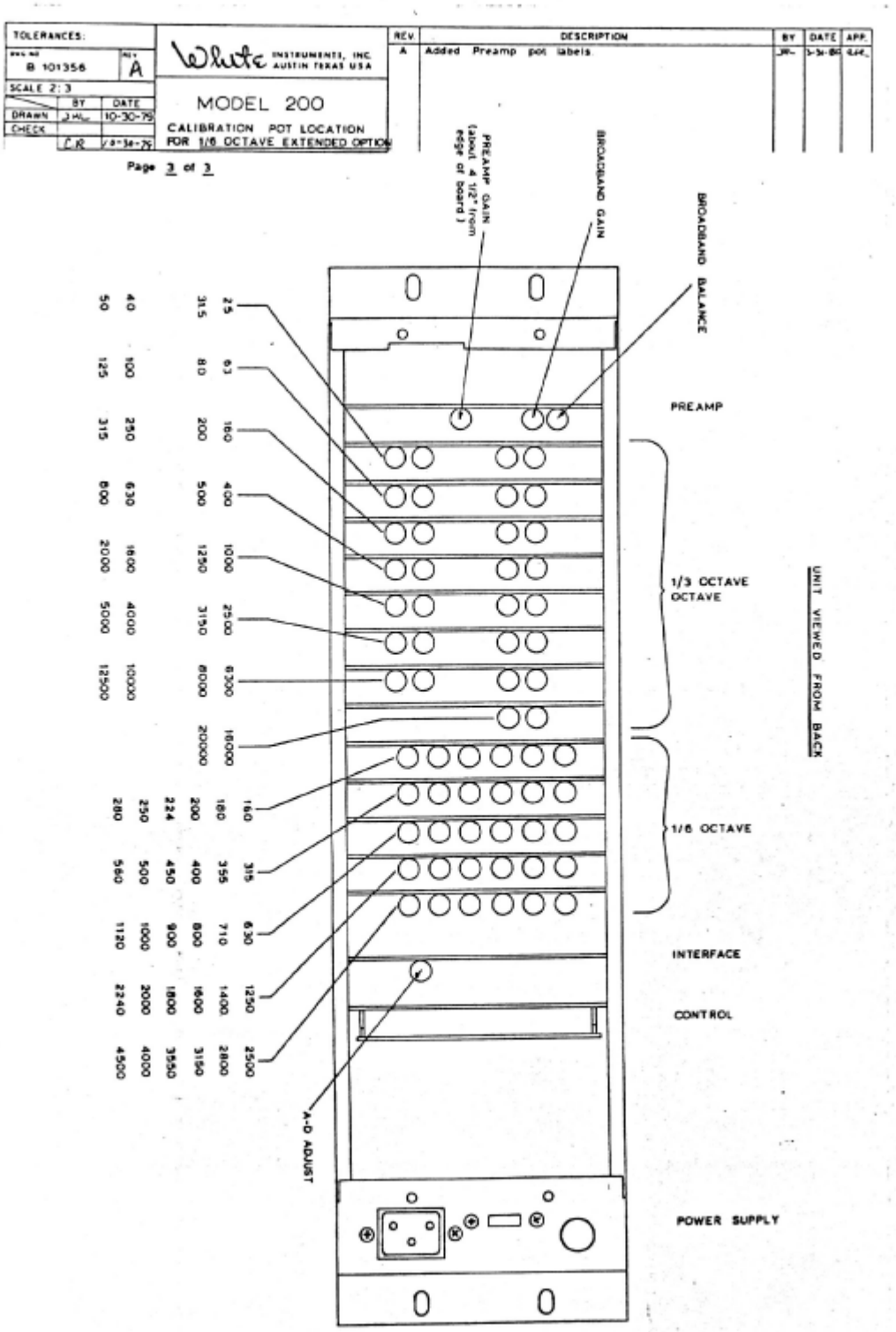

TOLERANCES:
B 101356
SCALE 2:3
DRAWN
CHECK
White INSTRUMENTS, INC. AUSTIN TEXAS USA
MODEL 200
CALIBRATION POT LOCATION FOR 1/6 OCTAVE OPTION
Page 2 of 3
REV.
DESCRIPTION
BY
DATE
APP.
A
Added Preamp pot labels.
PREAMP GAIN (about 4 1/2" from edge of board)
BROADBAND GAIN
BROADBAND BALANCE
PREAMP
1/3 OCTAVE
OCTAVE
1/6 OCTAVE
INTERFACE
CONTROL
POWER SUPPLY
A-D ADJUST
UNIT VIEWED FROM BACK
25 31.5 40 50
63 80 100 125
160 200 250 315
400 500 630 800
1000 1250 1600 2000
2500 3150 4000 5000
6300 8000 10000 12500
16000 20000
40 45 50 56 63 71
80 90 100 112 125 140
160 180 200 224 250 280
315 355 400 450 500 560
630 710 800 900 1000 1120


TOLERANCES:
B 101356
A
SCALE 2:3
DRAWN
CHECK
White INSTRUMENTS, INC. AUSTIN TEXAS USA
MODEL 200
CALIBRATION POT LOCATION FOR 1/6 OCTAVE EXTENDED OPTION
REV.
DESCRIPTION
BY
DATE
APP.
A
Added Preamp pot labels
Page 3 of 3
PREAMP GAIN (about 4 1/2" from edge of board)
BROADBAND GAIN
BROADBAND BALANCE
PREAMP
1/3 OCTAVE
OCTAVE
1/6 OCTAVE
INTERFACE
CONTROL
POWER SUPPLY
A-D ADJUST
UNIT VIEWED FROM BACK
25 31.5 40 50
63 80 100 125
160 200 250 315
400 500 630 800
1000 1250 1600 2000
2500 3150 4000 5000
6300 8000 10000 12500
16000 20000
160 180 200 224 250 280
315 355 400 450 500 560
630 710 800 900 1000 1120
1250 1400 1600 1800 2000 2240
2500 2800 3150 3550 4000 4500

18.04.03.12