Instruction Manual

MODEL 1100-AR SERIES
TELEMETRY RECEIVER
S/N 399 and above

July 1972

Microdyne

Excellence In Communications Technology

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Instruction Manual

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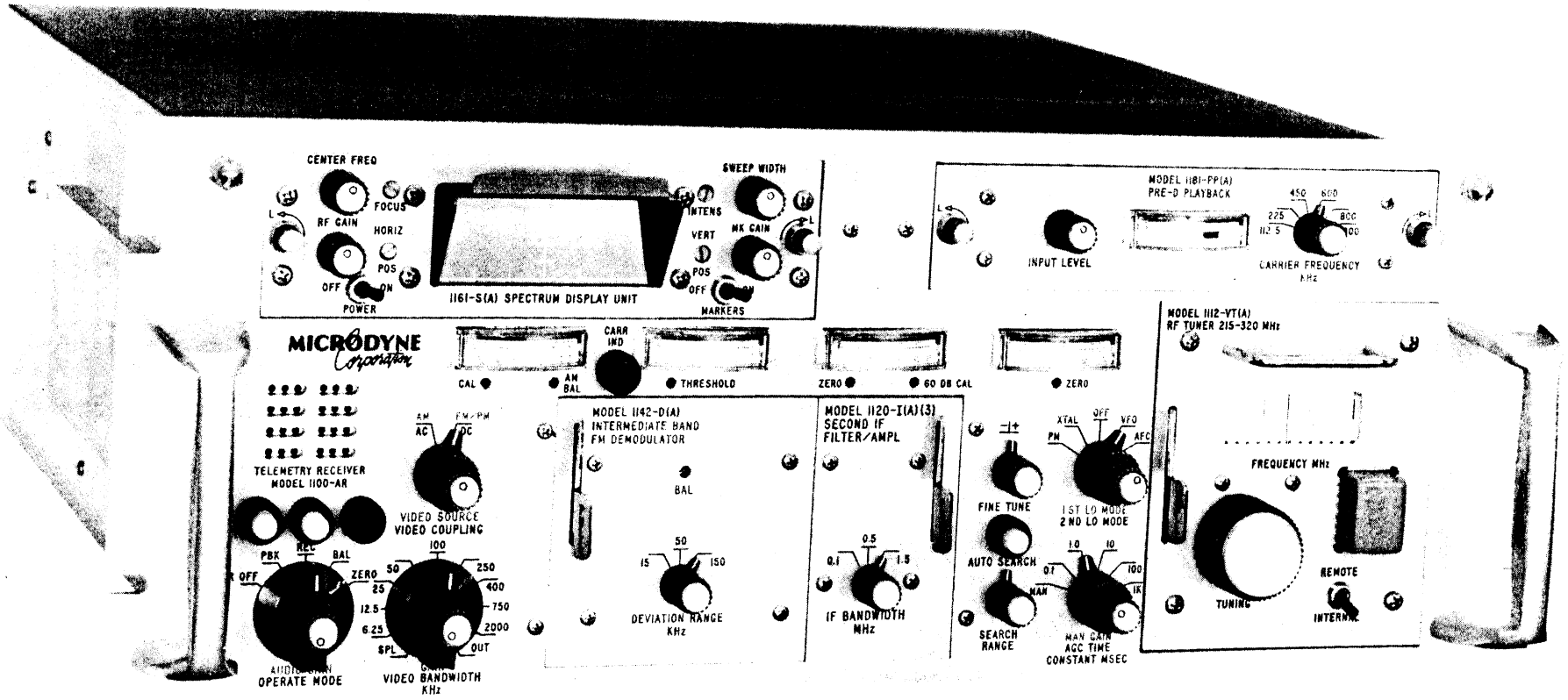


Figure 1-0. Model 1100-AR Telemetry Receiver, Typical Configuration

SECTION I
GENERAL INFORMATION

1.1 INTRODUCTION

This instruction manual provides operation and maintenance information for the Model 1100-AR Telemetry Receiver, designed and manufactured by Microdyne Corporation. The 1100-AR is a highly adaptable, completely modularized receiver which can be easily integrated into ground station and laboratory applications by simply selecting the module complement on order.

Being extremely versatile, the 1100-AR can be easily configured as a low-cost general purpose receiver supplying the minimum number of outputs, or as a complex data receiver with predetection record and playback capabilities, automatic search and lock for signal acquisition and spectrum analysis by simply selecting the module complement.

Because of the many combinations of modules available for the 1100-AR, this manual is constructed to be readily adaptable to any receiver configuration. It is composed of seven individual sections preceded by a receiver configuration page and contents pages. The receiver configuration page provides a listing of which modules are supplied in the associated receiver configuration and if applicable, special modifications or options. Using the information presented on this page, Sections I through VII can be modified as required to match the receiver. For example, if the applicable receiver does not contain playback or record capabilities, the information pertaining to these items can be designated as not applicable. Maintenance procedures, replaceable parts lists and schematic diagrams are adapted in a like manner.

Manuals supplied for special receivers which have been slightly modified to meet particular requirements contain an Addendum which thoroughly describes the modification and the effects it has on overall procedures and parameters. Also included are any special instructions for modifying operating and maintenance procedures, parts lists and schematic diagrams.

The final portion is composed of the instruction booklets for each plug-in module or a group of related modules excluding front panel plug-in modules. Included in each booklet is the theory of operation, special mounting procedures, repair and alignment procedures, parts lists and schematic diagrams. The number of booklets contained in this section depends upon the module complement of the associated receiver.

Front panel modules, because of their complexity, are supplied with a complete instruction manual. These manuals are provided as supplements to this manual and may or may not be bound in this volume.

1.2 PURPOSE AND DESCRIPTION

The Microdyne Model 1100-AR Telemetry Receiver is an advanced general purpose telemetry receiver featuring solid-state design through full use of integrated circuits and subminiature components. The 1100-AR is capable of receiving and processing any telemetry data format. The standard frequency ranges include 105 to 2300 MHz with discrete ranges to 6000 MHz available.

The receiver can be supplied in either of two basic configurations designated 1100-AR(5) and 1100-AR. The 1100-AR(5) has a 5-1/4 inch panel height and the

Purpose and Description, continued

1100-AR has a 7 inch panel height. The 1100-AR, with its 7 inch panel, has front panel provisions for a spectrum display unit and pre-d converters. Both configurations comprise front panel and internal modules that may be selected to meet the specific system requirements.

The building block concept of modular construction allows the 1100-AR to be configured for a wide variety of purposes and uses. In its most basic configuration, it is a low-cost general purpose receiver while in another configuration it is a complex data receiver with pre-d record and playback capabilities, automatic search and lock for signal acquisition, and spectrum analysis. If desired, the unit can be completely controlled by a computer or from a remote location.

The use of monolithic integrated circuits reduces component density and increases overall receiver reliability to a calculated MTBF in excess of 7,500 hours. Reduced component density increases maintainability to the extent that the MTTR for the 1100-AR is approximately 30 minutes.

Gain distribution is optimized by controlling signal and noise levels at all receiver interface points. Receiver gain, prior to second IF band limiting, is as low as possible to achieve optimum receiver noise figure characteristics.

The 1100-AR employs linear-phase steep-skirted IF filters to optimize phase nonlinearity in the second IF filter/amplifier without compromising the filter shape factor and subsequent degrading overall receiver selectivity.

The AFC circuitry provides variable automatic search and lock as well as high drift reduction AFC. The front panel adjustable search continues until a threshold signal appears in the second IF passband. At this point, receiver lock is automatically accomplished.

The 1100-AR can be used in predetection recording systems. An auxiliary front panel plug-in slot can accomodate either an 1181-PP(A) Predetection Playback Converter or an 1171-PR(A) Predetection Record Converter. These units provide a full capability for pre-d up and pre-d down conversion with a choice of six switch selectable record frequencies. Single frequency up and down converters are also available as internal plug-in modules.

The 1100-AR receivers are also adaptable to predetection or post detection diversity combining applications. The receiver AGC outputs which are available for controlling the combiner also have several operational advantages. These include reversible polarity, adjustable slope, and zero offset adjustments. Additionally, the receiver furnishes two logic signals indicating loss of carrier and AFC/APC search.

Front panel controls are grouped logically for ease of operation with concentric switches used in related areas. Multicolor lamps indicate playback, receiver, or calibration operating modes, carrier presence and automatic search. Meters display video output level, signal level, tuning error and loop stress, and deviation. Calibration controls are conveniently located adjacent to each respective meter.

The electrical, environmental and mechanical specifications are given in Table 1-1.

1.3 MODULE DESCRIPTIONS

Brief descriptions of the receiver modules are given in the following paragraphs. A modular layout illustration is shown in Figure 1-2.

1.3.1 RF TUNER (Front Panel)

A series of RF tuners covering discrete frequency bands is available for use with the 1100-AR to enable reception of RF carriers ranging from 105 MHz to 6000 MHz. These units are available in both voltage tuned and mechanically tuned models. The voltage tuned "D" series tuners are available with digital readout displays for indicating the received frequency. The "SYN" series of tuners offers synthesized tuning. The tuners function to down convert the selected RF input to a 50 MHz IF signal for further processing. The voltage tuned versions have the additional capability of being controlled by a voltage input from a remote tuning console or computer interface.

1.3.2 DEMODULATORS (Front Panel)

Demodulator modules are available for the processing of FM, phase, and bi-phase data. FM demodulators comprise three basic units, each of which covers a certain range of IF bandwidths. A narrow band unit covers up to and including 50 KHz, and intermediate and wide band units cover ranges of 100 KHz to 750 KHz and 750 KHz to 6 MHz. In addition, the intermediate and wide band units or all three ranges can be supplied in a single housing. The wide angle phase demodulator may be used with any IF bandwidth and is capable of retrieving PM data having peak deviations up to 2.8 radians. This module may be equipped with an option anti-sideband lock feature which effectively prevents sideband lock on signal acquisition. A bi-phase demodulator is available for use with IF bandwidths exceeding 100 KHz. Capabilities of this unit include demodulation of a ±90 PSK, bi-phase modulated signal at bit rates between 1 bit and 2 megabits, NRZ. It also is equipped with the anti-sideband lock feature.

1.3.3 SECOND IF FILTER/AMPLIFIERS (Front Panel)

The second IF filter/amplifier modules are employed to establish the bandwidth of the 10 MHz second IF signal. Both fixed and variable bandwidth units are available. Each of the fixed bandwidth models sets a single bandwidth in the range of 10 KHz to 6 MHz. Up to three of these filter/amplifiers can be installed in a module housing to enable multi-bandwidth operation. Modules of this type are equipped with a front panel selector switch. Variable bandwidth models are voltage tuned and are equipped with a front panel dial to permit selection of any IF bandwidth within its operating range. One such unit is the Model 1120-VI(600) which is capable of setting any bandwidth from 100 KHz to 600 KHz.

1.3.4 FIRST IF FILTER (Optional)

The first IF filter space in the receiver may be equipped with any one of three types of modules as selected by the customer on order. The first type of module supplies steep-skirted filtering of the first IF signal and establishes either a 600 KHz, 1.2 MHz or 4 MHz bandwidth. The second type contains any two of the standard or special bandwidths and is automatically switched by the second IF filter/amplifier. Both of these modules supply an isolated 50 MHz output for display purposes. The third type of module supplies no filtering whatsoever but provides a 50 MHz output for display purposes. A first IF filter is required if a spectrum display unit is used.

1.3.5 SECOND MIXER

The second mixer accepts the 50 MHz first IF input and a 60 MHz second local oscillator input, and provides a 10 MHz second IF output. When the receiver is used in the playback configuration, the 50 MHz pre-recorded signal is injected into the second mixer and processed identically to the normal first IF signal.

1.3.6 SECOND LOCAL OSCILLATOR

This module supplies the 60 MHz LO signal to the second mixer. The oscillator may be operated in any one of five modes to supply the required signal. These modes, VFO, CRYSTAL, AFC, PM or OFF, are controlled by a front panel switch. In the VFO mode, the frequency is controlled by a front panel fine tune control. In the AFC and PM modes, the frequency is controlled by a voltage generated by AFC circuitry or the phase demodulator (PM). When set to the CRYSTAL mode, a fixed 60 MHz signal is generated. The OFF position permits the injection of an external 60 MHz input.

1.3.7 AM DETECTOR

An AM detector module is employed in the 1100-AR to detect any AM data, derive the raw AGC voltage for gain control, and provide both linear and limited 10 MHz outputs for recording.

1.3.8 CALIBRATE/REFERENCE OSCILLATOR

The calibrate/reference oscillator serves a dual function. It provides a 10 MHz output which is employed to calibrate FM systems and it serves as a reference for PM systems.

1.3.9 VIDEO FILTERS

The video filters are employed in the receiver to establish the video cutoff frequency. Any two of seven video filter modules can be included in the 1100-AR main chassis. Each of the modules contains a number of video filter circuits in various combinations as selected by the customer. Selection of which filter used is made through a front panel switch. In addition, a third filter can be installed to establish a special non-standard cutoff frequency as specified by the customer.

1.3.10 VIDEO AMPLIFIER

The detected and filtered video signal is amplified by this module and coupled to a rear apron connector. A second output of this module also drives the front panel output meter. The gain of the video amplifier is adjustable through a front panel control.

1.3.11 AGC AMPLIFIER

The AGC amplifier contains three separate circuits: an AGC amplifier, an AGC output amplifier and a carrier operated relay (COR). The AGC amplifier circuit is driven by an output from the AM detector and is used to control the gain of the tuner, second mixer, and second IF filter/amplifier. This amplifier circuit also feeds the signal level meter on the front panel of the receiver. Various AGC time

AGC Amplifier, continued

constants from 0.1 milliseconds to 1 second are selectable through a front panel switch. The output voltage can also be manually set to the desired level through a selector switch and potentiometer.

The AGC output amplifier circuit is used to amplify the output of the AGC amplifier circuit and feed it to a rear panel connector. Signals appearing at this connector can then be recorded or applied to combining equipment as required. The COR circuit is also driven by the AGC amplifier circuit. This relay causes a front panel lamp to light when the receiver carrier is above preset threshold level. A double set of single pole double throw relay contacts (appearing at a rear panel connector) is also provided by the COR. These contacts operate when the front panel carrier lamp lights and may be used to control remote indicators.

1.3.12 METERING AMPLIFIER

The metering amplifier module supplies the drive voltages to the receiver deviation and output meters. These voltages are initially derived from the plug-in demodulator and video amplifier, respectively. Also contained in the metering amplifier module is a bridge amplifier circuit. This stage is employed to regulate the oven temperature when a crystal oven is installed in the tuner.

1.3.13 AFC AMPLIFIER

The AFC amplifier contains automatic sweep circuitry in addition to the normal AFC circuit. The automatic sweep circuit is employed in both the AFC and PM modes of operation to generate search voltages to the second LO to enable automatic search and lock after signal dropout. Outputs are also provided to control the search indicator lamp and to drive the tuning meter.

1.3.14 PLAYBACK CONVERTER (Optional)

Two types of playback converters are available for use with the 1100-AR. These are designated 20-1100 series and 100-117 series. When a receiver is equipped with a 20-1100 series, any one of the six standard video record carriers is up converted to 50 MHz and injected into the second mixer. When the receiver is equipped with a 100-117 series converter, a 10 MHz signal is up converted to 50 MHz and injected into the second mixer.

1.3.15 RECORD CONVERTER (Optional)

The record converters designed for use with the 1100-AR are designated 10-1100 series. There are six standard modules available, each of which supplies a single video record carrier output taken from a rear apron connector. The input to this module is supplied by the limited or linear 10 MHz output.

1.3.16 DISPLAY CONVERTER (Optional)

A display converter can be installed in the receiver to permit mating the 1100-AR with a spectrum display unit having an input frequency requirement of other than 50 MHz. This module accepts the 50 MHz IF signal and converts it to the customer specified frequency with unity gain.

1.3.17 SPECTRUM DISPLAY UNIT (Optional)

The Model 1161-S(A) Spectrum Display Unit can be installed directly into the top left side equipment space in the 1100-AR receiver only. When used with the 1100-AR(5), it must be installed in a separate housing. The 1161-S(A) accepts the 50 MHz IF signal and provides a visual representation of signals appearing in a 5 MHz passband on a CRT. All controls necessary for operation of the display unit are locked on its front panel.

1.3.18 PREDETECTION RECORD CONVERTER (Optional)

The Model 1170-PR(A) series of Predetection Record Converters is also designed for use in the 1100-AR receiver. A separate housing is available for use with the 1100-AR(5). This module accepts the linear or limited 10 MHz IF signal and provides any of six video record carrier outputs. Selection of the output frequency is made through a front panel switch.

1.3.19 PREDETECTION PLAYBACK CONVERTER (Optional)

The Model 1180-PP(A) series of Predetection Playback Converters is a third auxiliary plug-in for the 1100-AR. Like the display unit and companion 1171-PR(A) record converter, it also can be placed in a separate housing for use with the 1100-AR(5). The unit accepts any of the six standard video record carriers and up converts it to 10 MHz. This signal is then patched to the 100-117 (10 to 50 MHz) converter and injected into the second mixer. A front panel switch is provided for selecting the particular video carrier input. The unit is also equipped with a level adjustment and meter to enable optimum operation.

1.3.20 CENTER FREQUENCY OFFSET AND AUXILIARY AGC OUTPUT MODULES (Optional)

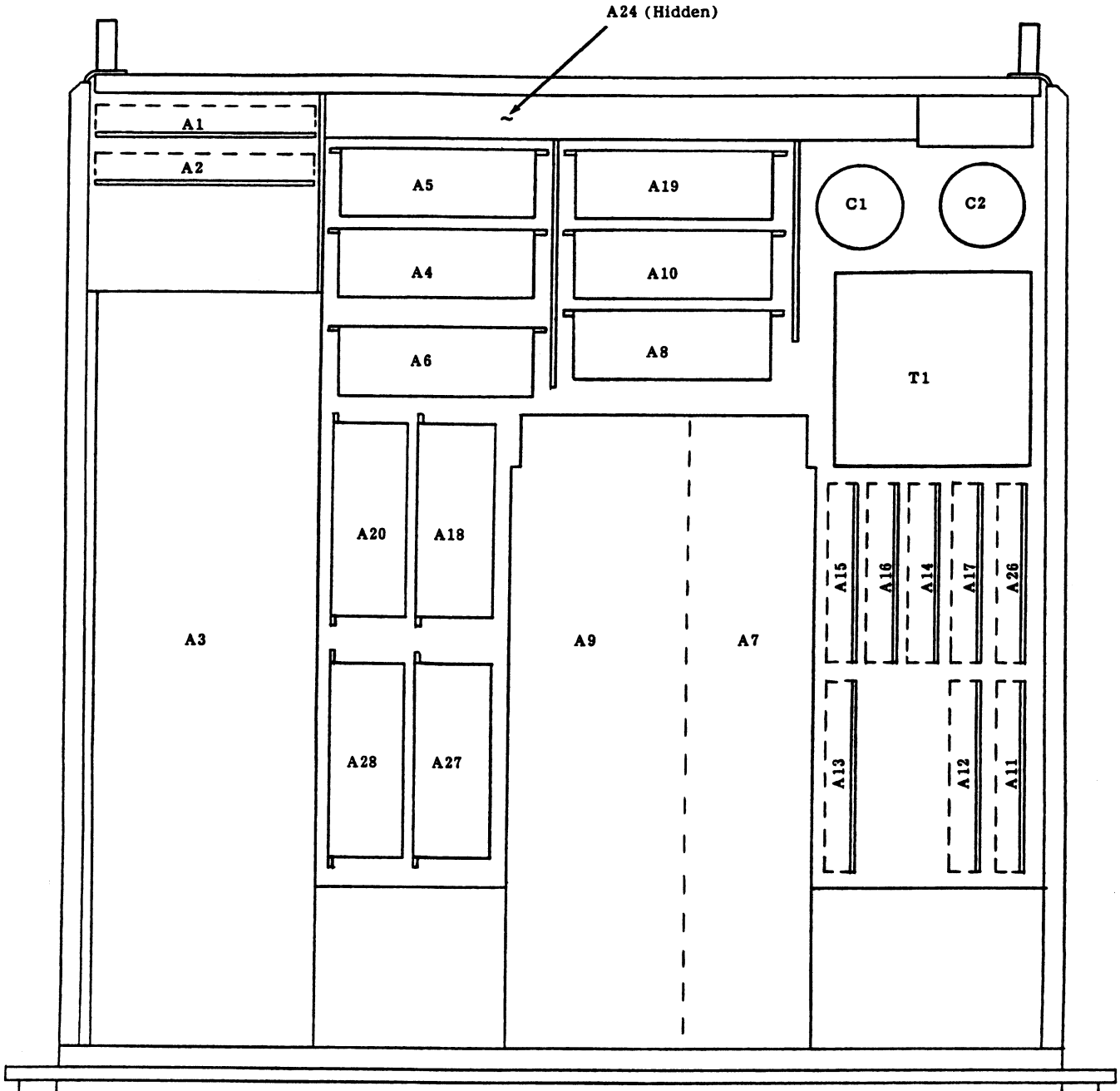
Center frequency offset (CFO) and auxiliary AGC output modules are available for the 1100-AR. The CFO modules provide a DC voltage output proportional to the frequency offset of the received signal in relation to the receiver IF center frequency. The CFO circuitry is operable in all receiver modes of operation.

The auxiliary AGC output modules provide a buffered AGC voltage output for driving external recorders or diversity combiners. The output ranges from 0 to 8V DC and can be of either positive or negative polarity depending on customer requirements. Included on these modules are slope and zero adjustments for setting the AGC output to match the input requirements of the external equipment. Additionally, both the CFO and auxiliary AGC output capabilities can be included in a single module. The model numbers and capabilities of the four modules in this series are:

41-1100	CFO output only. Unless otherwise specified, the sensitivity is factory set to 100 KHz/volt with a 2V p-p maximum output.
42-1100	Auxiliary AGC output only; 0 to -8V DC output range.
43-1100	Auxiliary AGC output only; 0 to +8V range.
44-1100	CFO and auxiliary AGC outputs. Unless otherwise specified, the CFO sensitivity is to 100 KHz/volt with a 2V p-p maximum output. The AGC output ranges from 0 to -8V DC; the polarity can be set positive to provide a 0 to +8V DC range if specified at time of order.

1.3.21 SIMULTANEOUS AM-FM/PM OUTPUT

Optional feature 45-1100, using a low level auxiliary video amplifier, provides a continuous AM video output regardless of the position of the receiver video switch. This adjustable AM video signal is provided simultaneously with the video signal selected by the video switch and is especially suitable as an AM tracking output.



BOTTOM VIEW WITHOUT COVER

A1 - Pos. Volt. Reg.
A2 - Neg. Volt. Reg.
*A3 - RF Tuner
ΔA4 - 1st IF Filter
A5 - 2nd Local Osc
A6 - 2nd Mixer
*A7 - 2nd IF Filter/Amp.
A8 - AM Detector
*A9 - Demodulator
A10 - Cal/Ref. Osc.
A11 - Video Filter #1
A12 - Video Filter #2
ΔA13 - Video Filter Special
A14 - Video Amplifier
A15 - AGC Amplifier
A16 - Metering Amplifier
A17 - AFC Amplifier
Δ A18 /A27 - Playback Conv.
ΔA19 - Record Conv.
ΔA20 - Display Conv.
A21 - Front Panel
A22 - Base Chassis
Δ*A23 - Spectrum Display Unit
A24 - Display Regulator
Δ*A25 - Pre-D Record/Playback Conv.
A26 - Not Assigned
ΔA28 - SDU Buffer

* Front Panel Module
Δ Optional Modules

Figure 1-1. Receiver Configuration Drawing

Table 1-1. Specifications

ELECTRICAL

Receiver Type	Double superheterodyne; 50 MHz first IF; 10 MHz second IF
Frequency Range	65 MHz-4.2 GHz determined by plug-in RF tuner
Input Impedance	50 ohms, unbalanced
Noise Figure	5.5 to 10.0 dB depending on RF tuner used
VSWR	2:1 maximum depending on RF tuner used
Image Rejection	60 dB minimum
IF Rejection	80 dB minimum
Dynamic Range	Threshold to -10 dBm (threshold is defined as a 6 dB signal-to-noise ratio). (May vary within some tuners; see manual for tuner in use.)

NOTE

The following specifications are applicable to the respective portion of the receiver circuitry only. They are not to be interpreted as being applicable to a complete receiver or any configuration thereof due to variations in IF and loop bandwidths, RF tuner noise figure and other similar limitations of the circuitry utilized in the receiver design.

First LO Characteristics:

Modes	Switch selectable: VFO, XTAL (crystal), OFF (external input)
Stability:	
VFO	±0.001% per degree Centigrade
Crystal	±0.005% without oven; ±0.0005% with oven
Synthesizer	±0.0005%, 0 to 50° C ambient

Second LO Characteristics:

Modes	Switch selectable: VFO, XTAL (crystal), AFC, PM, OFF (external input)
Stability:	
VFO	±0.001% per degree Centigrade
Crystal	±0.005%

continued

Table 1-1. Specifications, continued

AFC Characteristics:	
Tracking Range	±400 KHz in addition to ±250 KHz fine tune control
Acquisition Range	Up to ±400 KHz from center frequency in addition to ±250 KHz fine tune control
Drift Reduction Factor	Greater than 10,000:1
Search Range	50 KHz to greater than 800 KHz; approximately symmetrical about second LO frequency as set by front panel fine tune control
Search Rate	1.5 MHz/second
PM Characteristics:	
Control Range	±250 KHz in addition to second LO fine tuning range
Search Range	50 KHz to greater than 500 KHz; approximately symmetrical about second LO frequency; set by loop bandwidth control
Phase Loop Bandwidth	10, 30, 100, 300, 1000 Hz as determined by positioning of PM demodulator loop bandwidth switch
Demodulation:	
FM Demodulation	Refer to applicable FM demodulator manual
PM Demodulation	Refer to applicable PM demodulator manual
AM Demodulation:	
AM Response	5 Hz to one-half IF bandwidth (1.6 MHz maximum)
AM Distortion	Less than 3% with 90% modulation at a 1 KHz rate
AGC Time Constant	Switch selectable; 0.1, 1.0, 10, 100, 1000 msec normally supplied. Others available
Video Characteristics:	
Output Impedance	75 ohms
Rated Output	4 volts peak-to-peak
Maximum Output	10 volts peak-to-peak

continued

Table 1-1. Specifications, continued

Video Characteristics, continued	
Distortion	Less than 0.5% at rated output; less than 1% at maximum output
Source	Plug-in demodulator or AM detector
Coupling	AC or DC; switch selectable
Response	AC coupled - 5 Hz to 2.0 MHz +1.0 dB -3 dB DC coupled - DC to 2.0 MHz +1.0 dB -3 dB
Power Requirements	115/230V AC ±10%, 50-400 Hz, 35 watts - 1100-AR(5) or 50 watts - 1100-AR maximum
ENVIRONMENTAL	
Temperature Range:	
Storage	-62° to +65° Centigrade
Operating	0° to +50° Centigrade
Atmospheric Pressure:	
Storage	To 50,000 feet (15,240 m)
Operating	To 15,000 feet (4,572 m)
Humidity	To 95% relative humidity
MECHANICAL	
Height	5-7/32 inches (13.04 cm) 1100-AR(5) 6-31/32 inches (17.42 cm) 1100-AR
Width	19 inches (47.50 cm)
Depth	19-1/4 inches (48.12 cm)
Weight	1100-AR(5) approximately 35 pounds (15.88 kg) 1100-AR approximately 42 pounds (19.05 kg)

SECTION II
INSTALLATION

2.1 INTRODUCTION

This section contains installation information for the Model 1100-AR Telemetry Receiver in both the 5- and 7-inch configurations. Instructions are also included for handling, storage and packaging for reshipment.

2.2 UNPACKING AND HANDLING

The 1100-AR is shipped with all internal subassemblies installed; front panel modules are shipped separately to prevent possible in-transit damage. The receiver and power cord are sealed in a polyethylene bag and packed in a polystyrene shipping case which is sealed with tape. To open the case, lay it flat with the top side up. Cut the tape and remove the receiver package. Place the receiver on a bench and remove the bag. Thoroughly check the receiver for in-transit damage; i.e., broken meter faces, damaged connectors, dents, broken knobs. If damaged, notify the proper authorities immediately.

NOTE

Do not destroy the packing case
if the receiver is to be stored
or transferred to another site.

Prior to installing the receiver, remove the bottom cover and ensure that all modules are firmly secured in their receptacles. This may be done by simply pushing each module down into the receptacle. If the receiver was ordered with rack slides, the receiver portions of the slide assembly are installed before shipment and the rack portions shipped in a separate carton.

2.3 INSTALLATION

2.3.1 MECHANICAL

The 1100-AR is designed for mounting in a standard 19-inch equipment rack. No special hardware is required to mount the receiver whether or not it is equipped with slides (Microdyne RSA-11). The 1100-AR(5) requires 5 inches of vertical space and the 1100-AR requires 7 inches of vertical space.

2.3.2 ELECTRICAL

After mounting, all interconnections between the receiver and other equipment should be completed. Table 2-1 provides cabling requirements for the 1100-AR and includes the connectors and their functions, reference designations, types and impedances. A rear view of an 1100-AR is shown in Figure 2-1. Because of the many options available, certain rear apron connectors may or may not be supplied.

2.3.3 PRIMARY POWER

Unless otherwise requested, the 1100-AR is shipped wired for operation with a 115V AC input. Should it become necessary to operate at 230V AC, the primary T1 (terminals 1 through 4) must be rewired for 230 volt operation. Figure 2-2 shows the transformer wiring for both 115V AC and 230V AC operation. Access to T1 is obtained by removing the top cover. A power cord is supplied for connecting the receiver to the primary power outlet.

2.3.4 FRONT PANEL MODULE INSTALLATION

Two methods are employed to secure the receiver front panel modules. One type is used on both of the receiver configurations and consists of a release latch and bail. To install a module in the receiver, raise the top part of the mechanism in the direction of the arrow. Extend that bail marked PULL to limit. Insert the module into its slot and return the PULL handle to its original position until the latch lock engages.

NOTE

To install a demodulator into the receiver, the demodulator must first be mated to the companion IF filter and the two units installed together. The same procedure applies when installing an IF filter.

The second method of securing modules is evident on the 1100-AR only. This method involves the use of pawl fasteners and thumbscrews and is employed on the auxiliary modules only. To install a module which employs this type of fastener, adjust the thumbscrews until the pawls are retracted. Insert the module into its slot and adjust the thumbscrews as necessary to tighten the pawls.

2.3.5 INITIAL ADJUSTMENTS/CALIBRATION

Initial adjustments and calibration procedures are given under paragraph 3.7 in Section III.

2.4 STORAGE AND HANDLING

When storing or transporting the receiver, the environmental storage conditions given in Table 1-2 must not be exceeded. No special equipment is required to handle the receiver although care should be exercised to prevent excessive shock and vibration.

2.5 PACKAGING FOR RESHIPMENT

Should it become necessary to repack the receiver for shipment, proceed as follows:

a. Remove the front panel modules and package them following the instructions in the applicable instruction manuals. Shipment of front panel modules in the base chassis voids the warranty.

Packaging for Reshipment, continued

b. Place the receiver and a quantity of desiccant into a moisture-proof polyethylene bag and seal.

c. If the original polystyrene shipping case is available, place the receiver into the case and seal with shipping tape. If the original case is not available, proceed as follows:

1. Place the receiver into a heavy-duty cardboard box using sufficient padding to prevent movement.

2. Seal the carton and place it into a second carton or shipping crate, again using sufficient padding to prevent movement. Seal this carton.

d. Affix the necessary "Fragile" and "Delicate Equipment" labels.

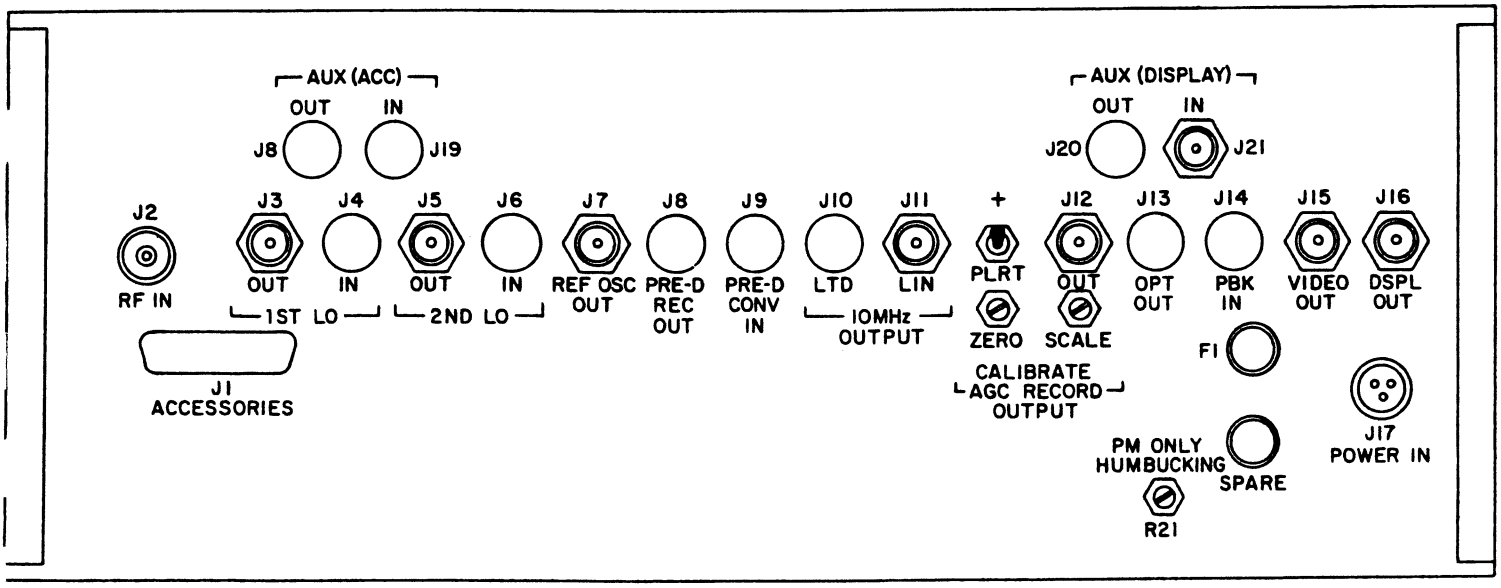


Figure 2-1. Model 1100-AR Telemetry Receiver, Typical Rear View

Table 2-1. Rear Panel Connectors

Connector	Function	Reference Designation	Type	Nominal Level/ Impedance	Recommended Cable
ACCESSORIES		J1	DBM-25S	----	
Pin 1	Ground				24 AWG
Pin 2	+15V DC	Available for monitoring. If desired for driving ancillary equipment, consult factory for current limitations for particular receiver configuration.			24 AWG
Pin 3	+ 6V DC				24 AWG
Pin 4	- 6V DC				24 AWG
Pin 5	-15V DC				24 AWG
Pin 6	Ch. 1 Select Switching/BCD Code	Remote control lines for remote controllable tuners. See tuner manual for details.			24 AWG
Pin 9	Ch. 4 Select Switching/BCD Code				24 AWG
Pin 11	Ch. 2 Select Switching/BCD Code				24 AWG
Pin 15	Ch. 3 Select Switching/BCD Code				24 AWG
Pin 7	RF tuner remote cont.(initiate)+	Remote tuning, + synthesized tuner control line. VI 2nd IF, see filter manual for details.			24 AWG
Pin 8	IF filter remote cont. input				24 AWG
Pin 10	CFO Monitor Out*				24 AWG
Pin 12	Spare				24 AWG
Pin 13	Lock loop indication, +10V DC lock; -0V DC unlocked				24 AWG
Pin 14	#1 AGC output	Parallel with AGC Record output (J12)			24 AWG
Pin 16	AM Det. DC Out	Synthesized Tuners			24 AWG
Pin 17	Spare				24 AWG
Pin 18	Remote Cont. - Advance				24 AWG
Pin 19	Spare				24 AWG
Pin 20	COR Sect. 1 common	These outputs are connected to the Carrier-operated Relay and may be used as Switching Controls for the ancillary equipment.			24 AWG
Pin 21	COR Sect. 1 NC				24 AWG
Pin 22	COR Sect. 1 NO				24 AWG
Pin 23	COR Sect. 2 common				24 AWG
Pin 24	COR Sect. 2 NC				24 AWG
Pin 25	COR Sect. 2 NO				24 AWG
RF IN	Input to RF Tuner	J2	N	50Ω	RG-223/U or RG-9/U

continued

Connector	Function	Reference Designation	Type	Nominal Level/ Impedance	Recommended Cable
1st LO OUT	Monitor output of first local oscillator (in RF tuner)	J3	BNC	-13 dBm/50Ω	RG-223/U
1st LO IN*	Input for injecting external signal to be used instead of internally generated first local oscillator signal	J4	BNC	-13 dBm/50Ω	RG-223/U
2nd LO OUT	Monitor output of second local oscillator, 60 (±0.5) MHz	J5	BNC	-13 dBm/50Ω	RG-223/U
2nd LO IN*	Input for injecting external LO in lieu of using the internal LO signal, 60 (±0.5) MHz.	J6	BNC	-13 dBm/50Ω	RG-223/U
REF OSC OUT	Monitor output of calibration/ reference oscillator, 10 MHz	J7	BNC	-20 dBm/50Ω	RG-223/U
PRE-D REC OUT*	Output from record converter A19	J8	BNC	4V p-p/75Ω	RG-59/U
PRE-D CONV IN*	Input to Pre-D converter	J9	BNC	4V p-p/75Ω	RG-223/U
10 MHz OUTPUT LTD*	Output for limited 10 MHz signal from AM detector	J10	BNC	-10 dBm/50Ω	RG-223/U
10 MHz OUTPUT LIN	Output for linear 10 MHz signal from AM detector	J11	BNC	-10 dBm/50Ω	RG-223/U
AGC RECORD OUT	Record output from AGC amplifier	J12	BNC	0-8V/1K load	RG-223/U

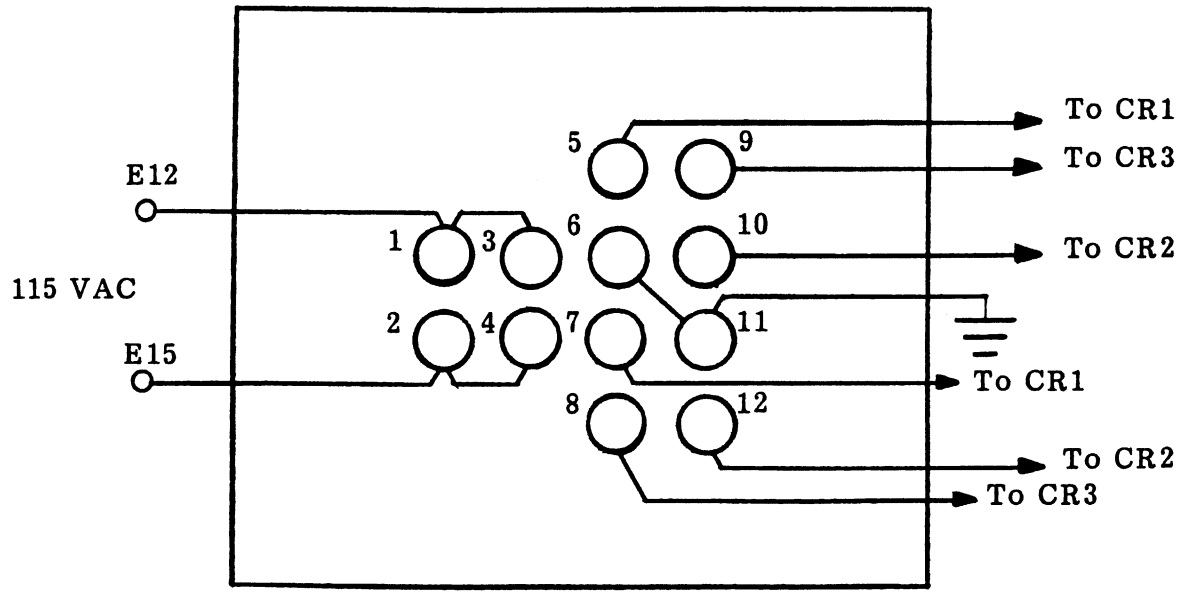
* These connectors are supplied only when specifically required.

continued

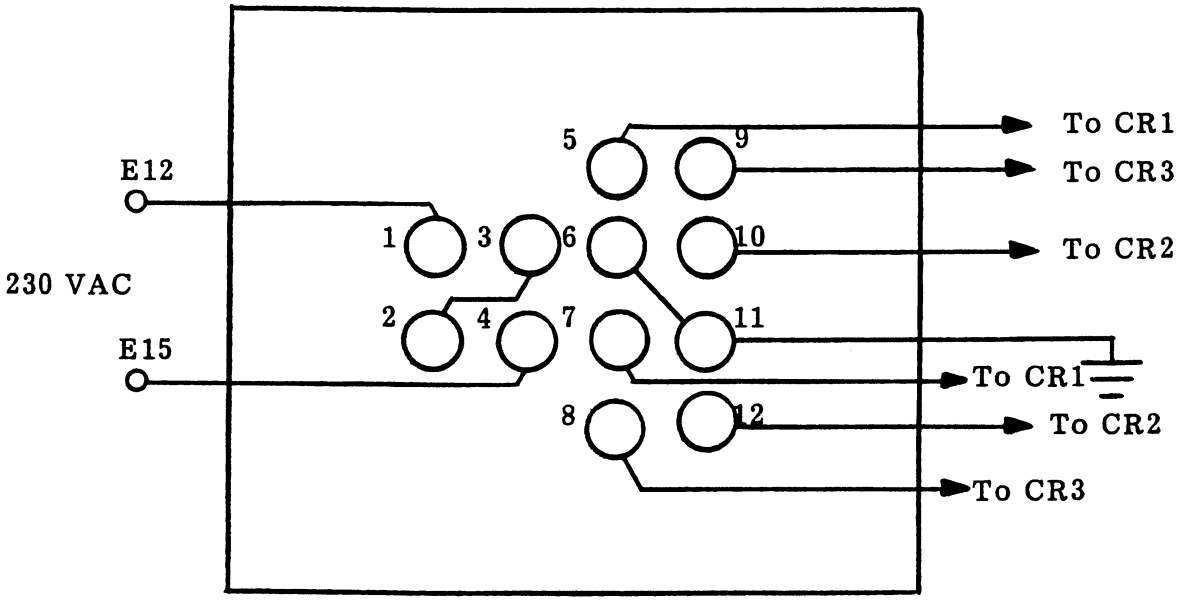
Table 2-1. Rear Apron Connectors, Continued

Connector	Function	Reference Designation	Type	Nominal Level/ Impedance	Recommended Cable
AM DET DC OUT*	High impedance monitor output of AM detector	J13	BNC	----	RG-223/U
PBK IN*	Input to playback converter, A18	J14	BNC	50Ω	RG-59/U
VIDEO OUT	Output for filtered video signals	J15	BNC	10V p-p Max/75Ω	RG-59/U
DISPLAY OUT#	Output (** MHz or 50 MHz) for spectrum display unit	J16	BNC	50Ω	RG-223/U
POWER IN	Input for AC power to receiver; 115/230V AC, 50-400 Hz	J17	MS3102A10 SL-3P	----	18/3 AWG
AUX (ACC) OUT*#	Output from predetection playback (or record) converter A25	J18	BNC	75/50Ω	RG-223/U
AUX (ACC) IN*#	Input to predetection playback (or record) converter A25	J19	BNC	50Ω	RG-223/U
AUX (DISPLAY) OUT*#	Optional coaxial connection to display unit receptacle	J20	BNC	----	RG-223/U
AUX (DISPLAY) IN*#	Input to spectrum display unit, 50 MHz	J21	BNC	50Ω	RG-223/U

* These connectors are supplied only when specifically required.
\# These connectors are supplied on the 7-inch receiver version as required.
** Customer-specified frequency.



A. Strapping - 115 VAC Input



B. Strapping - 230 VAC Input

NOTE: Only the connections to the transformer primary, terminals 1 thru 4, are affected by the conversion from 115V AC to 230V AC or vice versa.

Figure 2-2. Power Transformer Strapping

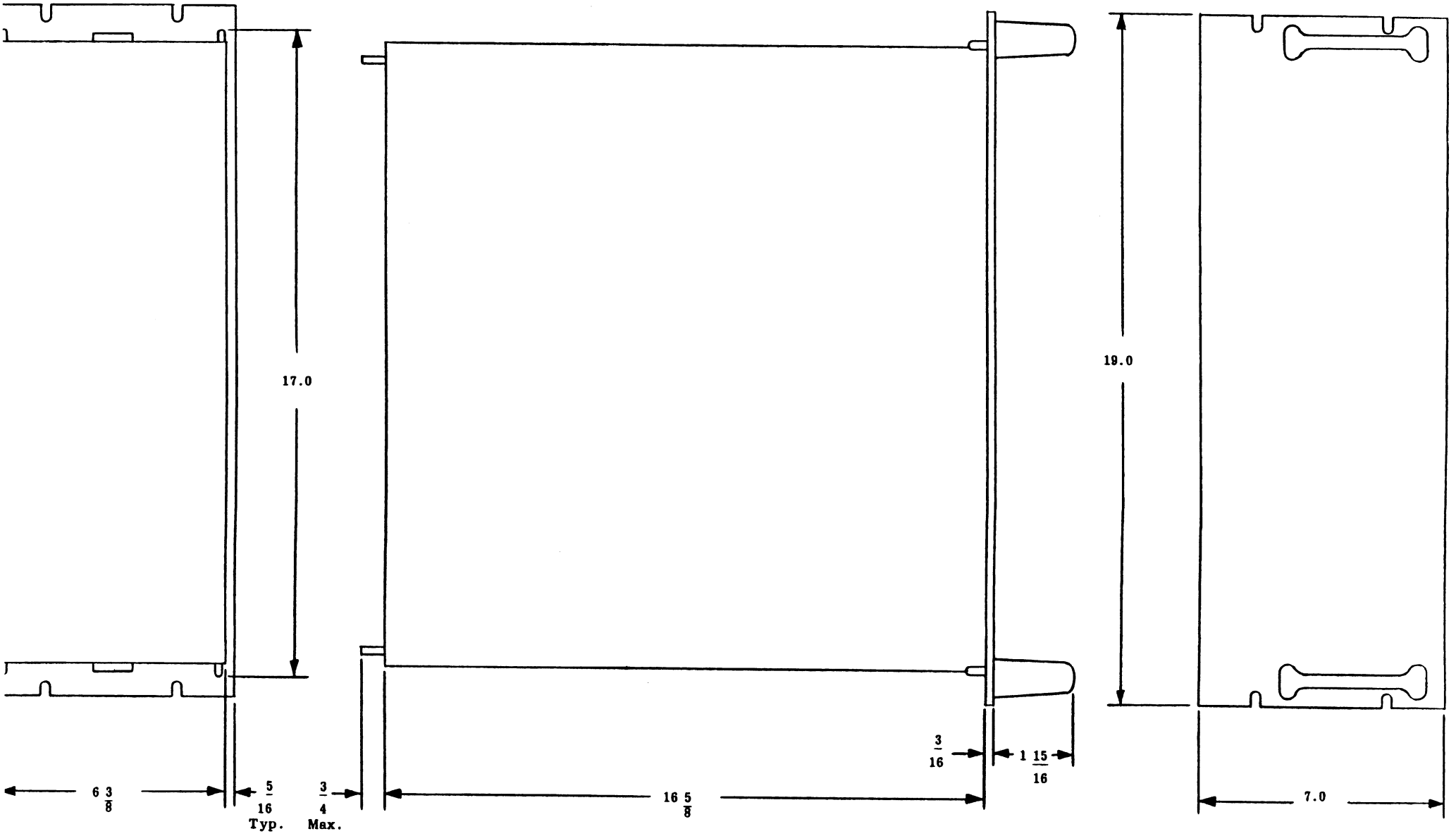


Figure 2-3. Outline Dimensional Diagram

SECTION III
OPERATION

3.1 GENERAL

This section provides operational information for the Model 1100-AR Telemetry Receiver. Included in this section is a list of the operating controls and indicators with their reference designations and functions, operating instructions, and operational information for the various receiver modes. Since the 1100-AR can be configured with many different modules to satisfy specific requirements, to include operating instructions for each configuration would be impractical. For this reason, only general operating instructions are provided. These instructions are, however, augmented by additional information for each operating mode to enable the operator to adjust the receiver controls to meet his specific requirements. Operating procedures for the auxiliary modules which plug into both the 5- and 7-inch versions are given in the applicable instruction manual or booklet supplementing this manual.

3.2 CONTROLS AND INDICATORS

The controls and indicators used in operating the 1100-AR are listed in Table 3-1 with their reference designation and function. This table also includes the controls for a typical complement of front panel plug-in modules. For functional descriptions of the controls on the specific modules in use, consult the applicable instruction manual for the modules.

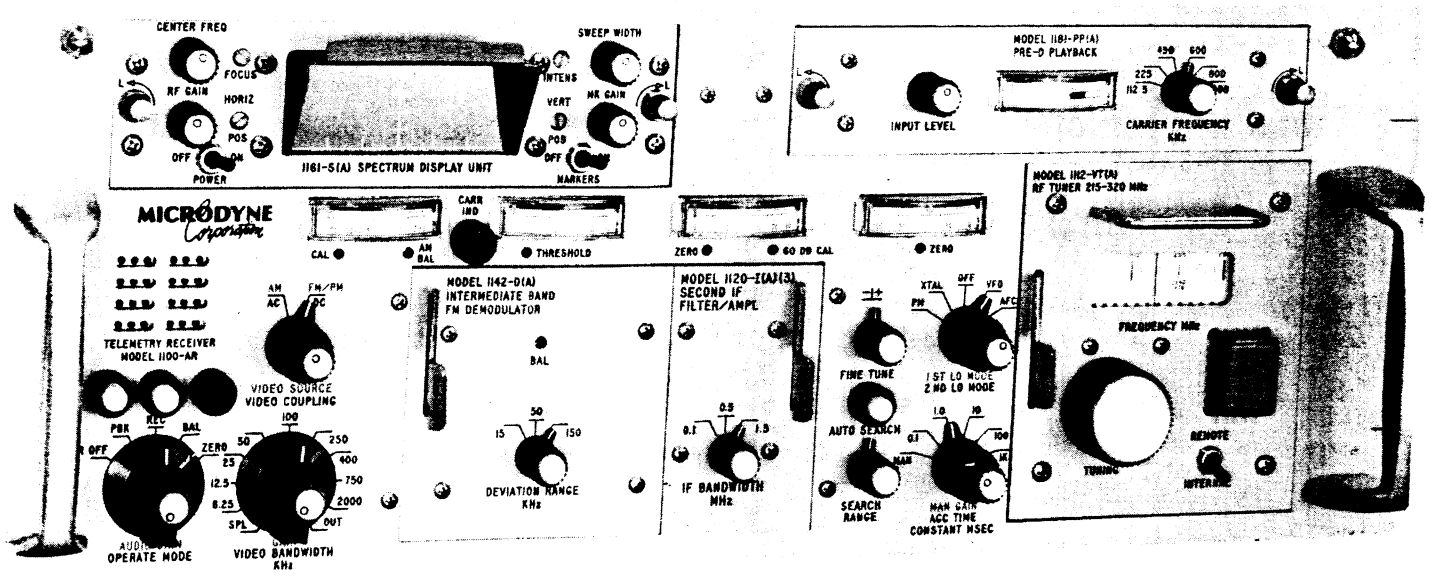


Figure 3-1. Model 1100-AR Telemetry Receiver, Typical Front View

Table 3-1. Controls and Indicators

Control/Indicator	Function
BASE CHASSIS:	
OPERATE MODE switch (S4)	Used to select one of five receiver operating modes: PWR OFF - Removes operating voltage from receiver power supply. PBK - Permits receiver to be used to play back previously recorded data. REC - Normal receiver operation. BAL - Permits the demodulators to be balanced. ZERO - Permits adjustment of tuning meter.
PBK lamp (amber) (DS1) REC lamp (white) (DS2) Calibrate lamp (red) (DS3)	These lamps light when the OPERATE MODE switch is set to the corresponding position.
AUDIO GAIN (R10)	Used to adjust speaker level.
VIDEO SOURCE (A22-S1)	Employed to select either the AM detector (AM) or plug-in demodulator (FM/PM) as the video source.
VIDEO COUPLING switch (A22-S2)	Selects either AC or DC video coupling to the video amplifier.
VIDEO BANDWIDTH KHz (A22-S3)	Selects the video filter cutoff frequency. SPL position is used to select a special video filter installed at customer request. The OUT position bypasses all filtering.
GAIN control (A22-R13)	Sets the video output level.
FINE TUNE control (R6)	Vernier tuning of second local oscillator. Permits ±250 KHz adjustment of second LO frequency.
AUTO SEARCH lamp (amber) (DS5)	Lights when receiver is in auto search operation in AFC and PM modes.

continued

Table 3-1. Controla and Indicators, Continued

Control/Indicator	Function
SEARCH RANGE control (R11)	Permits adjustment of auto search range to ±250 KHz.
1ST LO MODE switch (S1)	Selects the VFO, XTAL, or OFF mode of operation for the first local oscillator located in RF tuner.
2ND LO MODE switch (S2)	Selects the PM, XTAL, OFF, VFO, and AFC operating modes for the second local oscillator.
AGC TIME CONSTANT MSEC switch (S3)	Selects the time constant for the automatic gain control circuit to 0.1, 1, 10, 100 or 1000 milliseconds.
MAN GAIN control (R7)	Used to manually set the gain control of the receiver.
TUNING meter (M1)	Indicates the relative position of the applied signal in the IF passband. It also indicates the loop stress when the receiver is in the AFC or PM mode of operation.
ZERO control (R8)	Used to zero the TUNING meter.
SIGNAL LEVEL dB meter (M4)	Indicates signal level in dB above noise.
60 dB CAL control (R15)	Used to calibrate the 60 dB level on the SIGNAL LEVEL dB meter.
ZERO control (R4)	Used to select the SIGNAL LEVEL dB meter zero point.
DEVIATION KHz meter (M3)	Indicates the carrier deviation in KHz for FM and in degrees for PM.
CARR IND lamp (green) (DS4)	Lights when the applied signal level is above threshold.
THRESHOLD control (R2)	Used to set the level at which the carrier indicator lamp illuminates.
OUTPUT dB meter (M2)	Indicates the video output level in dB.
CAL control (R13)	Used to calibrate the OUTPUT dB meter.
AM BAL (R2)	Adjust video offset when the receiver is in AM operation.

continued

Table 3-1. Controls and Indicators, Continued

HUMBUCKING (R21)	Rear panel control utilized to minimize power line hum on the AFC/APC control line.
FM DEMODULATOR:	
DEVIATION RANGE switch (S1)	Selects the full-scale range of the receiver DEVIATION meter.
BAL control (R1)	Balances the FM video for zero DC output with no input.
RF TUNER (VT SERIES):	
TUNING control	Adjusts the RF tuner for receiving a specific frequency within its operating range.
FREQUENCY KHz	Indicates the frequency to which the receiver is tuned.
INTERNAL/REMOTE	Selects the local or remote tuning mode.
SECOND IF FILTER/AMPLIFIER:	
IF BANDWIDTH KHz	Selects one of the available IF bandwidths.

3.3 OPERATING INSTRUCTIONS

The following paragraphs provide generalized operating instructions for the receiver. These instructions are to be used as a reference as the receiver configuration will depend on the specific mission or requirements.

3.3.1 INITIAL SETUP AND CALIBRATION

Before operating the receiver, the necessary modules should be selected and installed and all rear apron connections checked. The receiver should then be calibrated for the operational mission.

> **CAUTION**
>
> In addition to the calibration procedures herein, the AGC system should be calibrated whenever the second IF filter/amplifier is replaced; see paragraph 5.3.3.1.
>
> Remove power prior to installing or removing any module.

3.3.1.1 FM MODE CALIBRATION

Before starting the calibration, set the front panel controls as follows:

Control	Position
OPERATE MODE	REC
AUDIO GAIN	Mid-Range
VIDEO GAIN	Mid-Range
VIDEO SOURCE	FM/PM
VIDEO COUPLING	AC
1ST and 2ND LO MODE	VFO
AGC TIME CONSTANT MSEC	100
DEVIATION RANGE	Compatible with IF BW
VIDEO BANDWIDTH	As desired

a. Remove the RF tuner, and inject a 50.000 MHz, 50 mV signal into XA3-A3. Place the AFC amplifier on a 300-423 extender card.

b. Set the 2ND LO MODE switch to VFO and adjust the FINE TUNE control for a 10.000 MHz output at J11 on the rear apron.

c. Adjust R22 on the video amplifier module (A14) for 0.0V DC at J15.

d. Set the VIDEO COUPLING switch to DC and adjust the demodulator BAL control for 0.0V DC at J15. Adjust the tuning meter ZERO control to a zero indication on the TUNING meter.

FM Mode Calibration, continued

e. Set the 2ND LO MODE switch to AFC and adjust the balance control on the AFC amplifier for a 10.000 MHz output at J11. (The balance control is R30 on the AFC amplifier.) Also observe that the receiver TUNING meter is on zero.

f. Remove the test signal and replace the tuner.

g. Connect a DC coupled oscilloscope to pin 11 of the extender card.

h. Set the receiver SEARCH RANGE control fully counterclockwise and adjust R37 on the AFC amplifier for a vertical deflection which is symmetrical about zero volts DC.

i. Apply an RF signal to the receiver from an external generator. Set the OPERATE MODE switch to REC. Adjust the RF tuner TUNING control and the FINE TUNE control for a zero tuning meter indication.

j. Set the signal generator attenuator for maximum attenuation.

k. Adjust the ZERO control beneath the SIGNAL LEVEL dB meter for a zero meter indication.

l. Set the signal generator for an output that is 60 dB above noise. This level is determined by the following formula:

-174 + NF = IF BW/dB + 60 dB = Input Level

where: -174 dB = constant

NF = maximum tuner noise figure. See Table 3-3

IF BW/dB = IF bandwidth expressed in dB. See Table 3-2

For example, if the IF bandwidth is 300 KHz and the maximum noise figure is 7 dB, the 60 dB level is calculated as follows:

-174 + 7 dB + 54 dB + 60 dB = -53 dBm

m. With the input level set, adjust the signal level meter 60 dB CAL control for a 60 dB meter indication.

n. Decrease the input signal level until the SIGNAL LEVEL dB meter indicates 6 dB. Adjust the THRESHOLD control until the CARR IND (carrier indicator) lamp just lights.

o. Set the VIDEO SOURCE switch to AM and DC coupling. Connect an HP412A DC voltemter to the VIDEO OUT (J15) on the rear apron. Adjust the AM BAL control (under the OUTPUT meter) for a zero volt DC output.

FM Mode Calibration, continued

p. Reset the VIDEO SOURCE switch to FM/PM.

q. Use a Boonton 202J signal generator and a Boonton 207H univerter to produce a 50 MHz signal frequency modulated with a 1700 Hz sine wave.

r. Remove the tuner from the receiver and connect the univerter output to XA3-A3.

s. Adjust the level of the modulation, as necessary, to obtain a carrier deviation equal to 30% of the second IF bandwidth. If the DEVIATION meter indicates other than the correct deviation (ensure that the setting of the demodulator DEVIATION RANGE switch is considered), refer to the booklet applicable to the metering amplifier for maintenance data.

t. Adjust the carrier deviation to the minimum level required to produce rated video output; i.e., 2.0 KHz 1141-D(A), 20 KHz 1142-D(A), 200 KHz 1143-D(A).

u. Connect an RMS voltmeter terminated in 75 ohms to the video output. Adjust the VIDEO GAIN control for a meter indication of 1.414V rms (4V p-p).

v. Set the modulation deviation to the average deviation to be encountered.

w. Set the BAL control for zero on the VIDEO OUTPUT meter.

x. Disconnect all test equipment and replace the RF tuner.

y. If the receiver AGC voltage is to be recorded, the SCALE and ZERO controls on the rear apron must be adjusted for compatability with the input requirements of the recording device. These adjustments are made as follows:

1. Connect a signal generator to the receiver RF input and set it for an output within the range of the RF tuner.

2. Tune the receiver to the test signal.

3. Connect an HP412A DC voltmeter to the AGC RECORD OUT (J12). Set the POLARITY switch to the position corresponding to the required AGC output polarity (+ or -).

4. Set the signal generator to the minimum RF level to be recorded and adjust the ZERO control for a zero volt indication on the voltmeter.

5. Set the generator for the highest signal level to be recorded and adjust the SCALE control for the desired output; this may be set up to 12 volts at a -10 dBm RF input level.

6. Recheck the zero point and adjust the ZERO control, if necessary.

7. Recheck the maximum point and adjust the SCALE control, if necessary.

8. Disconnect all test equipment.

3.3.1.2 PM MODE CALIBRATION

When the receiver is equipped with a phase demodulator, the BAL and ZERO positions on the OPERATE MODE switch are inoperable. Functions calibrated are the TUNING meter, SIGNAL LEVEL dB meter, demodulator locking threshold, AM balance and video output. The procedure for calibrating the receiver is as follows:

a. Set the OPERATE MODE switch to REC and allow 30 minutes for stabilization. Set the 2ND LO MODE switch to PM.

b. Set the demodulator SEARCH switch to MANUAL and the VIDEO SOURCE/ COUPLING to FM/PM AC. Set the ANTI-SIDEBAND switch to OUT, if applicable.

c. With no signal input, adjust the LOOP LOCK clockwise until the LOOP LOCK lamp is out.

d. Set the NOISE BAL control for zero on the TUNING meter.

e. Set the SEARCH switch to AUTO and adjust the LOOP LOCK counterclockwise until the AUTO SEARCH lamp begins to flicker. Slowly turn the LOOP LOCK clockwise until the SEARCH lamp is ON; the LOOP LOCK lamp will be out. Set the ANTI-SIDEBAND switch to IN, if applicable.

f. Apply an unmodulated signal to the receiver and lock the loop.

g. Adjust R22 on the video amplifier to 0.0 volts DC at J15.

h. Set the 2ND LO MODE switch to XTAL.

i. Calibrate the zero and 60 dB points of the SIGNAL LEVEL meter as follows:

   1. Set the signal generator for maximum attenuation (-130 dBm max signal) and adjust the ZERO control for a zero indication on the SIGNAL LEVEL meter.

   2. Set the generator for an input signal 60 dB above noise; this level is determined by:

      -174 + NF + IF BW/dB + 60 dB = Input Level

      where: -174 = constant

      NF = max. tuner noise figure. See Table 3-3

      IF BW/dB = IF bandwidth expressed in dB
      See Table 3-2

   3. With the input level set, adjust the 60 dB control for a 60 dB SIGNAL LEVEL meter indication.

j. Set the 2ND LO MODE switch to PM. Ensure the loop is locked.

PM Mode Calibration, continued

k. Calibrate the VIDEO OUTPUT meter to be compatible with mission requirements as follows:

1. Modulate the carrier with the phase deviation to be encountered.

2. Set the VIDEO GAIN control for the desired output level (usually 1.414V rms) using a 75 ohm terminated RMS voltmeter at J15.

3. Set the front panel BAL potentiometer for a zero indication on the VIDEO OUTPUT meter.

l. Remove the modulation.

m. Set the VIDEO SOURCE/VIDEO COUPLING switch to AM/DC and set the VIDEO GAIN control to max (CW). Adjust the AM BAL for 0.0V DC at J15.

n. If receiver AGC (coherent) is to be recorded, adjust the rear panel SCALE and ZERO controls as follows:

1. Connect a signal to the receiver and lock the phase lock loop.

2. Connect a DC voltmeter to the AGC RECORD OUT (J12).

3. Set the POLARITY switch for the desired recording polarity.

4. Set the signal generator for the minimum signal level to be encountered in the mission.

5. Adjust the ZERO control for a zero volt level at J12.

6. Increase the input signal level by 20 dB and adjust the SCALE control for 1 volt at J12. This establishes a 20 dB/volt sensitivity and is typical. Other sensitivity settings can be made to satisfy particular requirements.

7. Repeat steps 4, 5 and 6, as often as necessary.

8. Disconnect all test equipment.

Table 3-2. IF Bandwidth in dB

Bandwidth	dB	Bandwidth	dB
10 KHz	40	750 KHz	58
30 KHz	44	1.0 MHz	60
50 KHz	47	1.5 MHz	62
100 KHz	50	2.0 MHz	63
300 KHz	54	3.3 MHz	64
500 KHz	57	6.0 MHz	68

Table 3-3. RF Tuner Noise Figure (Maximum)

Tuner	NF	Tuner	NF
1111-VT(A)	5.5 dB	1116-VT(A)	10.0 dB
1112-VT(A)	7.0 dB	1117-VT(A)	8.5 dB
1113-VT(A)	8.0 dB	1118-VT(A)	8.0 dB
1114-VT(A)	10.0 dB	1119-VT(A)	10.0 dB
1115-VT(A)	10.0 dB		

3.3.2 CONTROL SETTINGS

After checking and calibrating the receiver, set the controls to their initial positions as outlined in the following steps. Controls then may be readjusted, as necessary, for optimum operation following the information given in paragraph 3.3.3.

a. Set the OPERATE MODE switch to REC.

b. Turn the AUDIO GAIN control to mid-range.

c. Set the VIDEO SOURCE switch to FM/PM position. This places the plug-in demodulator into the circuit as the video source. If AM data is to be received, place the switch in the AM position.

d. Set the VIDEO COUPLING switch to AC. Set the VIDEO BANDWIDTH KHz switch to the desired video bandwidth.

e. Set the FINE TUNE and AUTO SEARCH controls to mid-range.

f. Set the 1ST LO MODE switch to VFO. Set the 2ND LO MODE switch to XTAL.

g. Set the AGC TIME CONSTANT MSEC switch to 100 MSEC. If AM data is to be received, set the switch to 1000 MSEC.

h. If the receiver is equipped with a multiple bandwidth second IF filter/ amplifier, set the IF BANDWIDTH KHz switch to the widest position.

i. Set the demodulator DEVIATION RANGE KHz switch to widest position.

j. Set the video GAIN control to mid-range.

k. The calibrate/reference oscillator is used to balance the demodulator and the tuning meter. The balance procedure is as follows:

   1. Set the OPERATE MODE switch to BAL and adjust the demodulator BAL control for a zero indication on the TUNING meter.

   2. Set the OPERATE MODE switch to ZERO and adjust the tuning meter ZERO control for a zero indication on the TUNING meter.

l. Set the OPERATE MODE switch to the desired operating mode-REC or PBK.

3.3.3 RECEIVE MODE OPERATION

After the controls have been set to their initial positions as given in paragraph 3.3.2, they should be readjusted for optimum operation. This includes adjustment of the first and second local oscillators, video gain, AGC time constant, search range and audio level.

3.3.3.1 First Local Oscillator

The first local oscillator may be operated in any of three modes: VFO, XTAL and OFF. If the VFO mode is most desirable, set the 1ST LO MODE switch to VFO. Adjust the TUNING control until the desired frequency appears under the dial graticule and the TUNING meter indicates zero. If the XTAL (crystal) mode is selected, adjust the TUNING control until the desired frequency appears under the dial graticule. Insert the necessary crystal into the crystal socket in the tuner front panel using an adapter or oven as required. The formula for determining the correct crystal frequency is given in Table 3-4. The OFF mode is provided to permit the injection of an externally generated LO signal. Refer to the tuner manual for additional information.

3.3.3.2 Second Local Oscillator

With an FM demodulator, the second local oscillator may be operated in the crystal (XTAL), external input (OFF), VFO, or AFC mode as determined by the position of the 2ND LO MODE switch; a PM mode is also available for use in phase mode operation. (See paragraph 3.3.4.)

a. XTAL (Crystal) mode As in the case of the first local oscillator, no tuning of the second local oscillator is required when operated in the crystal mode. In this mode, the reception of a signal is indicated by the lighting of the CARR IND lamp and by a zero indication on the TUNING meter.

b. VFO mode When operated in the VFO mode, the second local oscillator is tuned by adjusting its FINE TUNE control until the CARR IND lamp lights and there is a zero indication on the TUNING meter. The 2ND LO MODE switch should then be set to the AFC position to maintain proper tuning.

Table 3-4. Crystal Determining Formulas

RF Tuner	Formula	RF Tuner		Formula
1111-VT(A)	$\frac{F_r + 50}{6}$	1116-T(A) 1116-VT(A)		$\frac{F_r + 50}{42}$
1112-VT(A)	$\frac{F_r + 50}{8}$	1117-T(A)	$\frac{F_r + 50*}{8}$	$\frac{F_r + 50**}{12}$
1113-VT(A)	$\frac{F_r + 50}{4}$	1118-VT(A)		$\frac{F_r + 50}{4}$
1114-T(A) 1114-VT(A)	$\frac{F_r + 50}{36}$	1119-T(A) 1119-VT(A)		$\frac{F_r + 50}{24}$
1115-T(A) 1115-VT(A)	$\frac{F_r + 50}{54}$			

where: F_r = received frequency

50 = intermediate frequency

* Used with input frequencies from 215 to 290 MHz

** Used with input frequencies from 290 to 410 MHz

Second Local Oscillator, continued

c. AFC mode The 2ND LO MODE switch should be initially set to AFC only when automatic search tuning of the oscillator is desired. In this position, a control signal from the receiver AFC amplifier causes the oscillator frequencies to be swept back and forth as indicated on the TUNING meter and by the lighting of the AUTO SEARCH lamp. The center of the frequency swept by the oscillator may be varied by adjusting the FINE TUNE control. The range swept by the oscillator may be varied ±250 KHz around the center frequency by adjusting the SEARCH RANGE control. When a signal is acquired in the channel, the AUTO SEARCH lamp goes out, the CARR IND lamp lights, and the TUNING meter shows steady indication. The meter may be indicating other than zero since it is controlled by the AFC loop stress voltage. If other than zero, adjust the FINE TUNE control to obtain a zero indication. This method of tuning is automatic and proper tuning is maintained until no carrier is detected or until the control limit of the AFC circuit is exceeded.

d. External Input (OFF) mode This mode is used when slaving two or more receivers together. The 2ND LO MODE switch is set to the OFF position and the 60 MHz external signal injected into J6 of a level of approximately -10 dBm.

3.3.3.3 Video Gain

Adjust the VIDEO GAIN control for the output level desired as indicated on the VIDEO OUTPUT meter.

3.3.3.4 AGC Time Constant

The AGC time constant is selected by the AGC TIME CONSTANT MSEC switch. With this switch in the MAN position, the receiver gain is adjusted by means of the MAN GAIN control. The proper setting of switch depends upon the characteristics of the carrier and the type of format being received. Unless another setting is required for proper signal demodulation, the AGC TIME CONSTANT MSEC switch should be left in the 100 position.

3.3.4 PM MODE OPERATION

Two signal search (acquisition) modes are available in PM operation: manual and automatic. The procedure for adjusting the receiver controls in each mode is given in paragraphs 3.3.4.2 and 3.3.4.3 and should be used in conjunction with the instructions given in paragraph 3.3.2. Prior to operating the receiver in the PM mode, carefully read the operating precautions in the following paragraph.

3.3.4.1 PM Mode Operating Precautions

When operating an 1100-AR receiver with any 1150-Series Phase Demodulator, the following precautions should be observed and implemented to obtain satisfactory receiver operation.

a. Operate the first local oscillator only in the XTAL mode.

PM Mode Operating Precautions, continued

b. Calibrate the HUMBUCKING potentiometer on the receiver rear panel using the following procedure. Normally, this adjustment is only required when setting up the receiver for the first time. It should be checked at least semi-annually and when the power line frequency has changed.

1. Apply a strong, stable, CW signal to the receiver.
2. Tune the receiver to the signal and phase lock using the 30 Hz loop bandwidth.
3. Connect an oscilloscope to the receiver video output (J15); terminate the connection in 75 ohms.
4. Adjust the HUMBUCKING control on the rear panel for minimum hum on the video output.
5. Disconnect the test equipment.

c. After warming up the receiver for a period of 30 minutes, the BAL controls on the phase demodulator may be normalized using the following procedure:

1. Install the demodulator into the receiver.
2. Set the OPERATE MODE switch to REC and the LOOP BANDWIDTH Hz switch to 300 Hz.
3. Set the demodulator SEARCH switch to MANUAL. Set the ANTI-SIDEBAND switch to OUT, if applicable.
4. With no signal input to the receiver, adjust the LOCK BAL control counter-clockwise until the LOOP LOCK lamp is out, if necessary.
5. Adjust the NOISE BAL control for a zero indication on the applicable receiver TUNING meter.
6. Set the SEARCH switch to AUTO and adjust the LOCK BAL control counter-clockwise until the applicable receiver AUTO SEARCH lamp begins to flicker.
7. Slowly turn the LOCK BAL clockwise until the AUTO SEARCH lamp is constantly on; the LOOP LOCK lamp will be out.
8. Rotate the LOCK BAL one full turn past the point at which the AUTO SEARCH lamp remains lit.
9. Optimize the N BAL control setting by injecting a 1 mV CW test signal into the receiver at frequency within the range of the tuner and phase lock. Set the generator for an output which will produce a -15 dB S/N ratio in the second IF and adjust the N BAL control until the LOOP LOCK lamp is just locking on the signal. The level required can be calculated as:

-174 + IF BW/dB + NF -15 = Negative SNR in the IF for phase lock

when: -174 = Constant
IF BW/dB = IF bandwidth in dB; see Table 3-2
NF = RF tuner noise figure; see Table 3-3 or perform actual measurement

PM Mode Operating Precautions, continued

d. The phase lock loop in the 1100-AR is an adaptive loop and is restricted as to the minimum modulation frequencies that can be handled at the various loop bandwidths. For unattenuated sine wave and accurate square wave video outputs, the minimum modulating frequencies at each loop bandwidth are listed below:

Loop Bandwidth Hz	10	30	100	300	1000
MIN. Sine Wave Frequency	70 Hz	210 Hz	700 Hz	2100 Hz	5000 Hz
MIN. Square Wave Frequency	350 Hz	1000 Hz	3500 Hz	10 KHz	25 KHz

3.3.4.2 Manual Search

a. Set the 1ST LO MODE switch to XTAL. Adjust the TUNING control to the desired frequency and insert the required crystal (see Table 3-4). Set the 2ND LO MODE switch to PM.

b. Set the demodulator SEARCH switch to MANUAL and the LOOP BANDWIDTH Hz switch to 1000.

c. Hold the LOOP switch in the OPEN position and adjust the demodulator FINE TUNE control for an aural zero beat tone from the speaker. The LOOP LOCK lamp should light. Release the switch.

d. Slowly adjust the demodulator FINE TUNE control to minimize the static phase error as indicated by a zeroing of the TUNING meter.

e. Reduce the loop bandwidth to the desired range.

f. Set the receiver video controls as required.

3.3.4.3 Automatic Search

a. Set the 1ST LO MODE switch to XTAL. Adjust the TUNING control to the desired frequency and insert the required crystal. (See Table 3-4.) Set the 2ND LO MODE switch to PM. Set the ANTI-SIDEBAND switch to OUT, if supplied.

b. Set the demodulator LOOP BANDWIDTH Hz switch to 1000. Set the demodulator FINE TUNE control to 5.

c. Set the SEARCH switch to AUTO. The LOOP LOCK lamp should light, indicating phase lock.

d. Adjust the demodulator FINE TUNE control to minimize the static phase error as indicated by a zeroing of the TUNING meter.

e. Reduce the loop bandwidth to the desired range.

f. Set the receiver video controls as required.

Automatic Search, continued

g. If the demodulator is equipped with an anti-sideband lock circuit, place the ANTI-SIDEBAND switch to ON. This will effectively prevent sideband locks during reacquisition cycles.

3.3.5 PLAYBACK MODE OPERATION

Set the controls and apply power to the receiver (refer to paragraphs 3.3.2 and 3.3.3). Set the OPERATE MODE switch to PBK; this disables the first LO and effectively removes the RF tuner as an active module in the receiver. If the receiver is equipped with a PM demodulator, adjust the receiver controls as directed in paragraph 3.3.4. Set the video output level of the receiver as directed in paragraph 3.3.3.3

3.3.6 COMPUTER/REMOTE CONTROL

The "VT" series of tuners permits remote tuning and/or crystal channel selection depending on tuner model. The "VT" series of second IF filter/amplifiers permits remote tuning of the bandwidth within the operational range of the module. To operate the receiver in the remote or computer-controlled mode, proceed as follows:

a. Refer to the applicable RF tuner and/or IF amplifier instruction manuals to ensure that the remote panel or computer interface is capable of supplying the correct range of control or switching voltages.

b. Consult the RF tuner and IF amplifier instruction manuals and Table 2-1 herein for cable connections to the accessories connector J1.

c. Set all receiver controls to the positions required by the operating mission excluding the RF frequency and IF bandwidth (refer to paragraph 3.3.2).

d. Refer to the tuner, IF filter/amplifier and remote control device instruction manuals for additional operational information, such as local control settings, etc.

3.3.7 AGC RECORDING

If the receiver AGC voltage is to be recorded, the SCALE and ZERO controls on the rear panel must be adjusted for compatibility with the input requirements of the recording device. These adjustments are made as follows:

a. Connect a signal generator to the receiver RF input and set it for an output within the range of the RF tuner.

b. Tune the receiver to the test signal.

c. Connect an HP412A DC voltmeter to the AGC RECORD OUT (J12). Set the POLARITY switch to the position corresponding to the required AGC output polarity (+ or -).

d. Set the signal generator to the minimum RF level to be recorded and adjust the ZERO control for a zero volt indication on the voltmeter.

AGC Recording, continued

e. Increase the signal generator output by 20 dB and adjust the SCALE control for 1 volt. This sets a 20 dB/volt scale.

f. Recheck the zero point and adjust the ZERO control, if necessary.

g. Recheck the 20 dB point and adjust the SCALE control, if necessary.

h. Disconnect all test equipment and connect the receiver for normal operation.

3.4 TURN-OFF PROCEDURE

To turn the receiver off, set the OPERATE MODE switch to the OFF position.

SECTION V
MAINTENANCE

5.1 GENERAL

This section contains information pertaining to the maintenance of the 1100-AR Telemetry Receiver. Included herein are a list of required test equipment and the preventive and corrective maintenance instructions.

The receiver is serviced on two levels: a) on the equipment level where the maintenance tasks are performed on the overall receiver, considering the modules and subassemblies as replaceable parts; and b) on the module level where the individual modules are independently serviced. The maintenance tasks in this section are limited to those pertaining to the overall receiver and thus the:

1. Preventive maintenance procedures are limited to those recommended for the overall receiver.

2. Troubleshooting data is that required for fault isolation to the module level, and

3. Alignment/adjustments are limited to the required interface calibration.

The instruction booklets for the modules should be consulted for maintenance data on the module circuitry.

If a low mean time to repair is required, it is recommended that a set of spare modules be maintained. If a fault occurs in a module, it can be replaced with a spare and the receiver returned quickly to operation. The defective module can then be repaired as time permits and maintained as the spare.

The test equipment required to maintain the 1100-AR (less the front panel modules) is listed in Table 5-2. Equivalent equipment may be used where applicable. Due to the various front panel modules that may be used in the receiver, it is impractical to list the test equipment requirements for these units herein. Test equipment requirements for the front panel modules are listed in the instruction manuals for same.

The design of the 1100-AR eliminates the need for special test equipment. To permit the testing and troubleshooting of the modules in the receiver, test cables and extender modules/cards are required. These are listed on the following page.

5.2 PREVENTIVE MAINTENANCE

Preventive maintenance for the 1100-AR consists of a visual inspection and a performance test. The performance test delineates the minimum acceptable standards for proper receiver operation.

Table 5-1. Test Cables/Modules

Component	Part Number
Extender Module	300-355
Extender Module	300-356
Extender Card	300-423
Tuner Test Cables	200-452, 200-453
Demodulator Test Cable	200-493
IF Filter/Amplifier Test Cable	200-494
IF Filter/Amplifier Test Cable	201-147 (Voltage Tuned Modules)
Extender Cable, Spectrum Display Record and Playback Converters	201-713
*Test Cable (2)	200-729

Table 5-2. Recommended Test Equipment**

Signal Generator/Univerter	Boonton 202J/207H
Signal Generator	HP608E
Signal Generator	HP606A or B
Oscilloscope	HP180A/1801A/1820A
Digital Voltmeter	Fluke 8000A
Noise Figure Meter (modified for 10 MHz input)	HP342A
Noise Sources	HP343A, HP349A
Sweep Generator	Texscan VS-80
Test Oscillator	HP652A
Frequency Counter	HP5245L/5253B
RF Sampling Voltmeter	HP3406A
RF Detector	HP8471A
Dual Power Supply	HP6205B
Distortion Analyzer	HP334B
AC Voltmeter	HP3400A
Spectrum Analyzer	HP8551B
VSWR Kit	Telonic TRK-2A
50 Ohm Termination	HP908A

5.2.1 VISUAL INSPECTION

A visual inspection of the receiver should be performed at monthly intervals to prevent possible malfunctions caused by a mechanical fault or failure. The inspection should include, but is not limited to, the following checks:

a. Rear apron connectors for corrosion, looseness and damaged or loose contacts.
b. Internal wiring for cut, cracked, frayed insulation and nuts and bolts for looseness.

---

* Not required - but recommended to facilitate access to inputs/outputs of module receptac
** Base Chassis and internal modules

Visual Inspection, continued

c. Solder joints for crystallization and corrosion.
d. Switches and internal connectors for loose connections and corrosion.
e. Resistors and wiring for discoloration and other evidence of overheating.
f. Dust and dirt accumulation. If dusty, blow out the receiver chassis using low pressure air.
g. Front panel for scratches and bare spots.

All loose hardware should be tightened immediately. Damaged and corroded switches and connectors should be replaced. Overheated resistors and wiring should be replaced only after determining the cause of overheating. Scratches and bare spots on the front panel should be covered using a matching touchup paint.

5.2.2 LUBRICATION

Lubrication of components within the receiver is not required.

5.2.3 PERFORMANCE TESTS

The following tests should be performed at six-month intervals to ensure proper receiver operation. Prior to beginning the tests, the receiver should be calibrated following the procedures given in Section III.

> **CAUTION**
>
> Remove power before installing or removing any module.

5.2.3.1 POWER SUPPLY CALIBRATION/TEST

The power supply calibration involves adjustments on the positive voltage regulator A1 and the negative voltage regulator A2. The subassemblies do not require extraction from the base unit; the potentiometers are physically located on top edge of the board to permit easy access. Use caution in making these adjustments.

Required Test Equipment: Digital Voltmeter, Oscilloscope

a. Apply power to the receiver and allow a fifteen-minute warm-up period.
b. Monitor the voltages on the appropriate pins of the accessories connector J1 and, if necessary, adjust the associated control for the correct voltage as listed below:

J1 Pin No.	Adjustment	Voltage
2	A1R9	+15.0V, ±5.0 mV
3	A1R12	+ 6.0V, ±2.0 mV
5	A2R9	-15.0V, ±5.0 mV
4	A2R12	- 6.0V, ±2.0 mV

c. Connect the voltmeter to the +5V DC line in the receiver. The voltage should be +5.0, ±0.2V DC.

Power Supply Calibration/Test, continued

d. Monitor each of the above voltages using an oscilloscope - AC coupled - and observe no greater ripple than 5 mV p-p.

e. Measure the voltage at pin 16 of the tuner connector XA3. This voltage should be -70 to -80 volts DC.

f. Measure the voltage present on pin 6 of the tuner connector XA3. It should be +70 to +80 volts DC.

g. Terminate pin 7 of XA23 to ground with a 30 ohm, 15 watt resistor bank and measure the voltage under load. This voltage should be +15.60V DC, ±0.150V DC. Remove the resistor load.

This completes the power supply calibration and test.

5.2.3.2 FM TESTS

Install an FM demodulator into the receiver and set the front panel controls as follows:

OPERATE MODE	REC
1ST LO MODE	XTAL
2ND LO MODE	XTAL
DEVIATION RANGE	Maximum
VIDEO SOURCE/COUPLING	AM/AC
VIDEO BANDWIDTH KHz	6.25
AGC TIME CONSTANT MSEC	100
SEARCH RANGE	Fully Counter-clockwise
VIDEO GAIN	Fully Counter-clockwise
AUDIO GAIN	Mid-Range

a. NOISE FIGURE
The following test ensures that the 1100-AR meets noise figure requirements. Test equipment required for this test consists of an HP342A noise figure meter and either an HP343A VHF noise source or an HP349A UHF noise source depending on the frequency range of the RF tuner.

1. Connect the noise source to the noise figure meter and to the receiver RF input.
2. Connect the receiver LIN 10 MHz OUTPUT (J11) to the noise meter input. Calibrate the noise equipment.
3. Set the 1ST LO MODE switch to VFO and tune the receiver over its range. Note that the noise level does not exceed the maximum level specified for the tuner installed. The tuners available for use with the 1100-AR and their maximum noise figure are listed in Table 3-3.
4. Set the 1ST LO MODE switch to XTAL. Insert a crystal into the front panel socket and adjust the TUNING control for the corresponding dial frequency. Observe that the noise figure does not exceed the maximum level as previously noted.
5. Repeat step 4 using crystals at the high, low and middle portions of the tuning range.
6. Disconnect all test equipment.

FM Tests, continued

b. AGC RANGE
This test is to ensure that the AGC circuit maintains the IF signal level within a 3 dB range at the demodulator input. Test equipment required consists of an HP3406A RF voltmeter and a signal generator compatible with the tuner frequency range.

1. Connect the signal generator to the receiver RF input. Connect the LIN 10 MHz OUTPUT (J11) to the input of the HP3406A RF voltmeter.
2. Set the 1ST LO MODE to XTAL.
3. Insert a mid-band crystal into the tuner socket. Set the generator output to approximately -60 dBm and tune it to the receiver.
4. Vary the input level from -100 dBm to -7 dBm and observe that the voltmeter indication varies less than 3 dB.
5. Vary input level from 0 dB SNR_{IF} to -7 dBm and again note that the voltmeter indication varies less than 3 dB. The starting level is determined by the following formula using the figures given in Tables 3-2 and 3-3.

   $$-174 + \text{IF BW/dB} + \text{NF} = 0 \text{ dB } SNR_{IF}$$

   where: IF BW/dB = the IF bandwidth expressed in dB. See Table 3-2.

   NF = maximum RF tuner noise figure. See Table 3-3.

   For example, using an IF bandwidth of 300 KHz and an 1115-T(A) tuner, threshold is:

   $-174 + 54 + 10 = -110$ dB

6. If the receiver is equipped with a multi-bandwidth filter, repeat step 5 for each bandwidth.
7. Disconnect all test equipment.

c. AFC RANGE
This test demonstrates the AFC system tracking range and drift reduction factor. Required test equipment consists of an HP5245L counter equipped with an HP5453B or HP5254B converter, a second HP5245L counter, and a signal generator compatible with the RF tuner frequency range.

1. Connect the counter and converter to the signal generator uncalibrated output. Connect the second counter to the LIN 10 MHz OUTPUT (J11).
2. Connect the signal generator calibrated output to the receiver input.
3. Set the 2ND LO MODE switch to VFO and tune the receiver to the input signal. Adjust the FINE TUNE control for a 10 MHz indication on the counter.
4. Set the 2ND LO MODE switch to AFC.

AFC Range, continued

5. Slowly vary the input signal frequency ±250 KHz. Record the 10 MHz counter indications at the ±250 KHz limits.
6. Calculate the drift reduction by dividing the change of the 10 MHz IF signal into 500,000. The reduction should be greater than 5,000.
7. Disconnect the test equipment.

5.2.3.3 PM TESTS

Install a PM demodulator into the receiver and set the front panel control as follows:

OPERATE MODE	REC
1ST LO MODE	XTAL
2ND LO MODE	PM
LOOP BANDWIDTH	1000
VIDEO SOURCE/COUPLING	FM/PM-AC
VIDEO BANDWIDTH	6.25 KHz
AGC TIME CONSTANT MSEC	100
SEARCH RANGE	Fully counter-clockwise
VIDEO GAIN	Fully counter-clockwise
AUDIO GAIN	Mid-Range

a. PHASE LOCK
This test ensures that the locking threshold of the receiver is within specifications. Test equipment required consists of a signal generator and a 10 dB attenuator.

1. Connect the output of the signal generator to the receiver RF input through the 10 dB attenuator, locating the attenuator directly at the receiver input jack.
2. Set the generator output level to -90 dBm and lock the receiver to the signal.
3. Vary the input level from threshold to -7 dBm and note that the receiver remains phase locked over the entire range. Threshold is defined by the following formula:

   -174 + IF BW/dB + NF - 15 = Threshold

   where: -174 = constant; -15 = Negative SNR_{IF} for Lock

   IF BW/dB = IF bandwidth expressed in dB. See Table 3-2.

   NF = maximum tuner noise figure. See Table 3-3.

   For example, with an IF bandwidth of 750 KHz and a tuner noise figure of 10 dB, threshold is:

   -174 + 58 + 10 - 15 = -121 dBm

4. Disconnect the test equipment.

PM Tests, continued

b. PHASE DEMODULATOR
The following test demonstrates that the receiver is capable of demodulating a signal with up to 150° of phase deviation. Test equipment required is:

Signal Generator	Boonton 202J
Univerter	Boonton 207H
Oscillator	HP651B
Spectrum Analyzer	HP8551A/HP8552A
Distortion Analyzer	HP334A

1. Connect the 202J to the 207H and adjust for an output of 50 MHz.
2. Connect the HP651B to the FM input of the 202J. Set the HP651B to 5 KHz.
3. Connect the 207H output, at 50 mV, to the spectrum analyzer input.
4. Set the output of the HP651B to 1.38 on the 3 volt scale of the 651B meter.
5. Adjust the FM MOD control on the 202J for a carrier null as observed on the analyzer. The 202J/207H configuration is now calibrated for 138° of PM and the first carrier null.
6. Adjust the HP651B output level to zero.
7. Disconnect the HP651B from the 202J. Disconnect the 207H from the analyzer.
8. Remove the tuner from the receiver and connect the output of the 207H to A3 of the receiver tuner receptacle through a 10 dB pad. Lock the receiver to the signal and adjust the FINE TUNE control for a zero tuning meter indication.
9. Connect the HP334A distortion analyzer, terminated in 75 ohms, to the receiver video output (J14). Set for voltmeter operation.
10. Reconnect the HP651B to the 202J and increase its output to 1.50 (150°).
11. Set the VIDEO BANDWIDTH KHZ switch to 25 and adjust the VIDEO GAIN control for a meter indication of 2.5V RMS.
12. Reset the HP334A for distortion measurement and check the distortion; it should be less than 3%.
13. Disconnect all test equipment.

5.3 CORRECTIVE MAINTENANCE

The corrective maintenance for the 1100-AR consists of troubleshooting, repair and replacement, and realignment. Information pertaining to these subjects is given in paragraphs 5.3.1, 5.3.2 and 5.3.3. Corrective maintenance sequence should be:

1. Isolation of the fault.
2. Replacement/Repair of the defective modules/part.
3. Realignment of the repaired module, if applicable.
4. Performance check of receiver.

5.3.1 TROUBLESHOOTING

Troubleshooting requirements for the 1100-AR consist of the steps and procedures necessary to isolate the problem to a defective plug-in module or to the base unit and power supply. Voltage measurements should be used to check out the power supply; also consult the instruction booklet for the regulators.

The nominal levels for the receiver outputs are given in Table 2-1. These levels, in conjunction with the functional block diagram, should enable the isolation of the fault to a module or particular group of modules and the switching/wiring thereto. Use the block diagram to determine which modules are common to the recognized symptoms. The suspected modules can then be checked by substitution, if spares are available, or by monitoring their input/output characteristics under operating conditions. Table 5-3 provides reference data for the standard modules. The meter indications and the effect the controls have or do not have should also be used as a troubleshooting guide. For example, with a known input, there is no video or audio outputs, but the signal level, tuning, and deviation meters are operating normally, the logical area to start troubleshooting would be at the video source switch A22S1. This is indicated by recognizing that all meters except the output meter are functioning normally and that only the video and audio outputs are absent.

The output of the module under test can be monitored at the signal termination point on the following module receptacle. For example, the IF output of the tuner may be checked at A1 of XA4 (first IF filter receptacle). The module must be removed to permit access to the receptacle. The 200-729 test cable may be used to gain access to the receptacle pins. Consult the receiver wiring diagram to identify the signal termination point. If a module is found defective, its instruction booklet should be consulted for maintenance data.

> **CAUTION**
>
> Remove power before removing or installing any module. The AGC system must be calibrated after repair or replacement of the second mixer, AM detector, second IF amplifier/filter, or AGC amplifier; see paragraph 5.3.3.1.

5.3.2 REPAIR

Repair procedures for the 1100-AR are grouped into three categories: base unit, front panel and internal plug-in modules. Repair procedures for the front panel plug-in modules are given in the applicable instruction manual. All electrical components used in the 1100-AR, excluding modules, are considered non-repairable and should be replaced when found defective.

5.3.2.1 BASE UNIT

No special tools or procedures are required to remove and replace components mounted on the base unit. The transformer and filter capacitor securing screws and nuts are accessible with the top cover removed. Series regulator transistors and load resistors are fixed to a mounting plate. This plate is secured to the rear panel with machine screws and will drop from the receiver with the screws removed.

5.3.2.2 FRONT PANEL

The majority of the front panel controls and indicators can be removed and replaced without removing the front panel from the receiver. However, the panel should be removed if there is a possibility of destroying or damaging any other components or wiring in the repair process. To remove the front panel, disconnect plug XA21 on the top of the receiver. Remove the knobs from the VIDEO BANDWIDTH KHZ and VIDEO COUPLING/ VIDEO SOURCE switches. Remove the four screws (two on either side) adjacent to the demodulator/IF filter slot. Remove the three Phillips screws on either side of the receiver chassis next to the front panel. Pull the front panel away from the chassis. All wiring is now exposed on the rear of the front panel. No special procedures are required to replace front panel components. After replacing components, verify all connections against the schematic diagram prior to replacing the front panel.

5.3.2.3 INTERNAL PLUG-IN MODULES

There are two types of plug-in modules in the 1100-AR: printed circuit cards and metal-encased modules. In both cases, the modules plug into base unit connectors. The metal-encased modules are held in place by a captive screw which must be released for removal of the module. A hole is provided in the modules for inserting a Microdyne 200-396 removal tool. To remove a module, simply insert the tool and lift out. To gain access to the circuitry in the metal-encased modules, the screws securing the wraparound cover must be removed. With the cover removed, the circuitry contained in the module is readily accessible.

The following procedure is recommended for removing components from a printed circuit board:

a. Gather the following material and equipment:

   1. Liquid soldering flux
   2. Flux remover
   3. Wire braid
   4. Soldering iron, soldering aid and longnose pliers

b. Dip one end of the braid in the soldering flux.

c. Place and hold the braid over the solder joint and apply heat; the braid will absorb most of the solder.

> **CAUTION**
>
> Excess heat may permanently damage the circuit board.

d. Apply heat directly to the solder joint and gently pry the component loose.

e. Clean the affected area using flux remover. If the hole remains clogged, repeat the process using the braid and the flux.

f. Position the component on the PC board.

g. Solder in place and trim the leads.

h. Clean the area with flux remover.

Table 5-3. Module Reference Data

A6 -	2nd Mixer		
	-0.5V AGC	0 dB gain (nominal)	
	-5.0V AGC	-6 dB gain (nominal)	
	Input Signal Range	-16 dBm to thermal noise	
A14 -	Video Amplifier		
	1 KHz Input	46 dB gain (nominal)	
	Rated Output	4V peak-to-peak (75 ohms)	
A10 -	Cal/Reference Oscillator		
	Output	10 MHz (±2 KHz) at approximately -20 dBm	
A28 -	SDU Buffer		
	Gain	Unity	
A18/A27 -	20-1100 Playback Converter		
	Input Signal Range	1 to 10V peak-to-peak	
	Output	Approximately -13 dBm	
A18 -	100-117 Playback Converter		
	Gain	-10 dB	
A19 -	10-1100 Record Converter		
	Output	2V peak-to-peak, into 75 ohms, with 50 mV input	
A3 -	RF Tuner		
	1111/1112/1113-VT(A)	17 (±3) dB gain	-0.5V AGC
	1114/1115/1116-VT(A)	14 (±2) dB gain	-0.5V AGC
	1118-VT(A)	16 (±4) dB gain	-0.5V AGC
A7 -	2nd IF Amplifier		
	Varies with bandwidth; see Table 5-2 in 2nd IF Amplifier instruction manual.		
A4 -	1st IF Filter (Standard)		
	Gain	Unity	
A5 -	2nd LO		
	Output	-10 to -6 dB (2nd Mixer)	
A15 -	AGC Amplifier		
	Check AGC System Calibration, see instruction booklet.		
A17 -	AFC Amplifier		
	Consult AFC Amplifier instruction booklet.		

5.3.3 ALIGNMENT/ADJUSTMENTS

No alignment procedure can be directly applied to the 1100-AR receiver as the modules are individually aligned. The recommended alignment procedure for the modules are provided in the instruction booklets with the exception of the video filters whose procedures are provided herein. After repairing and aligning any of the internal modules, the performance of the receiver should be checked using the procedures provided in paragraph 5.2.3.

5.3.3.1 AGC ADJUSTMENT

This procedure ensures the proper setting of the receiver AGC system and should be initiated after the repair and/or replacement of any of the following modules:

a. Second Mixer
b. AM Detector
c. Second IF Filter/Amplifier
d. AGC Amplifier

To adjust the AGC system, an HP606A signal generator and an HP412A DC voltmeter are required. The procedure for adjustment is:

a. Set the OPERATE MODE switch REC and allow 30 minutes for warmup. Remove the tuner and set the 2nd LO MODE switch to XTAL. If the receiver contains a phase demodulator, the 2ND LO MODE switch must also be set to XTAL to prevent locking and allow the envelope AGC to be set.

b. Remove the second IF filter/amplifier (A7) and inject a 10.000 MHz, -21 dBm signal into XA7-A1.

c. Connect the HP412A to J13 on the rear panel and adjust R20 on the AM detector for exactly +5.0V DC.

d. Disconnect the signal source and replace the IF filter/amplifier using the 200-494 test cable.

e. Remove the second mixer module (A6).

f. Connect the HP606A to XA6-A7.

g. Set the HP606A to exactly 10.000 MHz at -16 dBm.

h. Adjust R24 on the AM detector for +5V DC at J13. Then adjust R52 (R54 on the XTAL filters) on the second IF filter for -5V DC on the AGC buss.

i. Disconnect the HP606A and replace the mixer.

j. Install the tuner and set the receiver 1ST LO MODE switch to VFO.

k. Connect the HP412A to the AGC buss.

l. Rotate the TUNING control over the entire range and observe that the AGC voltage remains within a -0.2 to -0.8V DC range.

AGC Adjustment, continued

m. Adjust R49 on the second IF filter/amplifier, if necessary, to bring the AGC within the -0.2 to -0.8V DC range.

n. If R49 on the IF filter was adjusted in step m, it is necessary to repeat steps e through l.

o. Connect a signal generator compatible with the RF tuner to the receiver antenna input.

p. Adjust the receiver and signal generator to tune in a signal in the mid-range of the tuner.

q. Set the generator for a -7 dBm output and observe that the AGC buss voltage is -5.0 (±0.5) V DC.

r. Calibrate the receiver SIGNAL LEVEL meter and THRESHOLD control as directed in steps e through i of paragraph 3.3.1.1.

s. The procedure is completed. Disconnect all test equipment.

5.3.3.2 VIDEO FILTERS ALIGNMENT PROCEDURES

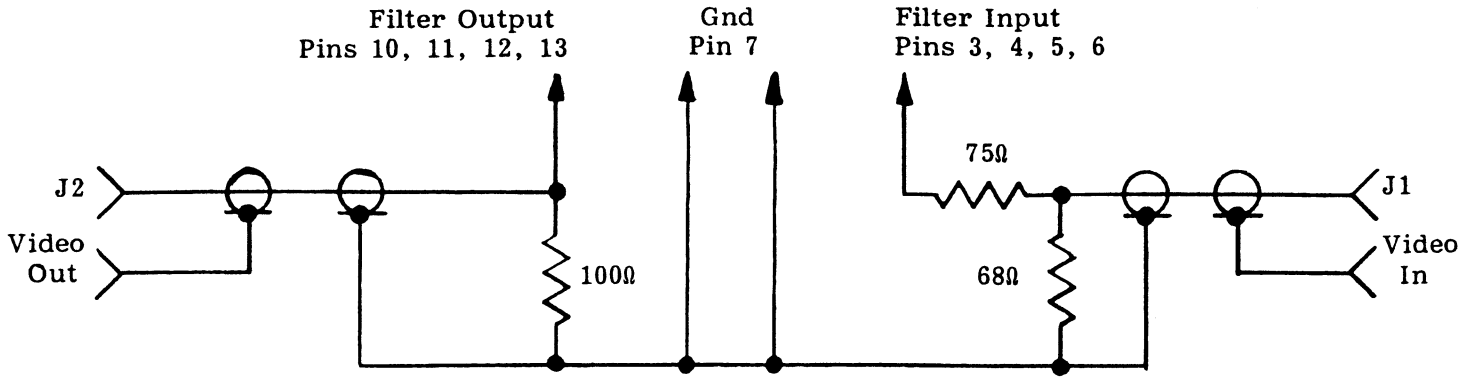
The most likely causes of a malfunction in the video filter are an open coil or broken connection. In the case of a repair to the filter, the alignment of the filter should be checked. The filters are aligned for the proper -3dB sine wave frequency roll-off and minimum overshoot for good phase linearity.

The following procedure refers to the inductors as input or output inductors rather than by reference designations. The input inductor is that connected to the video input terminal and the output inductor is that connected to the output terminal; see Figures 7-5 and 7-6 in Section VII.

Required Test Equipment:

AC VTVM	HP3400A
High Frequency Oscilloscope	HP180A/HP1801A/HP1820A
Signal Generator	HP651A
Square Wave Generator	HP211B

Video Filter Test Setup:



Video Filters Alignment Procedures, continued

The input and output coaxial cable connections to the test fixture should be type RG-223/U not to exceed three feet in length terminated with BNC type connectors.

a. Preset the input and output inductors clockwise two turns from minimum inductance.

b. Connect the video filter to the test fixture as shown on preceding page.

c. Connect the HP651A 50-ohm output to the test fixture input J1 and set the frequency to 1 KHz.

d. Connect the HP3400A to the test fixture output J2 and adjust the HP651A output level for a 0 dB reading on the 0.3 volt of the HP3400A. The output level of the HP651A will be approximately 0.5 volts rms. Maintain this level for the -3 dB frequency adjustment in the next step.

e. Set the HP651 frequency to the -3 dB frequency of the filter. Do not change the HP651A output level from that established in step d. Adjust the input inductor for a -3 dB indication on the 0.3 volt range of the HP3400A.

f. Disconnect the HP651A from the test fixture input J1 and connect 50-ohm output of the HP211B to J1.

g. Disconnect the HP3400A from the test fixture output J2 and connect the vertical input of the HP180A to J2.

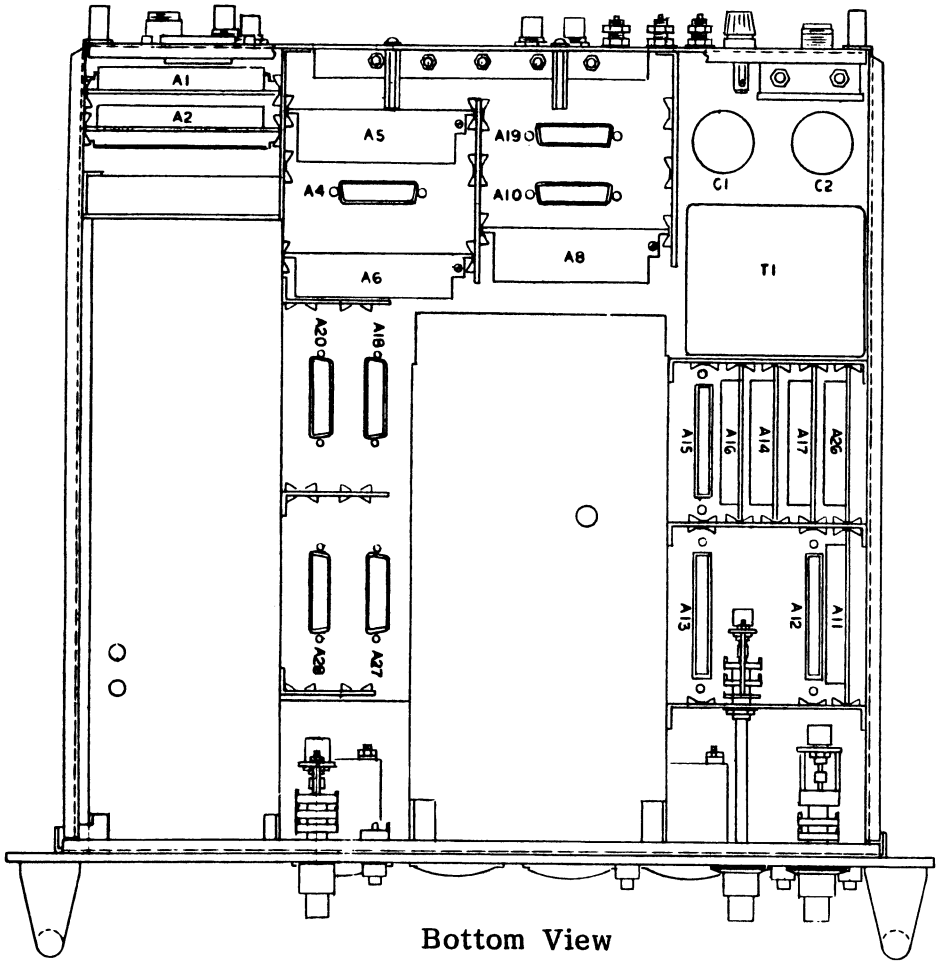
h. Set the HP211B frequency to one-fifth of the selected -3 dB frequency. Adjust the HP211B output level to obtain 0.7 volt peak square wave on the oscilloscope.

i. Observe the square wave on the HP180 and adjust the output inductor for a slight overshoot of 1 to 3%.

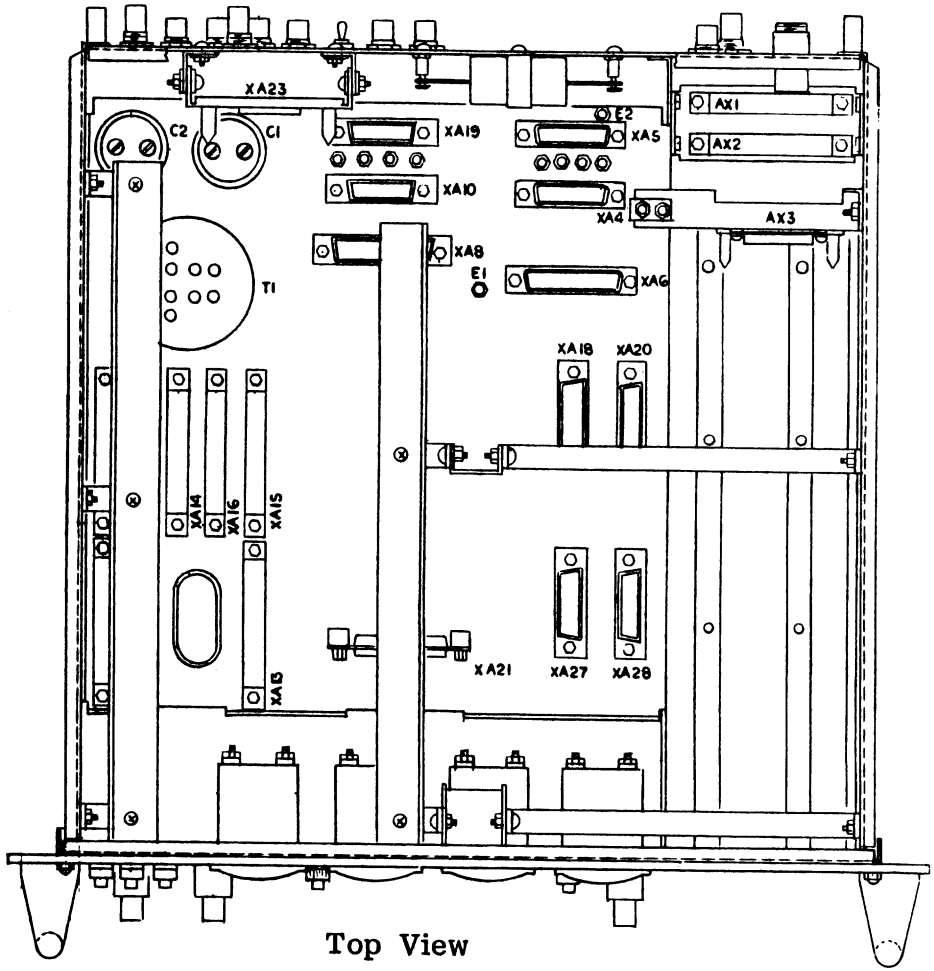
j. Repeat steps c through e to adjust the input inductor for the -3 dB frequency.

k. Repeat steps f through j.

l. Measure the -3 dB point of the filter and adjust the input inductor, if necessary, to obtain the -3 dB frequency specified.



Bottom View



Top View

Figure 6-1. Top and Bottom Views of Chassis with Cover Removed