RFL Electronics Inc.

INSTRUCTION DATA

Series 6385A
Single-Card Frequency-Shift Modems

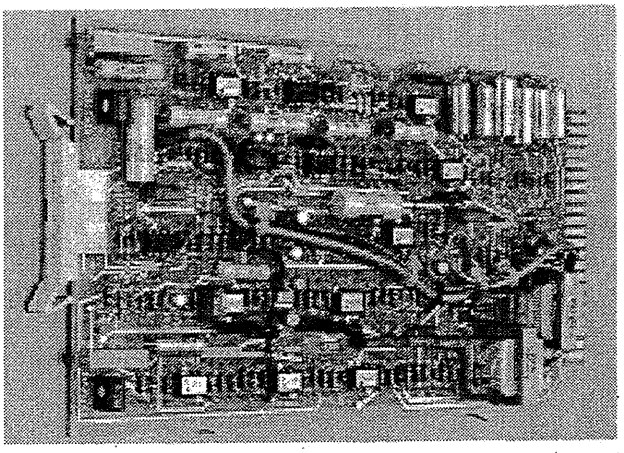


Figure 1. Typical Series 6385A Frequency-Shift Modem.

DESCRIPTION

RFL Series 6385A Frequency-Shift Modems (fig. 1) are ideal for communicating high-speed binary data over two-and four-wire Type 3002 private lines. They operate at speeds up to 1800 baud at a center frequency of 1700 Hz, with Bell 202-compatible modulation of ±500 Hz or CCITT-compatible modulation of ±400 Hz.

Integrated circuits and active filters are used in Series 6385A modems for stable performance over a wide temperature range. They can operate from either a single or bipolar 12-volt power supply, and supply variations between 11 and 16 volts will not affect their operation.

For applications where other data channels will be multiplexed on the same facility as the Series 6385A modem, the RFL Model 63 MOD FIL Modem Filter and Summing Amplifier should be used. A separate Instruction Data sheet is available which provides more information on the Model 63 MOD FIL.

SPECIFICATIONS

Modulation: FSK

Transmission Speed:
Unconditioned Type 3002 Channel: 1200 baud
C2 Conditioned Type 3002 Channel: 1800 baud

Line Interface:
Configuration: Two- or four-wire, balanced.
Impedance: 600 ohms.

Transmit Level:
Two-Wire: Adjustable from -30 dBm to +2 dBm.
Four-Wire: Adjustable from -30 dBm to +5 dBm.

Receive Level: -45 dBm to +6 dBm.

Carrier Detection:
Release Time: Approximately 1.3 ms to detect low or lost signal.
Attack Time: Approximately 4.7 ms to detect return of normal signal level.
Release Threshold Level: Adjustable from -40 dBm to 0 dBm with approximately 3.0 dB hysteresis between attack and release levels; other timing available on special order.
Receiver Data (BB): May be clamped to mark or space, or unclamped upon detector release.

Clear To Send (CB) Delay Time: Approximately 7.3 ms; Request To Send (CA) may be used to squelch receiver.

Terminal Interface:
Models 63A M1200-1 and 63A M1200-7: EIA
Models 63A M1200-3 and 63A M1200-9: DTL/TTL
Models 63A M1200-5 and 63A M1200-11: Positive neutral.

NOTE

HTL, CMOS, and CCITT interfaces are also available on special order. Contact factory for further information.

Transmit Data (BA) and Receive Data (BB) Polarity: Can be set for normal or reversed polarity.

Adjustments: Transmit frequency, transmit level, receive sensitivity, and receive bias.

RS-232 Interface Signals: Signal Ground (AB), Transmit Data (BA), Receive Data (BB) Request To Send (CA), Clear To Send (CB) Data Set Ready (CC), Carrier Detect (CF).

Operating Temperature: -20°C to +70°C (-4°F to +158°F)

Power Requirements:

Models 63A M1200-1, 63A M1200-3, and 63A M1200-5: Bipolar dc input, 11 to 16 volts @ 80 mA.

Models 63A M1200-7, 63A M1200-9, and 63A M1200-11: Positive dc input, 11 to 16 volts @ 160 mA.

Dimensions:

Models 63A M1200-1, 63A M1200-3, and 63A M1200-5: 4.71 x 8 x 0.9 inches; requires two module spaces in a Model 68 Chassis.

Models 63A M1200-7, 63A M1200-9, and 63A M1200-11: 4.71 x 8 x 1.3 inches; requires three module spaces in a Model 68 Chassis.

DIFFERENCES BETWEEN MODELS

Series 6385A modems are available in several different models, as indicated by dash numbers following the model number on the module handle. The differences between these models are shown in Table 1.

Other options are available on special order for special applications; contact an RFL Sales Engineer for further information.

Table 1
Differences Between Models, Series 6385A Frequency-Shift Modems

Module Designation	Circuit Card Assembly 39831	Interface Options			Negative Voltage Option
		EIA Level	TTL Level	Positive Neutral	
63A M1200-1	•	•			
63A M1200-3	•		•		
63A M1200-5	•			•	
63A M1200-7	•	•			•
63A M1200-9	•		•		•
63A M1200-11	•			•	•

INSTALLATION

NOTE

Series 6385A modems supplied as part of a system are installed and interconnected at the factory. The following installation instructions are provided for installing a modem into an existing system.

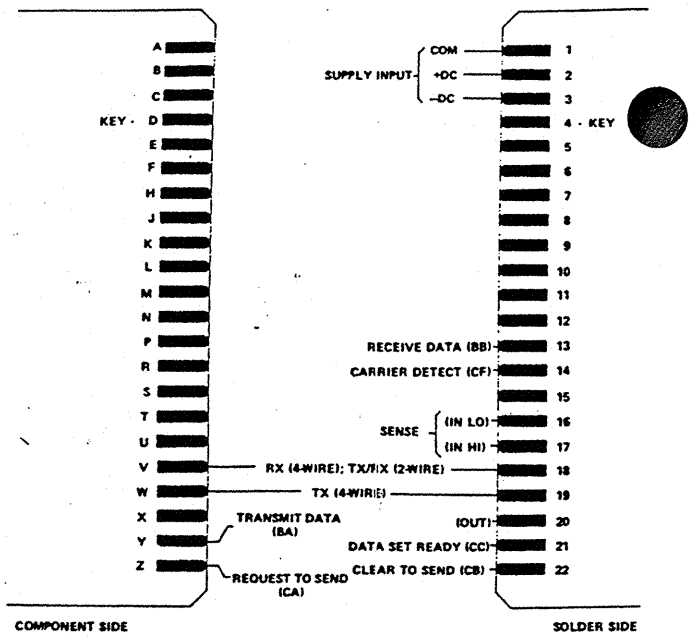


Figure 2. Edge Connector Terminal Assignments, Series 6385A Frequency-Shift Modems.

Series 6385A modems require either two or three module spaces in a Model 68 Chassis, depending on model (See Specifications section of this Instruction Data sheet.) The mating connector must have a key in position 4 (D). Refer to figure 2 for interconnect wiring terminal assignments.

Any of the following RFL power supplies can be used to power Series 6385A modems:

Model 68 PS **DC-1 Dc-dc Converter Power Supplies (24, 48, or 129-Vdc input, ±12-volt, ⅜-amp output)

Model 68 HPS **DC-1 Dc-dc Converter Power Supplies (24, 48, or 129-Vdc input, ±12-volt, 1-amp output)

Model 68 PS AC-1 Ac Power Supply (115/230-Vac input, ±12-volt, 250-mA output)

Model 68A HPS AC-1 Ac Power Supply (115/230-Vac input, ±12-volt, 1-amp output)

Once all interconnections have been made to the mating connector, the Series 6385A modem can be inserted into the chassis. Make sure the module is fully seated before proceeding.

STRAPPING

Series 6385A modems are prepared for use by installing various jumpers (fig. 3) on the circuit card for the desired operating parameters. The setting of these jumpers is called "strapping".

Many jumper positions are three holes in a row, with the center hole unmarked and the end holes marked M and S. When a jumper is installed between the center and M holes, this is called the "mark" position; between the center and S holes is called the "space" position.

CAUTION

Do not use bare wires for strapping; circuit damage and/or erratic system performance may result. Always use special molded jumpers or jumpers made from insulated solid wire.

Strapping For EIA Interface Operation: For EIA interface to the Transmit Data (BA) and Request To Send (CA) terminals, jumpers must be installed in the two spaces near the bottom of the circuit card marked EIA IN.

On Model 63A M1200-1 and 63A M1200-7 modems, these jumpers are installed at the factory; on all other models they are omitted.

BA High Keying. The BA HI jumper controls how the modem will respond to high inputs on the Transmit Data (BA) line. With this jumper in the mark position, the transmitter frequency will shift to 2200 Hz when the BA input is greater than 2.5 volts; in the space position, the transmitter will shift to 1200 Hz.

Unless otherwise specified at time of order, the BA HI jumper will be installed in the mark position at the factory.

Output High State: The HI OUT jumpers near the top of the circuit card control how the Receive Data (BB) output will respond to received signals. With both jumpers installed in the mark position, the BB output will go high upon receipt of a 2200-Hz signal; with both jumpers in the space position, the BB output will go high when the received signal is 1200 Hz.

Unless otherwise specified at the time of order, the HI OUT jumper closest to the front of the card will be installed in the mark position at the factory, and the other HI OUT jumper will be in the space position.

Clamp Select: The CF jumper next to the HI OUT jumpers controls how the receiver section of the modem reacts to squelch commands. With the jumper installed in the mark position, a receiver-squelch condition will cause the Receive Data ("B") output to go to whatever value it normally goes to upon receipt of a 2200-Hz signal; with the jumper in the space position, the BB output will be the same as if a 1200-Hz signal was received. (See Output High State paragraph above for normal signal conditions.)

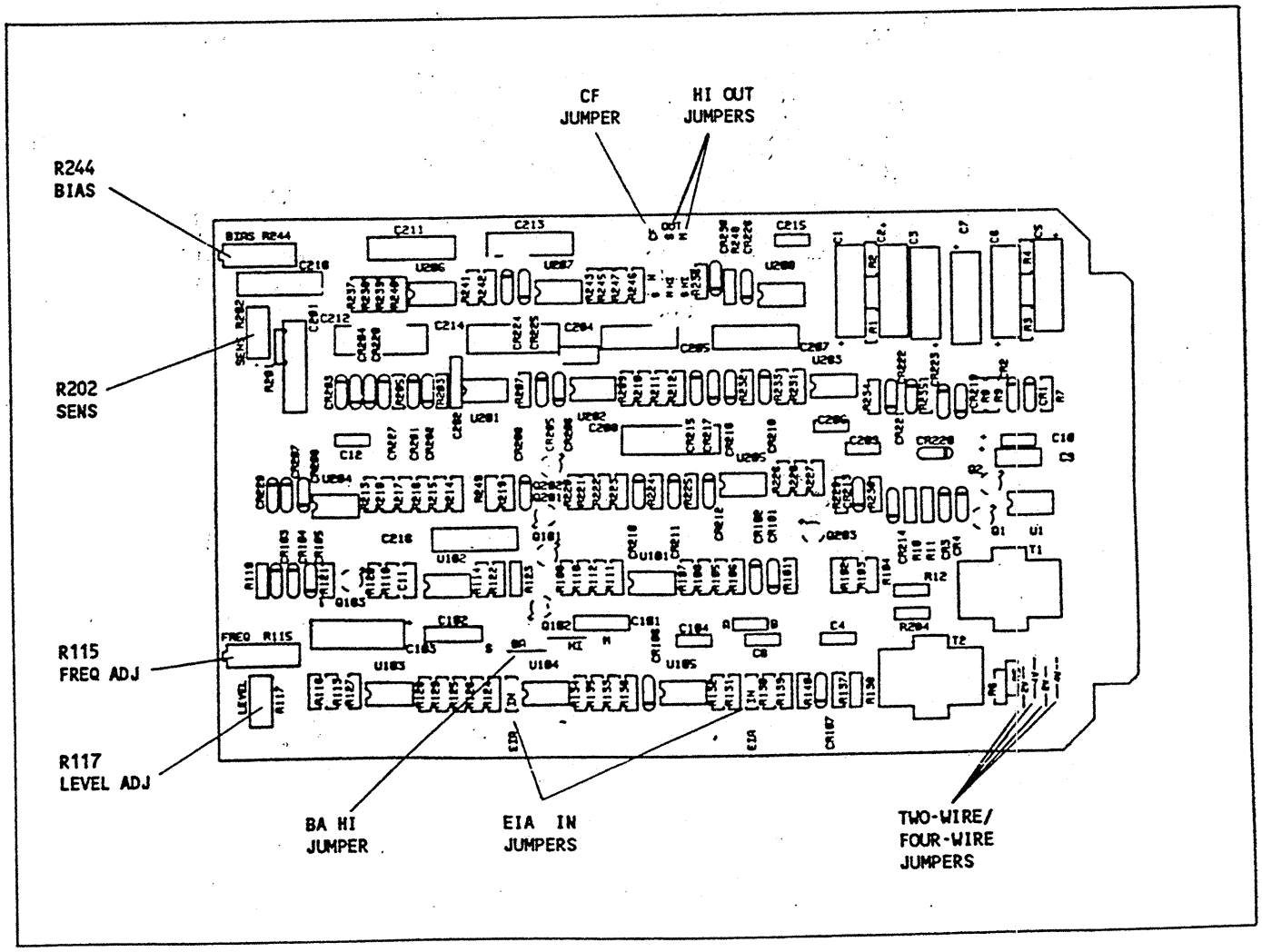


Figure 3. Controls and Jumpers, Series 6385A Frequency-Shift Modems.

Unless otherwise specified at the time of order, the CF jumper will be installed in the space position at the factory. If the state of the BB output during receiver squelch is not critical in your application, this jumper may be omitted completely.

Clamp Enable: Jumpers A and B near the bottom of the circuit card enable or disable receiver squelching action. With jumper A installed, the Request To Send (CA) output of the transmitter section will squelch the receiver; with jumper B installed, CA does not control receiver squelch.

Two-Wire/Four-Wire Operation: Two transformers (T1 and T2) in the lower rear corner of the circuit card satisfy the connection requirements for both two-wire and four-wire communications lines. As shown in figure 2, four-wire receive connections are made to edge connector terminals V and 18, and four-wire transmit connections are made to terminals W and 19; two-wire connections are made to terminals V and 18.

To change back and forth between two-wire and four-wire operation, either add jumpers on the edge connector or change the position of the 2W/4W jumpers on the circuit card near the transformers. If jumpers are to be installed on the edge connector, they should be installed as follows:

For Two-Wire Operation - place one jumper between terminals P and 20, and a second jumper between terminals R and S.

For Four-Wire Operation - place one jumper between terminals S and 20, and a second jumper between terminals P and R.

Interface Requirements: When EIA interfacing is used, the BA and CA inputs require a voltage greater than +2.5 volts to recognize a logic high, and less than +0.8 volts to recognize a logic low. Spaces have been provided on the circuit card for diodes, Zener diodes, and resistors to be installed on the BB, CB, CC, and CF output lines to limit the voltage swings normally encountered with other types of interfacing; when specified at time of order, these components will be installed at the factory.

ADJUSTMENTS

The following calibration procedure should be performed when the Series 6385A modem is first installed, after it is repaired, or any time its operation needs to be verified. All controls are located at the front of the circuit card, as shown in figure 3.

Equipment Requirements: The following equipment will be required to calibrate the Series 6385A modem.

1. Function generator, 1 MHz, 600-ohm output impedance, Hewlett-Packard 3311A or equivalent.
2. Frequency counter, digital, Fluke 1900A or equivalent.
3. Oscilloscope, dual trace, Tektronix Model 212 or equivalent.
4. Ac voltmeter calibrated in dBm, Fluke 8050A or equivalent.
5. Resistor, fixed composition, 490-ohm, ¼-watt or larger, Allen-Bradley CB Series or equivalent (2 required).
6. Resistor, fixed composition, 120-ohm, ¼-watt or larger, Allen-Bradley CB Series or equivalent.
7. Card extender, RFL Model 68 EXT.

Calibration Procedure: To calibrate the Series 6385A modem, proceed as follows. Perform all steps in the order presented. Expected results or comments will appear in **boldface** type.

1. Make sure the power supply driving the modem is turned off.

   The power switch should be in the OFF (down) position and the power indicator should not be lit.

2. Remove modem from chassis, insert card extender in its place, and insert modem into card extender.
3. Turn on power supply driving modem by placing the power switch in the ON (up) position.

   The power indicator should light.

4. Connect test equipment as shown in figure 4.
5. Set function generator output to 600 Hz, varying between zero and +12 volts.
6. Apply a logic high to edge connector terminal Z (CA - Request To Send).
7. Adjust LEVEL ADJ potentiometer R117 until the desired output level is indicated on the ac voltmeter.

   The desired signal level will vary according to application; unless otherwise specified at time of order, output is set at the factory to -10 dBm.

8. Set 1700-Hz center frequency by adjusting FREQ potentiometer R115 until counter indications are shown in Table 2.

   Mark and space frequencies should be balanced around 1700 Hz. If frequencies cannot be set as required by the desired modulation mode, check the value of resistors R109, R110, R113, and R114 against the values listed in Table 2. The values of these resistors determine whether the frequency shift is Bell 202-compatible (±500 Hz) or CCITT V.23-compatible (±400 Hz).

Table 2
Frequency Parameters, Series 6385A Frequency-Shift Modems

Modulation Mode (1200-baud, half-duplex)	Frequencies in Hz			Resistor Values			
	Mark	Center	Space	R109	R110	R113	R114
Bell 202	2200	1700	1200	66.5K	78.7K	61.9K	80.6K
Bell 202 Equalized	2200	1700	1200				
CCITT V.23 Mode 2	2100	1700	1300	61.9K	100K	56.2K	100K
CCITT V.23 Mode 2 Equalized	2100	1700	1300				

* - Refer to Table 3 (Replaceable Parts) for RFL Part Numbers.

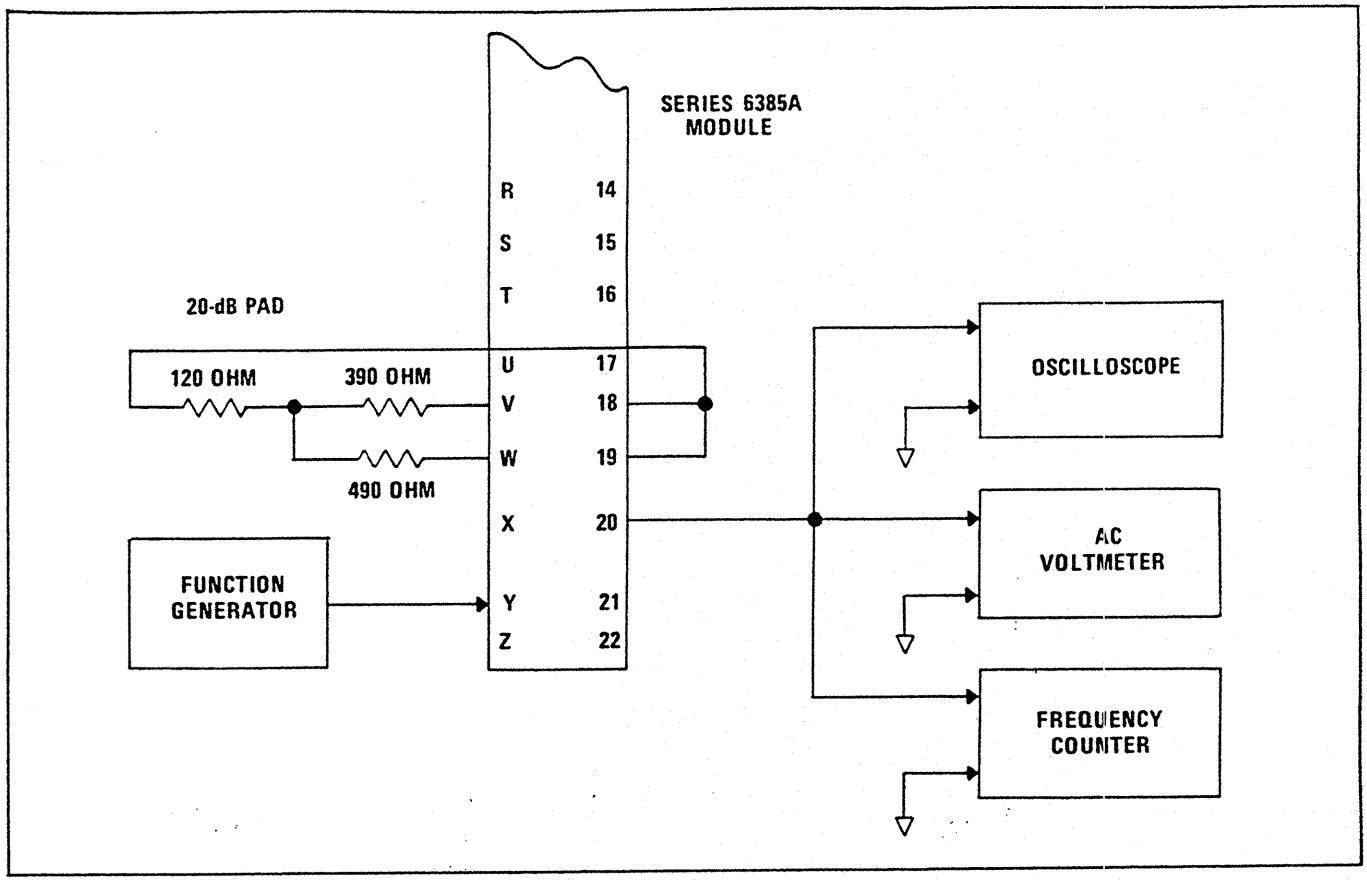


Figure 4. Test Equipment Connections For Calibration, Series 6385A Frequency-Shift Modems.

9. Note output signal waveform on oscilloscope.

   Output signal should be a clean sinewave.

10 Connect oscilloscope to edge connector terminal 13 and note duty cycle of Receive Data (BB) signal.

   BB signal duty cycle should be 50 percent. If not, adjust BIAS potentiometer R244 for 50 percent duty cycle, as indicated on oscilloscope.

11. Adjust SENS potentiometer R202 for the desired squelch level.

   There is about a 3-dB difference (dead zone) between the squelch and unsquelch levels.

12. Turn off the power supply driving the modem by placing the power switch in the OFF (down) position.

   The power indicator should go out.

13. Remove modem and card extender from chassis, pull modem out of card extender, and reinsert modem into chassis.

OPERATION

There are no operating procedures for Series 6385A modems. Once they are installed, strapped, and adjusted, they will operate whenever input power is applied and data is applied to the Transmit Data input.

THEORY OF OPERATION

OVERVIEW

The Series 6385A Single-Card Frequency-Shift Modem (shown in block diagram form in figure 5) converts binary data into an FSK signal for transmission over a two-or four-wire communication line. It also converts received FSK signals back into binary data. The Series 6385A modem has three different sections, which are interconnected to perform the desired functions: a transmitter, a receiver, and a power distribution/reference voltage circuit. Some models also contain a negative voltage generator, which allows operation from a single-ended power supply.

Each section of the Series 6385A modem uses a unique series of circuit designator numbers:

Power Distribution/Reference Voltage Circuit - 1 through 99
Transmitter - 101 through 199
Receiver - 201 through 299
Negative Voltage Generator - 301 through 399

Many integrated circuits on the circuit card have two halves. The half being discussed will be indicated by a slash number following the circuit designator (such as IC1/1, IC1/2, etc.).

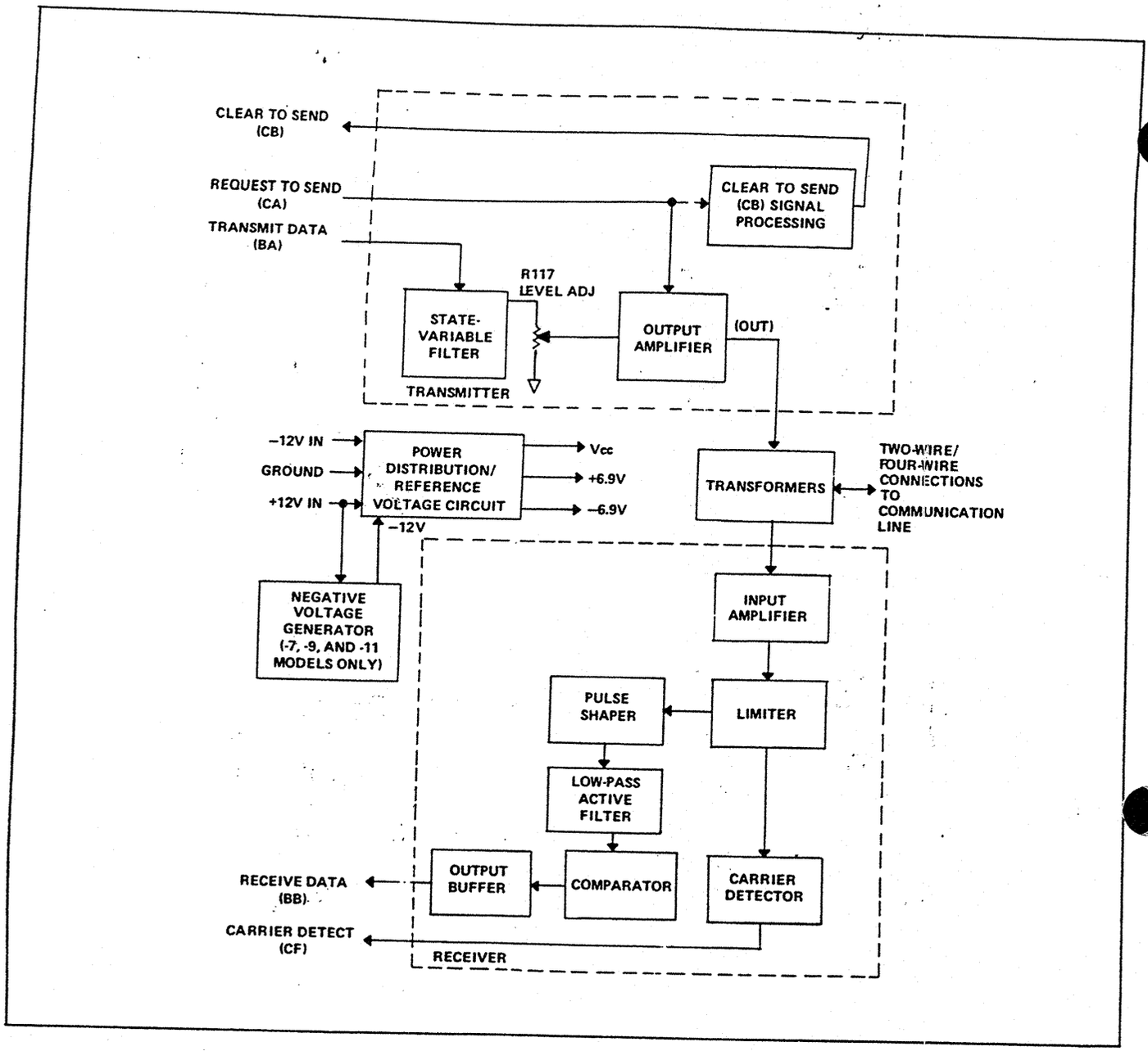


Figure 5. Block Diagram, Series 6385A Single-Card Frequency-Shift Modem.

TRANSMITTER

The transmitter (fig. 6) converts incoming binary data into an FSK signal, which is applied to the communication line. It comprises a state-variable filter, an output amplifier, and Clear To Send signal processing circuits.

State-Variable Filter: The heart of the transmitter is a state-variable filter, with positive feedback that causes it to oscillate. Field-effect transistors Q101 and Q102 are used to increase the operating frequency. Resistors R101 through R104 and diodes CR101 and CR102 control the amplitude at pin 1 of operational amplifier IC102/1.

Output Amplifier: The output amplifier buffers and amplifies the output of the state-variable filter, as controlled by the Request To Send (CA) signal applied to edge connector terminal Z. Field-effect transistor Q103 controls the gain of operational amplifier IC102/2 by varying its feedback. When CA is high, Q103 is turned off and there is a 40-dB gain from the wiper of LEVEL ADJ potentiometer R117 to pin 7 of IC102/2. With CA low and Q103 on, this gain is reduced by more than 60 dB.

Clear To Send Signal Processing: Operational amplifier IC105/2 and its associated circuits generate the Clear To Send (CB) signal and its delay. When CA goes low, capacitor C104 is rapidly charged through diode CR106, causing CB to go low; when CA goes high again, CR106 is reverse biased and C104 discharges through factory-selected resistor R136. The C104/R136 time constant sets the delay time, as indicated on figure 5. When the voltage across C104 falls below the switching point, pin 1 of IC105/2 will go high.

RECEIVER

The receiver (fig. 7) generates a pulse of fixed amplitude and width for each zero-crossing of the incoming signal. These pulses are then sent through a low-pass filter which yields the average dc value. A voltage comparator determines whether the average value is high or low; this provides the conversion to binary information.

Input Filter: Resistors R201 and R203, REC SENS potentiometer R202, and capacitor C201 form an input filter, which attenuates out-of-band noise interference before the incoming signal is applied to the input amplifier.

Input Amplifier: The input amplifier boosts the signal passed to it by the input filter. Operational amplifier IC201 develops 40 dB of gain, and is prevented from entering saturation by diodes CR203, CR204, CR227, and CR228.

Limiter: The limiter controls the amount of signal applied to the balance of the receiver. Operational amplifier IC202 is a limiting amplifier with hysteresis, and its output (pin 6) is a squarewave. Positive and negative transistions of this squarewave are fed to the pulse shaper via resistor R209 and capacitor C205.

Pulse Shaper: Operational amplifier IC203 and its associated components form a pulse shaper, which accepts the output of the limiter and produces a series of fixed-amplitude, fixed-width pulses. These pulses can be measured at pin 6 of IC203.

Low-Pass Active Filter: Both halves of operational amplifier IC206 form the active elements of a low-pass filter, which limits the bandwidth of the received signal. The output of the filter (pin 1 of IC206/2) is fed to the comparator.

Comparator: Operational amplifier IC207 and its associated components form a voltage comparator, which senses the output of the low-pass filter and turns on every time the output reaches a set level. BIAS potentiometer R244 controls the dc bias voltage applied to pin 3 of IC207, which determines the duty cycle of its output; normally, this is set for a 50 percent duty cycle.

Output Buffer: Operational amplifier IC208 is an output buffer; it boosts the output of the comparator to produce the Receive Data (BB) signal. The setting of the HI OUT jumpers determines the polarity of the BB signal.

Carrier Detector: The output of the input amplifier is also applied to the carrier detector circuit comprising operational amplifier IC204 and its associated components, through series resistor R207. IC204 generates squarewaves the same as IC202, except that if the input level at pin 2 falls below a preset point, its output will turn off.

Pin 6 of IC204 is coupled through resistor R218 and capacitor C216 to the base of transistor Q202. Each time the output of IC204 goes positive, Q202 will turn on momentarily, discharging capacitor C208. As long as carrier is detected by IC204, Q202 will keep C208 from charging; if carrier is no longer detected, Q202 stays off, C208 will charge, and pin 7 of operational amplifier IC205/1 will switch low.

When pin 7 of IC205/1 is low, two actions occur. First, field-effect transistor Q201 will turn off, widening the switching thresholds of IC204. This means that the carrier detector circuit will not restart until the input level is increased by about 3 dB above the turn-off level. This will prevent chatter caused by marginal signal levels. Second, transistor Q203 will turn on, discharging capacitor C209. This forces pin 2 of operational amplifier IC205/2 low, turning off the Carrier Detect (CF) output at edge connector terminal 14.

When IC204 starts producing squarewaves again, transistor Q203 will turn off, allowing C209 to charge through resistor R226. Once C209 charges to the proper negative value, IC205/2 will turn on, and the CF output will go high again.

POWER DISTRIBUTION/ REFERENCE VOLTAGE CIRCUIT

The power distribution/reference voltage circuit (fig. 8) accepts the input powr from the power supply, generates the ±6.9-volt reference voltages, and distributes these voltages to the other circuits.

The dc input to the modem is applied to edge connector terminals 1 through 3. Resistors R1 through R4 and capacitors C1 through C8, C11, and C12 decouple unwanted signals and prevent crosstalk interference.

Both halves of operational amplifier IC1, transistors Q1 and Q2, Zener diode CR1, diodes CR2 through CR4, resistors R7 through R11, and capacitors C9 and C10 form the reference voltage circuit. The voltage at the emitter of Q2 is held to +6.9 volts by Zener diode CR1. This creates the positive 6.9-volt reference, which drives pin 6 of operational amplifier IC1, where it is inverted to form the negative 6.9-volt reference.

NEGATIVE VOLTAGE GENERATOR

Model 63A M1200-7, 63A M1200-9, and 63A M1200-11 modems contain a negative voltage generator, which permits modem operation from a single power supply. All other Series 6385A modems do not have this circuit, and require bipolar power supplies for proper operation.

Operational amplifier IC301 and its associated components form the negative voltage generator. Transistors Q303 and Q304 are alternately switched on and off at a 50-kHz rate; Q301 and Q302 are connected as diodes. When Q304 is on, capacitor C303 charges through Q302, but when Q303 is on, C303 discharges through Q301 and the negative-voltage load.

Table 3
Replaceable Parts, Series 6385A Frequency-Shift Modem

Circuit Symbol (See figures 6-8)	Description	Part Number
	Main Circuit Card - Assembly No. 39831	
	CAPACITORS	
C1, 2, 5, 6, 103	Capacitor, tantalum, 33μF, 20%, 20V, Kemet T110C336M020AS or equiv.	1007 906
C3, 7	Capacitor, tantalum, 100μF, F, 20%, 20V, Kemet T110D107M020AS or equiv.	1007 883
C4, 8, 11, 12, 209	Capacitor, metallized polyester, 0.1μF, 10%, 250V, Seacor 106-0.1μF, or equiv.	1007 1255
C9	Capacitor, tantalum, 10μF, 10%, 20V, Kemet T322C106K020AS or equiv.	1007 955
C10	Capacitor, tantalum, 2.2μF, 10%, 25V, Kemet T3228225K025AS or equiv.	1007 752
C13-100, 105-200, 203, 217-300	Not used.	
C101, 102	Capacitor, mica, 0.002μF, 2%, 500V, Electro-Motive DM-19 or equiv.	16222
C104	Capacitor, metallized polyester, 0.22μF, 10%, 200V, Seacor Inc. 106-0.22μF, or equiv.	1007 1256
C201	Capacitor, polypropylene, 0.140μF, 2%, 100V, F-Dyne PPA-11-.14-100-2 or equiv.	0105 25
C202	Capacitor, mica, 150pF, 2%, 500V, Electro-Motive DM-15 or equiv.	16608
C204	Capacitor, mica, 390pF, 2%, 500V, Electro-Motive DM-10-391J or equiv.	1080 379
C205	Capacitor, polyester, 0.1μF, 2%, 100V, Wesco 32P or equiv.	5115 35
C206, 215	Capacitor, mica, 3pF, ±0.5pF, 500V, Electro-Motive Dm-15 or equiv.	16502
C207	Capacitor, polyester, 0.00255μF, 2%, 100V, Wesco 32P or equiv.	5115 6
C208	Capacitor, polyester, 0.065μF, 2%, 100V, Wesco 32P or equiv.	5115 74
C210	Capacitor, polyester, 0.016μF, 2%, 100V, Wesco 32P or equiv.	5115 45
C211, 213	Capacitor, polyester, 0.0056μF, 2%, 100V, Wesco 32P or equiv.	5115 23
C212, 214	Capacitor, polyester, 0.018μF, 2%, 100V, Wesco 32P or equiv.	5115 47
C216	Capacitor, polyester, 0.0033μF, 2%, 100V, Wesco 32P or equiv.	5115 11
	RESISTORS	
R1-4	Resistor, composition, 22 ohm, 5%,¼W, Allen-Bradley CB Series or equiv.	1009 613
R5	Resistor, metal film, 4.75K, 1%, ¼W, Type RN¼	0410 1353
R6	See TTL Option	
R7	Resistor, metal film, 1.5K, 1%, ¼W, Type RN¼	0410 1305
R8, 9, 105, 108, 118, 119, 246, 247	Resistor, metal film, 10K, 1%, ¼W, Type RN¼	0410 1384
R10, 218	Resistor, metal film, 3.01K, 1%, ¼W, Type RN¼	0410 1334
R11	Resistor, metal film, 9.09K, 1%, ¼W, Type RN¼	0410 1380
R12	Resistor, metal film, 301 ohm, 1%, ¼W, Type RN¼	0410 1238
R13-100, 141-200, 206 208, 250-300	Not used.	
R101, 104, 243	Resistor, metal film, 4.99K, 1%, ¼W, Type RN¼	0410 1355
R102, 103	Resistor, metal film, 2K, 1%, ¼W, Type RN¼	0410 1317
R106	Resistor, metal film, 6.04K, 1%,¼W, Type RN¼	0410 1363
R107	Resistor, metal film, 3.32K, 1%, ¼W, Type RN¼	0410 1338
R109	Resistor, metal film, 1%, ¼W, Type RN¼, value dependent upon modulation mode: For Bell 202 operation, 66.5K For CCITT V.23 operation, same as R137.	0410 1463

Table 3
Replaceable Parts, Series 6385A Frequency-Shift Modem - continued

Circuit Symbol (See figures 6-8)	Description	Part Number
	Main Circuit Card - Assembly No. 39831	
R110	Resistor, metal film, 1%, ¼W, Type RN¼, value dependent upon modulation mode: For Bell 202 operation, 78.7K For CCITT V.23 operation, same as R111.	0410 1470
R111, 120, 122, 123, 223, 229	Resistor, metal film, 100K, 1%, ¼W, Type RN¼	0410 1480
R112	Resistor, metal film, 49.9K, 1%, ¼W, Type RN¼	0410 1451
R113	Resistor, metal film, 1%, ¼W, Type RN¼, value dependent upon modulation mode: For Bell 202 operation, same as R137. For CCITT V.23 operation, 56.2K	0410 1456
R114	Resistor, metal film, 1%, ¼W, Type RN¼, value dependent upon modulation mode: For Bell 202 operation, 80.6K For CCITT V.23 operation, same as R111.	0410 1471
R115	Resistor, variable, 15-turn cermet, 10K, 10%, ¾W, Beckman Helipot 89PHR10K or equiv.	39539
R116	Resistor, metal film, 2.87K, 1%, ¼W, Type RN¼	0410 1332
R117, 202	Resistor, variable, single-turn cermet, 500 ohm, 10%, ½W, Beckman Helipot 72RXWR500 or equiv.	38569
R121, 204	Resistor, metal film, 604 ohm, 1%, ¼W, Type RN¼	0410 1267
R124, 130, 225	Resistor, metal film, 6.19K, 1%, ¼W, Type RN¼	0410 1364
R125, 131, 242	Resistor, metal film, 24.3K, 1%, ¼W, Type RN¼	0410 1421
R126, 132	Resistor, metal film, 5.11K, 1%, ¼W, Type RN¼	0410 1356
R127, 133	Resistor, metal film, 200K, 1%, ¼W, Type RN¼	0410 1509
R128, 134	Resistor, metal film, 39.2K, 1%, ¼W, Type RN¼	0410 1441
R129, 135	Resistor, metal film, 1.82K, 1%, ¼W, Type RN¼	0410 1313
R136, 138, 221, 228, 239	Resistor, metal film, 36.5K, 1%, ¼W, Type RN¼	0410 1438
R137, 222, 227	Resistor metal film, 61.9K, 1%, ¼W, Type RN¼	0410 1460
R139	Resistor, composition, 1M, 5%, ¼W, Allen-Bradley CB Series or equiv.	1009 798
R140, 214, 230, 248	Resistor, metal film, 2.74K, 1%, ¼W, Type RN¼	0410 1330
R201	Resistor, metal film, 100 ohm, 1%, ¼W, Type RN¼	0410 1192
R203	Resistor, metal film, 2.55K, 1%, ¼W, Type RN¼	0410 1327
R205	Resistor, metal film, 249K, 1%, ¼W, Type RN¼	0410 1518
R207, 212, 231-233	Resistor, metal film, 1K, 1%, ¼W, Type RN¼	0410 1288
R209, 213, 215, 216	Resistor metal film, 2.43K, 1%, ¼W, Type RN¼	0410 1325
R210	Resistor, metal film, 7.5K, 1%, ¼W, Type RN¼	0410 1372
R211	Resistor, composition, 33 ohm, 5%, ¼W, Allen-Bradley CB Series or equiv.	1009 829
R217	Resistor, metal film, 140 ohm, 1%, ¼W, Type RN¼	0410 1206
R219, 226	Resistor, metal film, 47.5K, 1%, ¼W, Type RN¼	0410 1449
R220	Resistor, metal film, 20K, 1%, ¼W, Type RN¼	0410 1413
R224, 236-238, 240, 241	Resistor, metal film, 12.1K, 1%, ¼W, Type RN¼	0410 1392
R234	Resistor, metal film, factory-selected value	Contact factory
R235	Resistor, metal film, 365 ohm, 1%, ¼W, Type RN¼	0410 1246
R244	Resistor, 15-turn cermet, 2K, 10%, ¾W, Beckman Helipot 89PHR2K or equiv.	39537
R245	Resistor, composition, 510K, 5%, ¼W, Allen-Bradley CB Series or equiv.	1009 809
R249	Resistor, metal film, 150K, 1%, ¼W, Type RN¼	0410 1497

Table 3
Replaceable Parts, Series 6385A Frequency-Shift Modem - continued

Circuit Symbol (See figures 6-8)	Description	Part Number
	Main Circuit Card - Assembly No. 39831	
	SEMICONDUCTORS	
CR1	Diode, Zener, 6.2V, 5%, 400mW, 1N753A	37498
CR2-4, 101-106, 201-213, 215-222, 224-229	Diode, silicon, 1N914B or 1N4448	26482
CR107, 214, 230	See TTL Option.	
CR223	Diode, Zener, 5.1V, 5%, 400mW, 1N751A	37497
IC1, 101, 102, 105, 205, 206	Operational amplifier, dual, 8-pin DIP, Texas Instruments MC1458P or equiv.	0620 51
IC103, 104, 203, 208	Operational amplifier, high-performance, 8-pin DIP, National Semiconductor LM748CN or equiv.	0620 70
IC201	Operational amplifier, high-performance, 8-pin DIP, Texas Instruments LM307P or equiv.	0620 93
IC202, 204, 207	Operational amplifier, high-performance, 8-pin DIP, Texas Instruments LM301AP or equiv.	0620 76
Q1, 203	Transistor, PNP, TO-18 case, 2N2907A	44179
Q2, 202	Transistor, NPN, TO-18 case, 2N2222A	44178
Q101-103, 201	Transistor, N-channel field-effect, TO-18 case, 2N4393	34379
	MISCELLANEOUS COMPONENTS	
T1	Transformer, audio, 600/1200 ohm, Microtran MT9-PC or equiv.	92938
T2	Transformer, audio, 600/600 ohm, Microtran MT1-PC or equiv.	34199
---	Shorting bar, single, Aries LP300 or equiv.	42904
---	Resistor, zero-ohm, ¼-W size, Corning OMA07 or equiv.	1510 2217

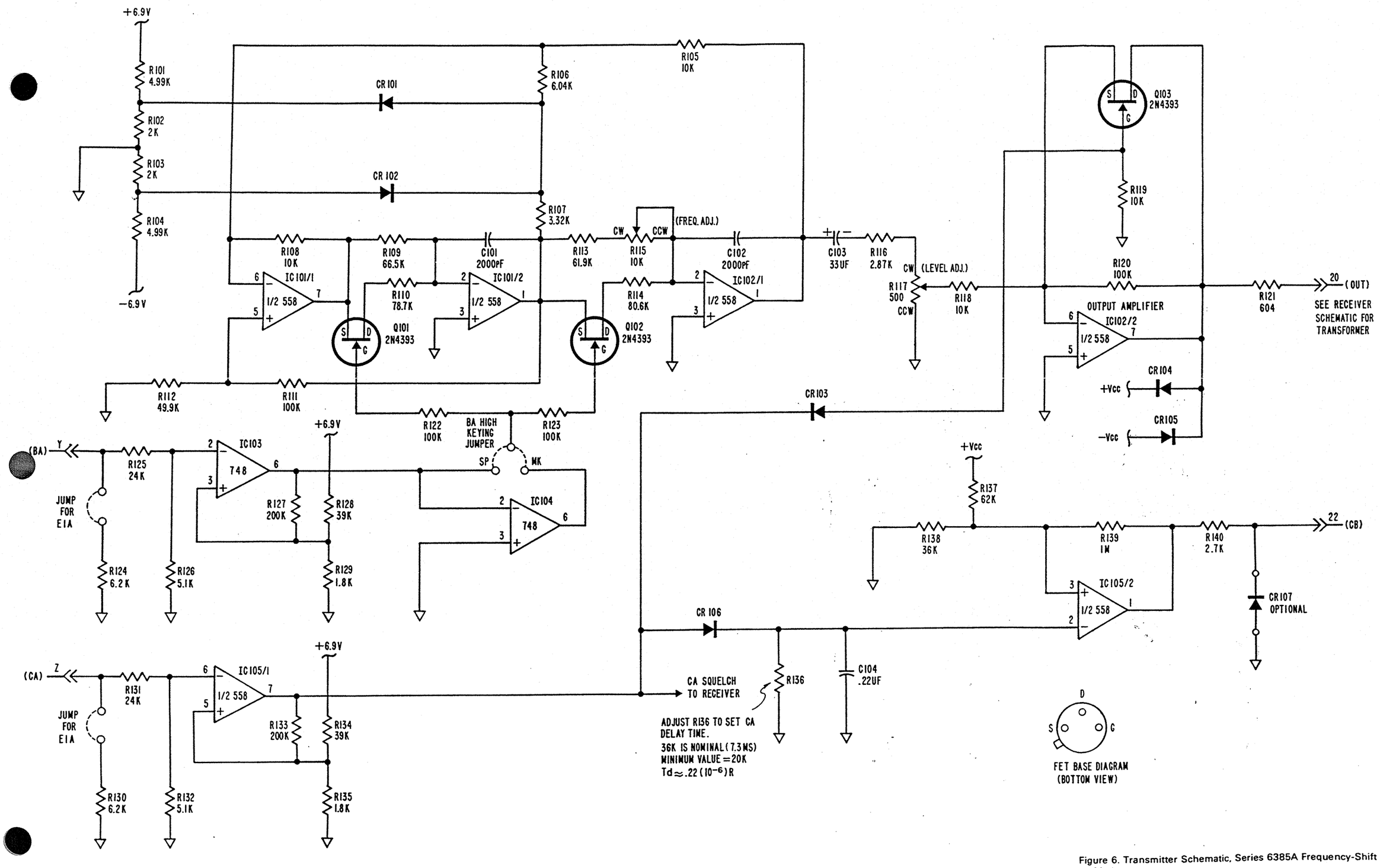


Figure 6. Transmitter Schematic, Series 6385A Frequency-Shift Modem.

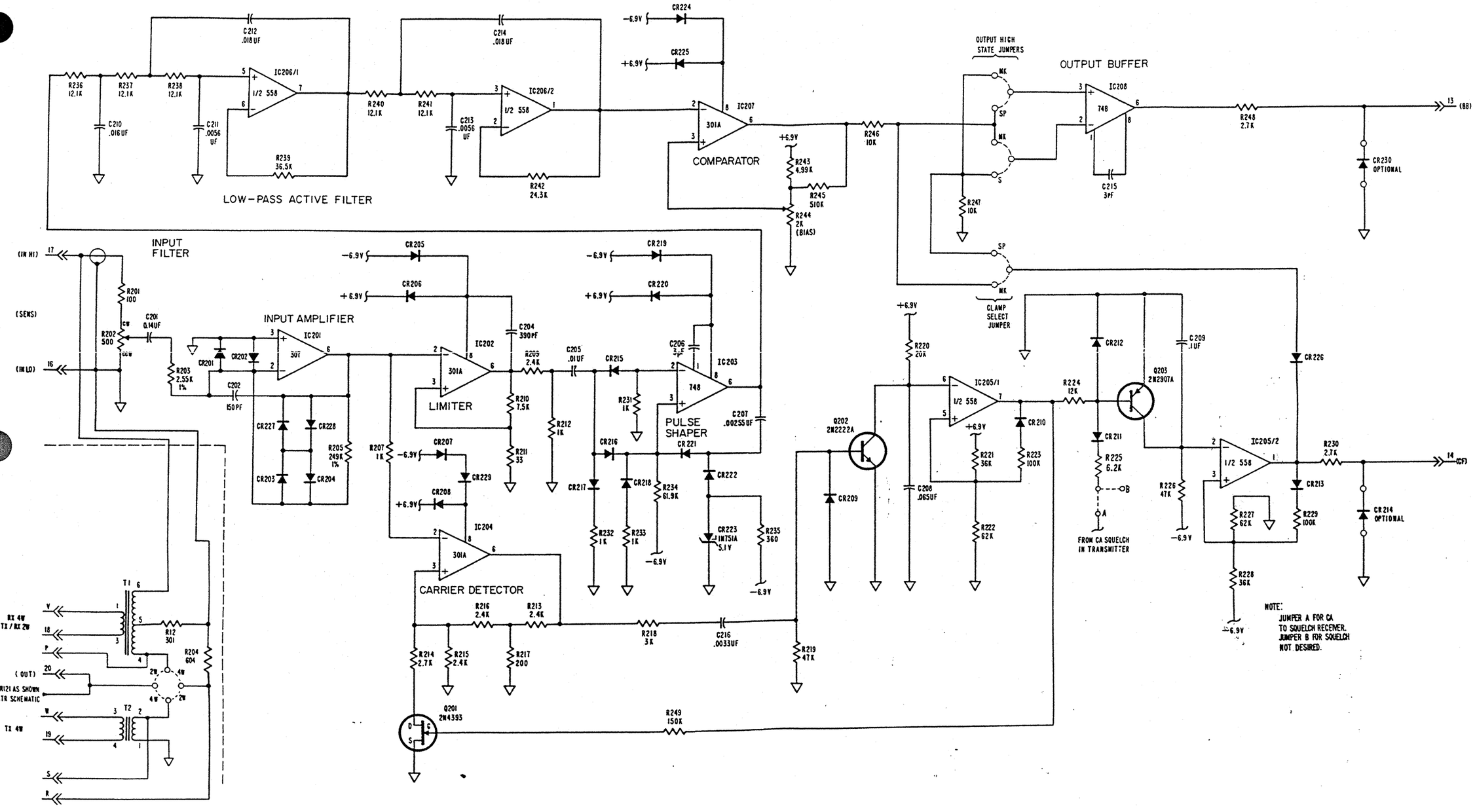
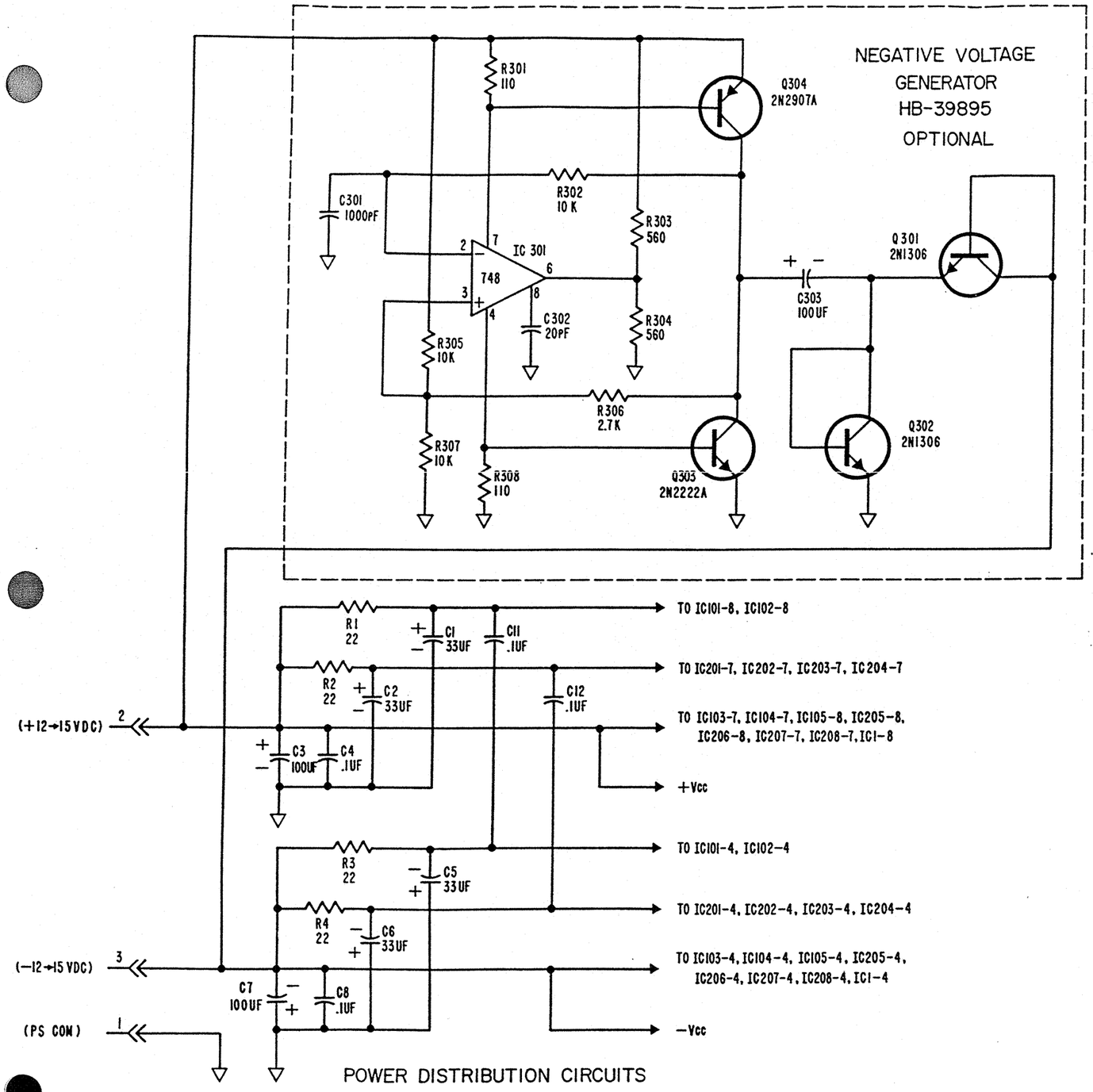


Figure 7. Receiver Schematic, Series 6385A Frequency-Shift Modem.



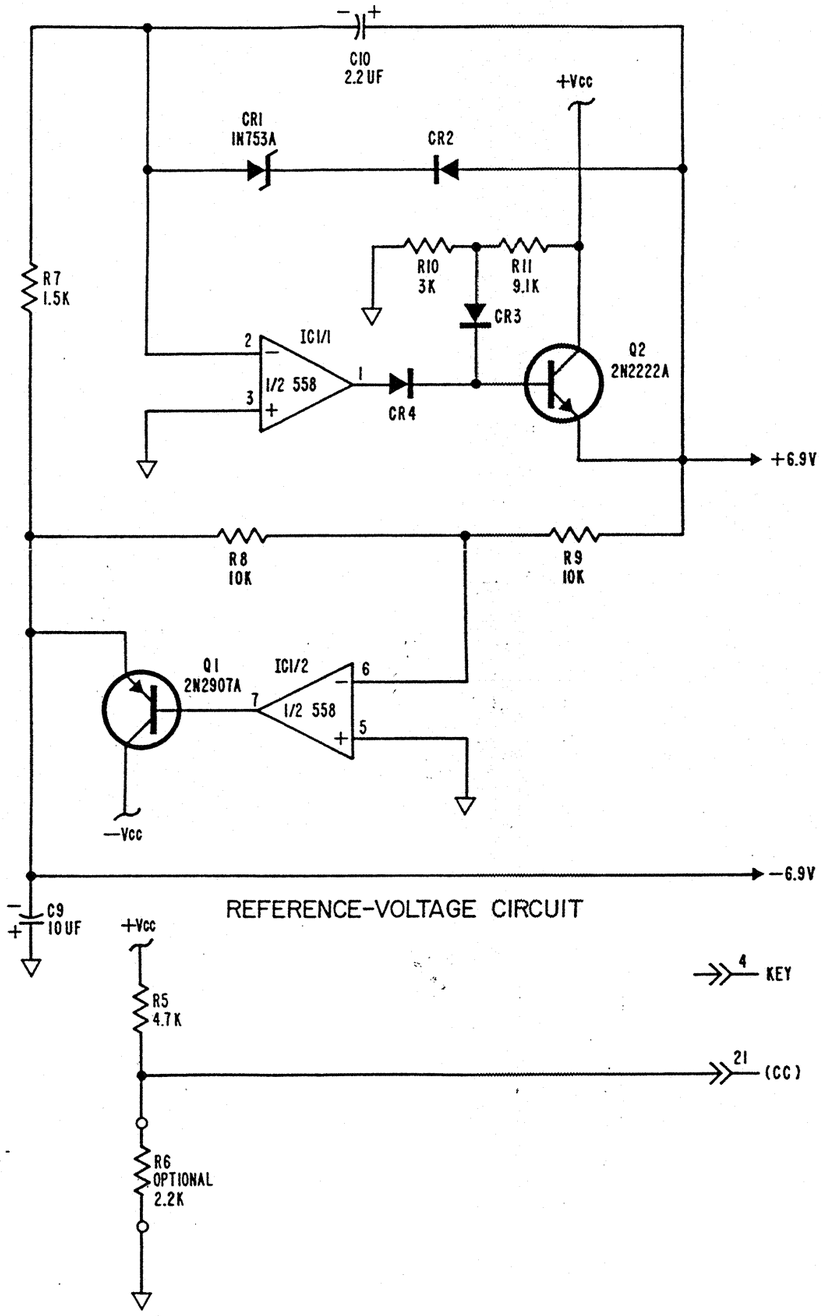


Figure 8. Power Distribution/Reference Voltage Circuit Schematic, Series 6385A Frequency-Shift Modem.

Table 3
Replaceable Parts, Series 6385A Frequency-Shift Modem - continued

Circuit Symbol (See figures 6-8)	Description	Part Number
	TTL Option - Assembly No. 43810	
R6	Resistor, metal film, 2.21K,1%, ¼W, Type RN¼	0410 1321
CR107, 214, 230	Diode, Zener, 5.1V, 5%, 400mW, 1N751A	37497
	Negative Voltage Generator - Assembly No. 39895	
C301	Capacitor, mica, 0.00μF, 2%, 500V, Electro-Motive DM-19 or equiv.	1080 286
C302	Capacitor, mica, 20pF, 5%, 500V, Electro-Motive DM-15 or equiv.	16507
C303	Capacitor, tantalum, 100μF, 20%, 20V, Kemet T110D107M020AS or equiv.	1007 883
IC301	Operational amplifier, high-performance, 8-pin DIP, National Semiconductor LM748CN or equiv.	0620 70
Q301, 302	Transistor, germanium, NPN, 2N1306	17474
Q303	Transistor, NPN, plastic package, 2N2222A	37445
Q304	Transistor, PNP, plastic package, 2N2907A	37439
R301, 308	Resistor, metal film, 110 ohm, 1%, ¼W, Type RN¼	0410 1196
R302, 305, 307	Resistor, metal film, 10K, 1%, ¼W, Type RN¼	0410 1384
R303, 304	Resistor, metal film, 562 ohm, 1%, ¼W, Type RN¼	0410 1264
R306	Resistor, metal film, 2.74K, 1%, ¼W, Type RN¼	0410 1330

NOTICE

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