

SCMA-1

Precision Digital FM SCA Modulation Monitor/Analyzer

Guide to Operations

7/99

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SCMA-1 Digital FM SCA Monitor/Analyzer

1 General Information

1-1 General Description

The Belar SCMA-1 Digital FM SCA Modulation Monitor and Analyzer is a DSP based precision SCA monitor designed to operate in conjunction with the Belar FMMA-1 or FMM-2 Modulation Monitors, or other high quality sources of wideband FM composite baseband signals.

The SCMA-1 digitizes the composite signal and demodulates the selected subcarrier signal using digital signal processing techniques. Unlike an analog design, a DSP based design is not subject to variations due to temperature, component tolerances or aging. The result is a circuit that achieves high performance, yet requires no adjustments. In addition, the DSP design allows the use of finite impulse response (FIR) linear-phase filters whose bandwidth can be varied from the front panel. The use of variable bandwidth filters allows the user to optimize the subcarrier bandpass filter (BPF) and detector lowpass filter (LPF) cutoff frequencies for a particular SCA modulation scheme. The use of DSP processing also eliminates the need for a separate crystal oscillator for each subcarrier frequency—all available frequencies are synthesized from a common system clock.

The SCMA-1 implements all measurement and metering functions using digital signal processing (DSP). Therefore, calibration of the SCMA-1 is independent of any circuit component values. This guarantees the calibration of the unit will remain stable over time. By digitizing the measurements, the user can display modulation peaks, injections, and decibel (dB) readings directly. As an added benefit, all readings can be viewed remotely using an IBM-compatible personal computer.

1-2 Specifications

Metering

Total, Main (L+R), Subcarrier Modulation	0–150%, 1% increments, peak reading
Main (L+R), Subcarrier Modulation	+3.5 to –99 dB, 0.5 dB steps, auto-ranged RMS reading
Subcarrier Injection	0.0–25.5%, 0.1% increments

Subcarrier

Frequency Range	41.0 kHz–100.0 kHz, 0.5 kHz steps
Bandpass Filter Bandwidth	1 kHz–16 kHz, 1 kHz steps
Detector Bandwidth	1 kHz–8 kHz, 1 kHz steps
Deviation Sensitivities	100%=1.0 kHz–7.0 kHz, 0.1 kHz steps
Internal Calibrator	67 kHz, 6 kHz peak deviation, 1 kHz modulation @ 10.0% injection

Input

Baseband Composite	1.0–2.0 Vrms (2.8 V–5.7 V P-P) for 100% Total, 100 k Ω , unbalanced, BNC Connector
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Outputs

Main (L+R) Audio	+10 dBm, 600 Ω , active-balanced, XLR connector
Main (L+R) Test	5 Vrms, 75 Ω , unbalanced, BNC connector
Scope	2.5 Vrms auto-ranged, 75 Ω , unbalanced, BNC connector
Subcarrier Audio	+10 dBm, 600 Ω , active-balanced, XLR connector
Subcarrier Test	5 Vrms, 75 Ω , unbalanced, BNC connector
Subcarrier BPF Output	0.1414 Vrms @ 10.0% injection, 75 Ω , unbalanced, BNC connector

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Interface

Serial	RS-232
Unit	Wizard Standard Interface

Remote Meter Outputs

Subcarrier Analog Modulation Meter
Open collector and relay closures for subcarrier presence and subcarrier peak modulation indicators.

Main (L+R) Specifications (20 Hz to 15 kHz)

Frequency Response	± 0.1 dB
Distortion (THD + Noise)	0.01%
SNR	80 dB

Subcarrier Specifications (BPF BW = 16 kHz, Detector BW = 8 kHz)

Frequency Response (20 Hz to 8 kHz, 6 kHz Dev)	
BPF In	+0.1, -1.75 dB
BPF Out	± 0.1 dB
Distortion (THD + N) @ 1 kHz, 6 kHz dev, 150 μ sec	
BPF In	0.25%
BPF Out	0.05%
SNR, 150 μ sec de-emphasized	80 dB

Crosstalk

Sub to Main	80 dB
Main to Sub	80 dB
Stereo to Sub	80 dB

Dimensions	1.75" H x 14.5" D x 19" W (1 EIA Rack Unit)
Power Requirements	17 Watts, 100-240 VAC, 50-60 Hz
Net Weight	6 lbs (2.7 kgs)
Shipping Weight	9 lbs (4.1 kgs)

2 Unpacking

2-1 Initial Inspection

Check the shipping carton for external damage. If the carton exhibits evidence of abuse in handling (holes, broken corners, etc.) ask the carrier's agent to be present when the unit is unpacked. Carefully unpack the unit and inspect all equipment for physical damage immediately after unpacking. Bent or broken parts, dents and scratches should be noted. If damage is found, refer to *Section 2-2* for the recommended claim procedure. Keep all packing material for proof of claim or for possible future use.

The SCMA-1 is shipped with a Guide to Operations, 4 black rack mount screws, a BNC jumper, a Wizard interface ribbon cable and a molded IEC three-conductor AC line cord.

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2-2 Claims

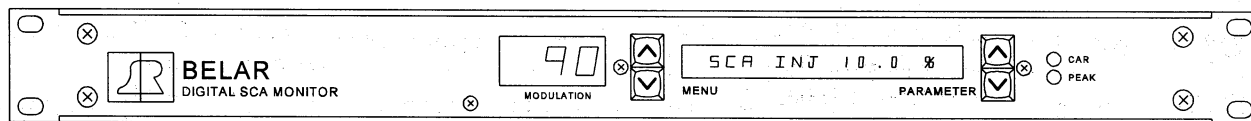
If the unit has been damaged, notify the carrier immediately. File a claim with the carrier or transportation company and advise Belar of such action to arrange the repair or replacement of the unit without waiting for a claim to be settled with the carrier.

2-3 Repacking for Shipment

If the unit is to be returned to Belar, attach a tag to it showing owner and owner's address. A description of the service required should be included on the tag. The original shipping carton and packaging materials should be used for reshipment. If they are not available or reusable, Belar can provide a replacement box and packaging at a nominal cost. Alternatively, the unit should be repackaged in the following manner:

- a) Use a double-walled carton with a minimum test strength of 275 pounds.
- b) Use heavy paper or sheets of cardboard to protect all surfaces.
- c) Use at least 4 inches of tightly packed, industry approved, shock absorbing material such as extra firm polyurethane foam or rubberized hair. **Newspaper is not sufficient for cushioning material!**
- d) Use heavy duty shipping tape to secure the outside of the carton.
- e) Use large **FRAGILE** labels on each surface.
- f) Return the unit, freight prepaid. Be sure to insure the unit for full value.

3 Front Panel Operation



The **MODULATION** window displays the subcarrier modulation, expressed in percent modulation, and normalized to the subcarrier deviation sensitivity.

The **MENU/PARAMETER** window is a 16 character alphanumeric display that displays menu selections, associated parameters, and measurement values.

To the left of the Menu/Parameter Window, the **UP** and **DOWN MENU** buttons are used to scroll through the various menu selections of the SCMA-1. The menu selections consist of a main outer loop and three submenu loops. Either the UP or DOWN button will get you to your menu choice—but usually one direction will get you there quicker than the other.

To the right of the Menu/Parameter Window, the **UP** and **DOWN PARAMETER** buttons are used to scroll through the available settings for a given menu selection, where applicable. The outer loop consists of all the measurements the SCMA-1 can make, as well as the displays MODIFY BPF, MODIFY DET, and MODIFY SETTINGS. The three submenu loops (accessed by pressing the UP PARAMETER button at the MODIFY BPF, MODIFY DET, and MODIFY SETTINGS windows, respectively) consist of all the adjustable parameters in the unit, such as filter bandwidth, hold time, etc. These parameters are all explained in

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Section 3-2 *MODIFY BPF Menu Selections*, Section 3-3 *MODIFY DET Menu Selections*, and Section 3-4 *MODIFY SETTINGS Menu Selections*, following.

The green **CAR** LED is illuminated when the unit detects a subcarrier at the selected frequency. The subcarrier injection threshold required to illuminate this light is user-defined. For more information on setting this threshold, see the MUTE menu selection in *Section 3-4 MODIFY SETTINGS*.

The red **PEAK** LED is illuminated when the peak modulation of the subcarrier exceeds the user-defined threshold. For more information on setting this threshold refer to the PEAK MOD menu selection in *Section 3-4 MODIFY SETTINGS*.

3-1 Main Menu Selections

TOTAL XXX % Displays total peak modulation of the complete composite signal in percent. The range is 0 to 150%.

MAIN XXX% Displays Main (L+R) channel modulation expressed in percent. The range is 0 to 150%.

SCA#X INJ XX.X % Displays the subcarrier injection in percent for the selected preset. The range is 0.0 to 25.5%. Up to five configurations can be recalled using this menu selection. To change preset numbers use the UP/DOWN PARAMETER buttons. For further information on how to save configurations see the "SAVE CONFIG #X" menu selection in *Section 3-4 MODIFY SETTINGS*. When the internal calibrator is turned on, the unit automatically loads the calibration configuration. An asterisk (*) is displayed after the # sign to indicate the calibrator is on.

MAIN -XX.X DB * Displays Main (L+R) channel modulation in decibels. The range is +3.5 to -99.0 dB. Measurements are referenced to 0 dB = 100% L+R modulation. DB measurements can be made with or without 75 μ sec de-emphasis. Pressing the UP PARAMETER button selects a de-emphasized reading. An asterisk (*) will appear after the DB in the MENU/PARAMETER window. Pressing the DOWN PARAMETER button removes the de-emphasis filter and the asterisk (*).

SCA -XX.X DB */+ Displays subcarrier modulation in dB. The range is +3.5 to -99.0 dB. Measurements are referenced to 0 dB = 100% subcarrier modulation as set by the user in the MODIFY DET submenu. (See *Section 3-3, MODIFY DET SubMenu Selections*.) DB measurements can be made with or without 150/75 μ sec de-emphasis. Pressing the UP PARAMETER button selects a de-emphasized reading. An asterisk (*) will appear after the DB in the MENU/PARAMETER window to indicate 75 μ sec de-emphasis and a plus sign (+) for 150 μ sec de-emphasis. Pressing the DOWN PARAMETER button removes the de-emphasis filter and the asterisk (*) or plus sign (+).

MODIFY BPF Press the UP PARAMETER arrow to enter the MODIFY BPF settings submenu section. In this section are found a number of parameters that control the subcarrier bandpass filter, as described below in *Section 3-2 MODIFY BPF Menu Selections*.

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MODIFY DET Press the UP PARAMETER arrow to enter the MODIFY DET settings submenu section. In this section are found a number of parameters that control the detector settings, as described below in *Section 3-3 MODIFY DET Menu Selections*.

MODIFY SETTINGS Press the UP PARAMETER arrow to enter the MODIFY SETTINGS submenu section. This section contains all the general parameters of the unit. The parameter settings are described below in *Section 3-4 MODIFY SETTINGS Menu Selections*.

3-2 MODIFY BPF SubMenu Selections

BPF - IN/OUT This selection switches the subcarrier bandpass filter in and out of the signal path . The BPF maybe bypassed by switching it to OUT if the SCMA-1 is being used to check the performance of the SCA generator directly. Otherwise, the BPF should be left in during normal operation.

FREQ - XXX.X KHZ This setting determines the center frequency of the subcarrier BPF. The frequency range is 41.0 kHz to 100.0 kHz in 0.5 kHz steps. For normal operation, the center frequency is set to the carrier frequency of the desired subcarrier. When the MOD TYPE is set to RDS, the FREQ is locked at 57 kHz. To indicate lock the menu reads "FREQ (RDS) 57 KHZ".

BPF BW - XX KHZ Allows the bandwidth of the bandpass filter to be optimized for a particular subcarrier. The BPF bandwidth is adjustable from 16 kHz to 1 kHz in 1 kHz steps. Depending on the modulation type and/or deviation of the subcarrier, the BPF bandwidth should be set to the widest setting that provides acceptable performance. Selecting an overly narrow BPF bandwidth will result in an increase in distortion due to bandlimiting of the subcarrier signal. When the MOD TYPE is set to RDS the BPF bandwidth is fixed. To indicate this the menu reads "BPF BW - RDS" .

EXIT ? Pressing the UP PARAMETER button will exit the MODIFY BPF submenu and return to the outer MAIN MENU selections.

3-3 MODIFY DET SubMenu Selections

MOD TYPE - FM/RDS This setting selects the modulation type of the subcarrier to be monitored. Selecting FM will accommodate the most typical SCA modulation schemes. For accurate measurement of RDS injection, the RDS Mod Type must be selected. When the Mod Type is set to RDS a 57 kHz BPF optimized for measuring the RDS subcarrier is automatically selected. The SCMA-1 does not demodulate the RDS signal so the unit automatically mutes the SCA modulation output and blanks the display while measuring RDS injection.

DET RESP - FLAT/75US/150US This selection determines the frequency response of the detected signal present at the SCA OUTPUT jacks on the rear of the unit. Depending on the response selected the frequency response of the output will be flat or have one of the two de-emphasis curves applied. For typical FM subcarriers this should be set to 150 μ sec de-emphasis.

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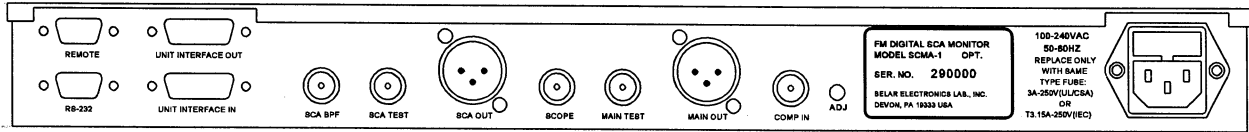
DET BW - X KHZ	Determines the bandwidth of the LPF applied to the detected SCA signal. The detector bandwidth is adjustable from 8 kHz to 1 kHz in 1 kHz steps. This setting affects the signal fed to the SCA OUTPUT jacks and the internal metering section. The detector bandwidth should be chosen based upon the highest modulating frequencies present in the signal. Selecting an overly narrow detector bandwidth will result in errors in the modulation readings due to bandlimiting of the demodulated signal.
NORM - X.X KHZ	Sets the value of the peak deviation of the subcarrier which represents "100%" modulation. The normalization range is 1.0 kHz to 7.0 kHz deviation in 0.1 kHz steps. The normalization also affects the SCA OUTPUT jacks by scaling the signal so that the output level for a 100% modulation reading remains constant. Setting the normalization too low may result in high modulation readings and clipping at the SCA OUTPUT jacks.
EXIT ?	Pressing the UP PARAMETER button exits the MODIFY DET submenu and returns to the outer MAIN MENU selections.
3-4 MODIFY SETTINGS SubMenu Selections	
HOLD XX.X SEC	Determines the time interval over which readings are held and/or acquired. When in PAST TIME MODE, the unit waits the HOLD time and displays the highest peak in that interval. In REAL TIME MODE, the hold time represents the length of time the current peak is held on the display, unless a new higher peak is detected. If a new higher peak is detected before the hold time has expired, the new peak is immediately displayed and the hold time clock restarted. The HOLD time may be set in 0.5 second intervals from 0.5 to 10.0 seconds. In PAST TIME MODE, the additional HOLD-EXT setting allows the SCMA-1 display to be externally synchronized with other units in the Wizard system.
HOLD - EXT	
PEAK MOD XXX %	Sets the peak modulation threshold for the SCA modulation PEAK light. The threshold is adjustable from 1 to 150% in 1% increments. The reference deviation for an indication of "100%" is set by the user in the MODIFY DET submenu. (See <i>Section 3-3</i> .)
TIME MODE - REAL/PAST	Determines the mode in which peaks are displayed. In REAL time mode the display is updated as soon as a new peak is detected. In PAST time mode the unit waits the HOLD time and displays the highest peak which occurred during this HOLD interval.
INFINITE - ON/OFF	Enables or disables infinite hold of display. If infinite hold is ON (enabled), the display acts as a "high water mark" and will "stick" at the highest modulation (until infinite hold is set to OFF).
REMOTE - ON/OFF	Enables or disables the RS-232 port. This allows users to enable or block remote access to the unit. REMOTE cannot be turned off while someone is communicating with the unit remotely. Also, REMOTE can only be turned OFF from the front panel.

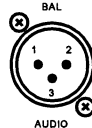
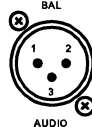
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SAVE CONFIG #X	Allows the user to save a configuration consisting of all parameters to the internal EEPROM. Up to five different configurations can be stored. The configuration number being saved is displayed after the # sign. To change the configuration number you must go to the "SCA#X INJ XX.X %" selection in the MAIN MENU. The unit configurations are preserved when power is removed. Press the UP PARAMETER button to save a configuration.
MUTE - OFF/ON/AUTO	Determines how the mute functions. The mute maybe turned specifically ON or OFF, or set to AUTOMATICALLY actuate when the subcarrier injection falls below a user-set threshold. The threshold is set in the "MUTE - XX.X%" menu selection described below. When MUTE is active, no audio appears at the rear panel SCA output jacks. The MODULATION display also indicates "- - -". When the MOD TYPE is set to RDS, the MUTE is locked ON. The menu reads "MUTE (RDS) - ON".
MUTE XX.X %	Sets the subcarrier injection threshold for the subcarrier presence LED and automatic mute function. The range is adjustable from 0.1 to 15.0% in 0.1% increments. When the subcarrier injection falls below this threshold setting the green CAR LED on the front panel will extinguish. If the mute function is set to AUTO the unit will also mute the SCA outputs and change the modulation display to " - - -".
MAIN RESP - FLAT/75US	Enables or Disables the Main (L+R) output 75 μ sec de-emphasis filter. This setting affects both the balanced MAIN OUT and unbalanced MAIN TEST outputs on the rear panel. For normal operation the 75 μ sec de-emphasis filter is switched in.
CALIBRATOR- ON/OFF	Switches the internal calibrator on and off. The internal calibrate signal consists of a 67 kHz FM subcarrier with 6 kHz deviation at a 1 kHz modulating frequency and 10.0% injection. When the calibrator is turned on the unit automatically saves the current configuration and loads the calibration configuration. The original configuration is restored when the calibrator is turned off. This signal maybe used to check the calibration of the SCMA-1.
EXIT ?	Pressing the UP PARAMETER arrow to exit the MODIFY SETTINGS submenu and returns to the outer MAIN MENU selections.

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4 Rear Panel



COMP IN	Wideband composite, 100 k Ω , unbalanced, BNC Connector, 1.0 – 2.0 Vrms (2.8 V – 5.7 V P-P).
MAIN OUT	Main (L+R) output , 600 Ω, active-balanced, +10 dBm @ 100% Main, XLR type connector. Pin 1 is ground, pin 2 is +, pin 3 is -. The frequency response of this output maybe configured as FLAT or with 75 μsec de-emphasis. 
MAIN TEST	Main (L+R) test output, 5.0 Vrms @ 100% Main, 75 Ω, unbalanced, BNC connector. The frequency response of this output follows the balanced output and maybe configured as FLAT or with 75 μsec de-emphasis.
SCOPE	Scope output, 2.5 Vrms @ 0.0 dB, 75 Ω, unbalanced, BNC connector. The output signal depends on the dB measurement selected on the front panel of the SCMA-1. When the dB measurement drops below -40 dB a gain of +40.0 dB is automatically inserted for better resolution. The frequency response of this output is determined by the front panel selection and may be FLAT, or with 150 μsec or 75 μsec de-emphasis.
SCA OUT	SCA modulation output , 600 Ω, active-balanced, +10 dBm @ 100%, XLR type connector. Pin 1 is ground, pin 2 is +, pin 3 is -. The frequency response of this output maybe configured as FLAT, or with 150 μsec or 75 μsec de-emphasis. 
SCA TEST	SCA test modulation output, 5.0 Vrms @ 100%, 75 Ω, unbalanced, BNC connector. The frequency response of this output follows the balanced output and maybe configured as FLAT, or with 150 μsec or 75 μsec de-emphasis.

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SCA BPF

SCA bandpass filter output, 0.1414 Vrms @ 10.0% subcarrier injection, 75 Ω , unbalanced, BNC connector. The BPF output contains the selected subcarrier at its original carrier frequency after the SCMA-1's BPF section. If the BPF has been switched OUT from the front panel, the output becomes a wideband signal composed of all signals present at the composite input. Either one of these signals may be used to check input signal that is being applied to the SCMA-1's detector and metering circuits.

Unit Interface IN

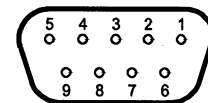
This interface is used to connect to other units in The Wizard System for unified remote operation. Note that when the SCMA-1 is connected to another Wizard System unit, such as the Belar FMMA-1, the HOLD TIME on *all but one* of the units in the chain should be set to EXT so all the units will be synchronized.

Unit Interface OUT

This interface is used to connect other Wizard-interface-equipped equipment, such as the Belar FMMA-1 to the SCMA-1 for combined remote operation. The interface works in a daisy chain configuration, with the first unit (say, the FMMA-1) at the start of the chain, with its Unit Interface Out connected to the Unit Interface In on the next unit (say, the FMSA-1). The Unit Interface Out of the SCMA-1 is then connected to the Unit Interface In jack of the next unit.

REMOTE

This connector is used to connect the optional MP-16 Analog Meter Panel to the SCMA-1, or for other remote metering or monitoring applications. The meter panel displays SCA modulation and also provides remote CAR and PEAK LEDs.



Remote
connector

The pinout of this connector is as follows:

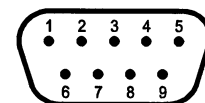
- Pin 1 Carrier Presence relay (when the LED is lit, pins 1 and 2 are closed)
- Pin 2 Carrier Presence relay
- Pin 3 Peak Relay (when the LED is lit, pins 3 and 4 are closed)
- Pin 4 Peak Relay
- Pin 5 Remote Meter Out (+)
- Pin 6 Ground
- Pin 7 Carrier Presence (open collector)
- Pin 8 Peak (open collector)
- Pin 9 +5V (75 mA max)

(Note: relays are rated at 10 W max, 0.5 A max, 200 VDC max)

RS-232

The RS-232 connector is provided for direct communication between the SCMA-1 and an IBM-compatible computer using the Wizard Software. If you intend to write software to directly communicate with the SCMA-1 using this port, please refer to *Section 7*.

Pin	Type	Description
1	input CD	Carrier detect from Modem
2	input Rx	Receive data
3	output Tx	Transmit data
4	output DTR	Data terminal ready
5	ground GND	signal ground
6-9		not used



RS-232
connector

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5 Installation and Setup

The SCMA-1 FM SCA Modulation Monitor is designed to be mounted in a standard 19 inch electronic equipment rack with EIA standard spacing. When the monitor is mounted above equipment generating large amounts of heat, such as power supplies and amplifiers, provisions must be made to insure the free movement of cool air around the SCMA-1. In no instance should the ambient chassis temperature be allowed to rise above 50°C (122°F). Mount the SCMA-1 to the rack using the four black 10-32 rack mounting screws provided.

The SCMA-1 uses a switching power supply that accepts line voltages in the range of 100–240 VAC, 50–60 Hz. No adjustment is necessary as long as the line voltage falls within these ranges. The fuse in the rear panel AC input module should be only a type 3A–250V (UL/CSA) fuse or a type T3.15A–250V (IEC) fuse. A spare fuse is stored in the removable fuse compartment in the module.

The rear panel AC power entry module conforms to the IEC-320 standard and accepts a PH-386 grounded AC connector. The SCMA-1 is supplied with a three-conductor power cord with a PH-386 connector on one end and a type 290B connector on the other end. When the power cord is plugged into an appropriate AC outlet, the unit is grounded. (The offset pin on the power cable's three-prong connector is the ground contact.) To preserve the grounding feature when operating the unit from a two-contact outlet, use a three-prong-to-two-prong adaptor and connect the green pigtail on the adaptor to a good electrical ground.

The SCMA-1 does not have an internal power switch. When the power cord is attached, the unit is operating.

5-1 Initial Setup and Calibration

Connect the composite output of your FMMA-1, FMM-2, or other wideband FM demodulator to the Composite Input jack on the rear panel. Apply an appropriate calibration signal to the unit (for example, the Belar FMMA-1 or FMM-2 with its internal calibrator turned on). Adjust the SCMA-1 input potentiometer, located on the back panel, until the SCMA-1 TOTAL display, found in the Main Menu Selections, reads “100%”. The unit is now calibrated and all peak, dB, and injection readings will be accurate.

5-2 Configuring the SCMA-1 to Monitor Specific Subcarriers

The SCMA-1 can store up to five different configurations to monitor the various subcarriers which may be present. To set up the unit to monitor a specific subcarrier follow the steps below:

1. Locate the “SCA#X INJ XX.X %” menu selection in the Main Menu. Using the UP/DOWN PARAMETER buttons select which configuration you want to set up.
2. Locate the “MODIFY BPF” selection in the Main Menu. Press the UP PARAMETER button to enter the MODIFY BPF submenu. This submenu contains settings which affect the subcarrier bandpass filter.
 - a. The “BPF - IN/OUT” is set to IN for normal operation.
 - b. The center frequency of the BPF filter should be set to the subcarrier frequency you wish to monitor using the “FREQ - XX.X KHZ” menu selection.
 - c. The BPF bandwidth must be set to the widest setting for acceptable performance in the “BPF BW - XX KHZ” menu selection. For most typical FM subcarriers, setting the bandwidth to 16 kHz provides enough selectivity to avoid interference problems. If you are creating a configuration to monitor an

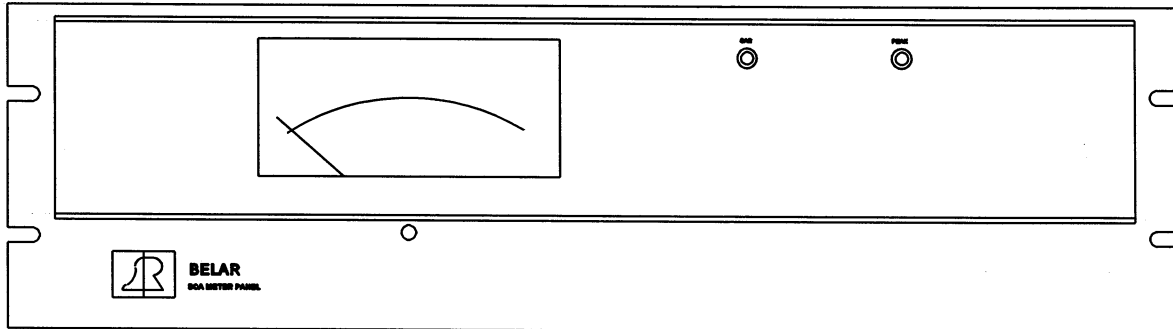
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RDS subcarrier, the bandwidth and center frequency will automatically be configured when you select “MOD TYPE - RDS” in the MODIFY DET section.

- d. To exit the “MODIFY BPF” submenu find the “EXIT ?” menu selection and press the UP PARAMETER button.
3. Find the “MODIFY DET” selection in the Main Menu. Press the UP PARAMETER button to enter the MODIFY DET submenu. This submenu contains settings which affect the detector used to demodulate the subcarrier.
 - a. The “MOD TYPE - FM/RDS” selection refers to the technique used to modulate the subcarrier. If the configuration being created is for an RDS subcarrier, select the RDS Mod Type and skip ahead to step #4. The unit automatically configures itself for RDS subcarriers. Otherwise, set the Mod Type to FM.
 - b. The “DET RESP - FLAT/75US/150US” affects the frequency response of the demodulated signal present at the SCA OUTPUT jacks on the rear panel. For typical FM subcarriers this should be set to 150 μ sec.
 - c. The “DET BW - X KHZ” determines the bandwidth of the lowpass filter applied to the detected signal. The LPF bandwidth should be chosen to pass the highest modulating frequency present without attenuation. For most FM subcarriers with music, the bandwidth can be set at 8 kHz. For voice or typical data, the bandwidth can be lowered to 3 to 4 kHz for improved SNR.
If you are creating a configuration for a 67 kHz subcarrier and are also broadcasting a 57 kHz RDS signal you will typically hear a high frequency buzz in the 67 kHz subcarrier’s demodulated output. This is due to some overlap of the upper sideband of the RDS signal and the lower sideband on the 67 kHz SCA. The best way to alleviate this problem is not by decreasing the BPF bandwidth, which would increase the audio distortion due to bandlimiting of the subcarrier’s sidebands, but by decreasing the detector bandwidth to 6 or 7 kHz. This is because the RDS signal’s upper sideband shows up as a spur in the 67 kHz SCA modulation output at around 9 kHz and is easily filtered out with the detector’s LPF.
 - d. The “NORM - X.X KHZ” sets the subcarrier deviation required to indicate 100% modulation. The normalization also affects the SCA OUTPUT jacks by scaling the signal so that the output level for a 100% modulation reading remains constant. The normalization should be set to the expected peak deviation of the subcarrier for the best compromise between headroom and SNR. Typically the NORM is set to 6.0 kHz deviation
 - e. To exit the “MODIFY BPF” submenu find the “EXIT ?” menu selection and press the UP PARAMETER button.
 4. Locate the “MODIFY SETTINGS” selection in the Main Menu. Press the UP PARAMETER button to enter the MODIFY SETTINGS submenu. This submenu contains all the general settings of the unit.
 - a. To save the configuration you have just created and leave the remainder of the settings at their default values find the “SAVE CONFIG #X” menu selection. Pressing the UP PARAMETER button will save the current configuration to the selected preset number. This new configuration can now be recalled by using the “SCA#X INJ XX.X%” Main Menu Selection.

The Wizard System

5-3 Accessories



The optional Analog Meter Panel, Model MP-16, which consists of one large backlit analog meter and two LED indicators, provides continuous analog metering of SCA modulation. The meter panel also has a remote subcarrier presence LED and a subcarrier peak modulation LED (labeled "CAR" and "PEAK", respectively).

Before connecting the MP-16 to the SCMA-1, ensure that the meters are at mechanical zero.

Using the interconnect cable (provided), connect the D-connector end of the plug to the Remote connector (J1A) on the SCMA-1. The other end of the cable should be connected to the terminal strip (TB1) on the back of the MP-16 as follows:

<i>Terminal Number</i>	<i>Wire Color</i>
1	Brown
2	Red
3	Orange
4	White
5	Green

MP-16 Line Voltage Selection Procedure:

1. Unplug line cord.
2. Open fuse compartment door.
3. Move fuse pull lever to left to remove fuse. Leave fuse pull lever in the leftmost position.
4. Using needle nose pliers, pull the voltage select board straight out of the power entry module.
5. While facing the rear of the unit, orient the voltage select board so the desired line voltage is up and reads correctly ("120" for 115 Vac operation, "240" for 230 Vac operation).

Note: The "100" and "220" positions on the opposite side of the board are not used.

6. Plug the voltage select board into the power entry module.
7. Install the fuse (F1).
8. Close fuse compartment door.
9. Plug line cord in.

Note: The MP-16 uses line power only to illuminate the meter. It is not required for proper operation of the meter panel.

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MP-16 Calibration:

1. Turn on the SCMA-1 calibrator.
2. Note the reading on the SCMA-1 MODULATION display.
3. Adjust potentiometer R1 on the rear of the MP-16 so the remote modulation meter reads the same percentage.

6 Running the Setup Program

To run the setup program, plug in the SCMA-1 and press any of the keys located on the front panel while the INITIALIZATION message is being displayed. After a few seconds the SCMA-1 will display a flashing RUNNING SETUP message as it enters the program.

6-1 Main Setup Menu Selections

RESET DEFAULTS ? Resets the SCMA-1 to default factory settings including the passwords. Pressing the UP PARAMETER button will reset the unit to default settings. The default settings are as follows:

BPF - IN
FREQ - 67.0 KHZ
BPF BW - 16 KHZ

MOD TYPE - FM
DET RESP - 150US
DET BW - 8 KHZ
NORM - 6.0 KHZ

HOLD 1.0 SEC
PEAK MOD 100%
TIME MODE - PAST
INFINITE - OFF
REMOTE - OFF
MUTE - AUTO
MUTE 2.5%
MAIN RESP - 75US

MODIFY OPTIONS ? Press the UP PARAMETER button to enter the MODIFY OPTIONS submenu. This submenu contains the settings related to the RS-232 and Unit Interface.

MODIFY ID ? Press the UP PARAMETER button to enter the MODIFY ID submenu. This submenu allows the user to edit the unit's identification string.

UNIT INFO ? Press the UP PARAMETER button to enter the UNIT INFO submenu. This submenu displays the unit's serial number and EPROM version.

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- TEST RELAY/LED ?** This submenu allows the relays and LEDs to be tested. Press the UP PARAMETER button to enter the TEST RELAY/LED submenu.
- TEST RS-232 ?** This submenu allows the RS-232 port to be tested. Press the UP PARAMETER button to enter the TEST RS-232 submenu.
- EXIT SETUP ?** Exits the SETUP MENU and returns the unit to normal operation. Press the UP PARAMETER button to exit the setup program.

6-2 MODIFY OPTIONS SubMenu Selections

- BAUD RATE**
1200/2400/
4800/9600 Selects the baud rate for the RS-232 Port. This baud rate should be set to the same baud rate as the device the SCMA-1 is being interfaced with.
- PASSWORDS -**
ON/OFF Enables/disables password protection of the unit when it is accessed with The Wizard Software. If passwords are disabled, the user will not be prompted to enter a password when establishing a connection with the unit. If the SCMA-1 is connected to a external MODEM the passwords should be enabled to protect the unit from unauthorized users. If a direct or hard wired connection is used the password protection may not be needed.
- EXT SYNC - ON/OFF** Determines whether or not the unit synchronizes its data collection to the PC's internal time of day clock. When using The Wizard Software the EXT SYNC should be enabled. This guarantees that the PC and remote unit are locked to the same time reference.
- CMD TYPE: -**
BELAR/ASCII Determines the RS-232 Command type. For normal operation, with the Wizard Software, the command type should be set to "BELAR". For use with the *SCMA-1 ASCII RS-232 Interface Commands* in Section 7, set the command type to "ASCII".
- INTERFACE:**
MASTER/SLAVE Selects the configuration of the Unit Interface. The Unit Interface is used to connect to other units in The Wizard System for unified remote operation. Only one unit may have its Unit Interface set to MASTER. The MASTER unit controls the Unit Interface activity. Typically the FMMA-1 would be set to MASTER and the SCMA-1 to SLAVE.
- UNIT CHANNEL:X** The Unit Channel Number allows multiple SCMA-1 units to be accessed on the Unit Interface. The first unit present should be set to Unit Channel:0. The second unit present should be set to Unit Channel:1, and so forth, up to Unit channel:3. Up to 4 SCMA-1's may be present on the Unit Interface and each unit must be set to a unique channel number.
- EXIT ?** Pressing the UP PARAMETER button exits the MODIFY OPTIONS submenu and returns the Main Setup Menu.

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6-3 MODIFY ID SubMenu Selections

- ID(X):XXXXXXXXXX** The unit ID is a 10 character string used to uniquely identify a unit when it is accessed remotely. The string is set by default to “..SCMA-1..” when the unit is shipped. This string may be altered by using the UP PARAMETER button to scroll through the available ASCII characters at the current cursor position. The current cursor position is indicated in parentheses. The cursor position is changed by using the DOWN PARAMETER button.
- EXIT ?** Pressing the UP PARAMETER button exits the MODIFY ID submenu and returns to the Main Setup Menu.

6-4 UNIT INFO SubMenu Selections

- VERSION X.XX** Indicates the EPROM version installed in the unit.
- SERIAL# 29XXXX** Indicates the unit’s factory serial number.
- EXIT ?** Pressing the UP PARAMETER button exits the UNIT INFO submenu and returns to the Main Setup Menu.

6-5 TEST RELAY/LED SubMenu Selections

- RELAY #X - OPEN/CLOSE** Allows the relays and their associated LEDs to be tested. The relay number being tested is displayed along with its state, either open or closed. The unit is configured so that when a LED is illuminated the relay is closed. The test program will continually cycle the chosen relay open and closed while it turns on and off the corresponding LED. To change the relay/LED being tested press the UP or DOWN PARAMETER button.
- EXIT ?** Pressing the UP PARAMETER button exits the TEST RELAY/LED submenu and returns to the Main Setup Menu.

6-6 TEST RS-232 SubMenu Selections

- TRANSMIT \$XX X** The RS-232 test alternately transmits a \$55 and \$AA over the interface. The display shows the byte being transmitted followed by the byte received. If no byte is received a “RECEIVE FAILED” message is displayed. In addition to testing the Rx and Tx lines the test also toggles the DTR on the Tx and reads the CD line on the Rx. The “0” or “1” displayed after the data byte is the current logic state of the DTR or CD line.
- RECEIVE \$XX X**
- RECEIVE FAILED X**
- EXIT ?** Pressing the UP PARAMETER button exits the TEST RS-232 submenu and returns to the Main Setup Menu.

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7 SCMA-1 ASCII RS-232 Interface Commands

In order for the ASCII command set to be active the CMD TYPE - ASCII option must be selected. This option is found in the MODIFY OPTIONS section of the SETUP PROGRAM.

'D' - Send Unit Data: Instructs SCMA-1 to send back the current value of the specified data. Use the tables below to determine the second character of the command string.

Data Available

- 'A' - SCA Peak Max
- 'B' - Total Peak Max
- 'C' - Main Peak Max
- 'D' - SCA Injection
- 'E' - Main dB
- 'F' - SCA dB
- 'G' - CAR Presence LED
- 'H' - SCA Peak LED

The command syntax is:

'D' + X: (ASCII character data specifier) + CR: (carriage return)

The unit will send back four ASCII characters, representing the decimal value of the data, terminated with a carriage return.

Note: If the data requested is the SCA injection the leading digit is the current preset number. If the data requested is a dB reading the first digit returned determines the sign. A leading '1' indicates a positive value, while a leading '0' implies a negative value.

Example: Send Total Peak Modulation

Command Sent: 'D' + 'A' + CR: (carriage return)
ASCII Value : \$44 \$41 \$0D

Data Returned (assume total peak = 100%): '0100' + CR
ASCII Value: \$30 \$31 \$30 \$30 \$0D

'C' - Send Unit Configuration : Instructs SCMA-1 to send back the current setting of the specified parameter. Use the tables below to determine the second character of the command string.

Parameters Available

- 'A' - SCA Injection Preset
- 'B' - Main dB Response
- 'C' - SCA dB Response
- 'D' - BPF Bypass
- 'E' - BPF Center Frequency
- 'F' - BPF Bandwidth
- 'G' - Subcarrier Modulation Type

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'H' - Detector Response
'T' - Detector Bandwidth
'J' - Normalization
'K' - Hold Time
'L' - SCA Peak Threshold
'M' - Time Mode
'N' - Infinite
'O' - Remote
'P' - Save Configuration
'Q' - Mute
'R' - Mute Threshold
'S' - Main Channel Response
'T' - *** RESERVED ***
'U' - Calibrator

The command syntax is:

'C' + X: (ASCII character parameter specifier) + CR: (carriage return)

The unit will send back four ASCII characters, representing the decimal value of the parameter, terminated with a carriage return.

Example: Send Time Mode

Command Sent: 'C' + 'M' + CR: (carriage return)

ASCII Value : \$43 \$4D \$0D

Data Returned (assume Time Mode = Past): '0001' + CR

ASCII Value: \$30 \$30 \$30 \$31 \$0D

'A' - Alter Unit Configuration : Instructs SCMA-1 to change the value of the specified parameter. Use the tables below to determine the second character of the command string.

Parameters Available

'A' - SCA Injection Preset
'B' - Main dB Response
'C' - SCA dB Response
'D' - BPF Bypass
'E' - BPF Center Frequency
'F' - BPF Bandwidth
'G' - Subcarrier Modulation Type
'H' - Detector Response
'T' - Detector Bandwidth
'J' - Normalization
'K' - Hold Time
'L' - SCA Peak Threshold
'M' - Time Mode
'N' - Infinite

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'O' - Remote
'P' - Save Configuration
'Q' - Mute
'R' - Mute Threshold
'S' - Main Channel Response
'T' - *** RESERVED ***
'U' - Calibrator

The command syntax is:

'A' + X: (ASCII character parameter specifier)
+ XXXX: (ASCII parameter data 1st digit = thousands
2nd digit = hundreds
3rd digit = tens
4th digit = ones)
+ CR: (carriage return)

The unit will send back four ASCII characters, representing the decimal value of the updated parameter, terminated with a carriage return.

Example: Alter Time Mode

Command Sent: 'A' + 'M' + '0001' + CR: (carriage return)

ASCII Value : \$41 \$4D \$30 \$30 \$30 \$31 \$0D

Data Returned (assume Time Mode = Past): '0001' + CR

ASCII Value: \$30 \$30 \$30 \$31 \$0D

UNIT DATA DEFINITIONS

Data	High	Low	Increments
SCA Peak Max	150	0	1%
Total Peak Max	150	0	1%
Main Peak Max	150	0	1%
SCA Injection	25.5	0	0.1%
Main dB	+3.5	-99.0	0.5 dB
SCA dB	+3.5	-99.0	0.5 dB
CAR LED	1	0	toggle
PEAK LED	1	0	toggle

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UNIT PARAMETER DEFINITIONS

Parameter	High	Low	Increments
SCA Injection Preset	5	1	1
Main dB Response	1	0	toggle (75 μ sec=1, FLAT=0)
SCA dB Response	2	0	150 μ sec=2, 75 μ sec=1, FLAT=0
BPF Bypass	1	0	toggle (IN=1, OUT=0)
BPF Frequency	200	82	multiples of 0.5 kHz
BPF Bandwidth	16	1	multiples of 1 kHz
Mod Type	1	0	RDS=1, FM=0
Detector Response	2	0	150 μ s=2, 75 μ s=1, FLAT=0
Detector Bandwidth	7	0	8 kHz=7 --> 1 kHz=0
Normalization	60	0	multiplies of 0.1 kHz, offset by 1.0 kHz
Hold Time	20	0	0-EXT; (1-20: multiples of 0.5 sec)
SCA Peak	150	1	1%
Time Mode	1	0	toggle (PAST=1, REAL=0)
Infinite	1	0	toggle (ON=1, OFF=0)
Remote	1	0	toggle (ON=1, OFF=0), not accessible
Save Configuration	1	0	toggle (Save=1)
Mute	2	0	2-AUTO; 1-ON; 0-OFF
Mute Threshold	150	1	multiples of 0.1%
Main Response	1	0	toggle (1=75 μ sec, 0=FLAT)
Calibrator	1	0	toggle (1=ON, 0=OFF)

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8 Diagrams, Schematics and Parts Lists

Replaceable Parts. This page contains information for ordering replaceable parts for the SCMA-1. The tables that follow list the parts in alphanumeric order by reference designation and provides a description of the part with the Belar part number.

Ordering Information. To order a replacement part from Belar, address the order or inquiry to Belar and supply the following information:

- a. Model number and serial number of unit.
- b. Description of part, *including the reference designation and location.*

Orders may also be taken over the telephone. Parts orders can be put on your VISA, MasterCard, or American Express card, or we can ship them COD.

REFERENCE DESIGNATORS

A	= assembly	J	= jack	S	= switch
BR	= diode bridge	L	= inductor	T	= transformer
C	= capacitor	M	= meter	TB	= terminal block
CR	= diode or LED	P	= plug	U	= integrated circuit
DS	= display or lamp	Q	= transistor	W	= cable
F	= fuse	R	= resistor	X	= socket
FL	= filter	RL	= relay	Y	= crystal
HDR	= header connector	RN	= resistor network		

ABBREVIATIONS

ADC	= analog-to-digital converter	PIV	= peak inverse voltage
BCD	= binary coded decimal	POLY	= polystyrene
CER	= ceramic	PORC	= porcelain
COMP	= composition	POT	= potentiometer
CONN	= connector	SEMICON	= semiconductor
DAC	= digital-to-analog convertor	SI	= silicon
DPM	= digital panel meter	TANT	= tantalum
ELEC	= electrolytic	uF	= microfarads
GE	= germanium	V	= volt
IC	= integrated circuit	VAR	= variable
k	= kilo = 1,000	VDCW	= dc working volts
M	= meg = 1,000,000	W	= watts
MOD	= modulation	WW	= wirewound
MY	= Mylar		
PC	= printed circuit		
pF	= picofarads		

Appendix A: Using The Wizard Software

Getting Started

Using The Wizard Software any Belar Monitor equipped with an RS-232 Port can be operated from any IBM-compatible personal computer, either through a direct connection (on-site) or from any distance via telephone/modem connection. It can also control other Belar units connected to it using The Wizard Interface. With The Wizard Interface multiple units in a series can be accessed remotely using a single RS-232 port.

Direct Connection

Equipment Required:

- The Wizard Software.
- An IBM compatible PC with an RS-232C serial (COM) port.
- An RS-232 cable with a 9 pin female D-connector at one end (for the Belar unit) and the appropriate connector for your computer (generally either a 9 or 25 pin female D-connector). For direct connection to a PC, only a three wire connection is actually needed: Rx, TX and GND. The various cable pinouts are below; your computer manual may also offer helpful information.

Generally, the RS-232 cable for direct connection is referred to as a "null modem" cable. For your convenience, the proper pin-out follows:

Pinout for Direct Connection (if your computer has a 9-pin D connector serial port):

<u>PC</u>	<u><==></u>	<u>Belar Unit</u>
2 - Rx	<u><==</u>	3 - Tx
3 - Tx	<u>==></u>	2 - Rx
5 - GND	<u><==></u>	5 - GND

Pinout for Direct Connection (if your computer has a 25-pin D connector serial port):

<u>PC</u>	<u><==></u>	<u>Belar Unit</u>
3 - Rx	<u><==</u>	3 - Tx
2 - Tx	<u>==></u>	2 - Rx
7 - GND	<u><==></u>	5 - GND

Procedure:

1. Connect one end of your RS-232 cable to the port on the back of the unit labeled "RS232", and connect the other end to the RS-232 (COM) port of your personal computer.
2. For safety's sake, if you plan to run The Wizard Software directly from the floppy disk, make a backup copy first and store the original in a safe place. Alternatively, copy The Wizard software to your hard disk, preferably in its own subdirectory (we suggest C:\WIZ).
3. From the **A>** or **C:\WIZ>** prompt, type **WIZ** and press **Enter**. Once the software has been started, pressing **F1** will bring up context-sensitive help.
4. Using the mouse, select the **Communications** menu from the top of the screen. If you do not have a mouse, press Alt-C. A drop-down menu will appear:

Start Communications
Connect VIA MODEM
Setup MODEM/RS232
Send Command String
Change Password
About
Exit

Select **Setup Modem/RS232** (using the arrow keys) and press **Enter**. Using the arrow and tab keys, configure your computer to the proper COM port, IRQ, and speed. Press **F1** in this screen for more information on any of these selections. Once you have made the selections, select Start Communications to establish a connection to the unit. The unit comes configured from the factory with a Supervisor password of **BELAR3**.

Connection via Modem

Equipment Required:

- The Wizard Software.
- An IBM compatible computer with at least a 1200 baud (preferably 2400 baud or greater) Hayes-compatible modem, internal or external.
- An external 1200 or 2400 baud external modem (for connection to the unit), set up as described below.
- An RS-232 cable with a 9 pin female D-connector at one end (for the unit) and the appropriate connector for your external modem (generally either a 9 or 25 pin female D-connector). For reliable external modem operation all five lines from the unit's RS-232C connector should be used. The pinout of this cable follows.
- A telephone line for connecting the two modems.

Pinout for Modem connection (25-pin D connector serial port at modem):

<u>PC</u>	<u><==></u>	<u>Belar Unit</u>
2 - Rx	<u><==</u>	3 - Tx
3 - Tx	<u>==></u>	2 - Rx
7 - GND	<u><==></u>	5 - GND
8 - CD	<u>==></u>	1 - CD
20 - DTR	<u><==</u>	4 - DTR

External Modem Setup:

Most external modems have non-volatile memory for storing configuration information. In order to configure the modem to work with the unit you must have a computer with a RS-232 port and some kind of communications software or other way of communicating with your modem. Connect the external modem to the computer using the appropriate cable and access it using your communications software. Using the appropriate AT commands set up the modem to do the following:

AT command Description

ATS0=n Puts modem in Auto-Answer mode, where "n" is the number of rings desired before the call will be answered. Note: "n" cannot equal 0 (we suggest n=1).

AT&C1	Carrier Detect (CD) active during connect.
AT&D3	Data Terminal Ready (DTR) disconnect and reset.
AT&W0	Writes user configuration to non-volatile memory.

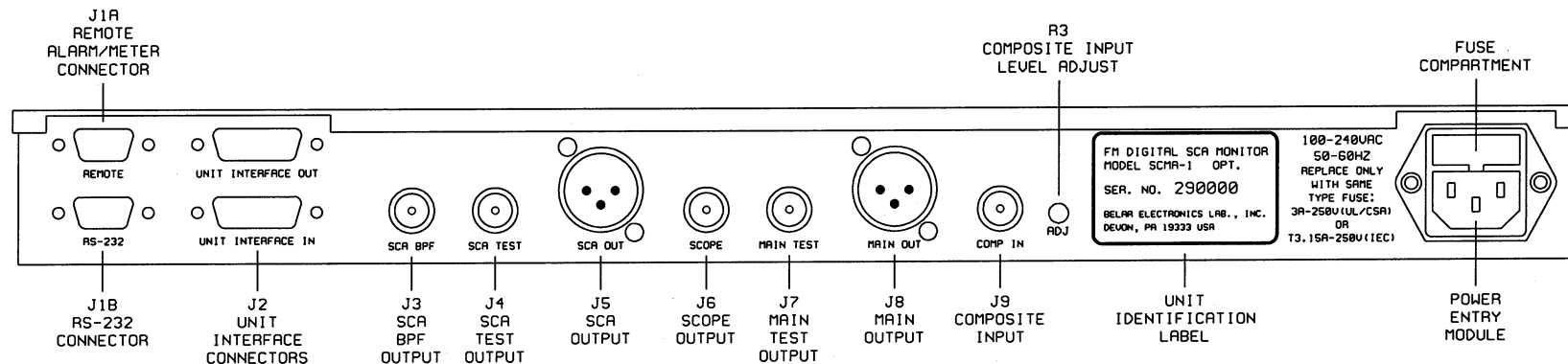
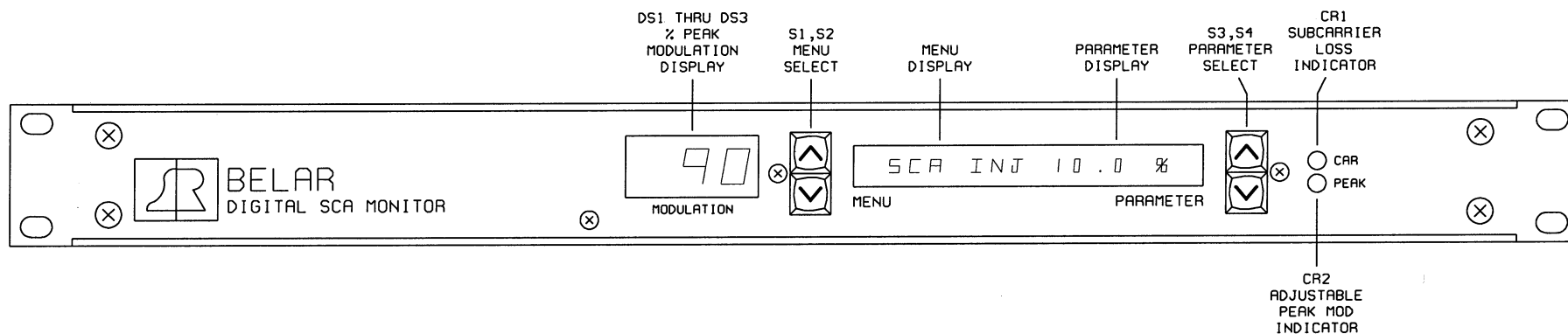
Some modems have various data compression schemes to increase the apparent speed under certain circumstances. Be sure to configure your modem to disable such compression schemes. Refer to your modem and communication software manuals if you encounter problems.

Procedure:

1. For safety's sake, if you plan to run The Wizard software directly from the floppy disk, make a backup copy first and store the original in a safe place. Alternatively, copy The Wizard software to your hard disk, preferably in its own subdirectory (we suggest C:\WIZ).
2. From the A> or C:\WIZ> prompt, type **WIZ** and press **Enter**. The Wizard front panel will appear in the lower half of your screen.
3. Using the mouse, select the **Communications** menu from the top of the screen. If you do not have a mouse, press Alt-C. A drop-down menu will appear:

Start Communications
Connect VIA MODEM
Setup MODEM/RS232
Send Command String
Change Password
About
Exit

Select **Setup Modem/RS232** (using the arrow keys) and press **Enter**. Using the arrow and tab keys, configure your computer to the proper COM port, IRQ, speed, and telephone number(s). Press **F1** in this screen for more information on any of these selections. Once you have made the selections, select **Connect VIA MODEM** to instruct your modem to dial up the modem at the remote unit and established a connection. The unit comes configured from the factory with a Supervisor password of **BELAR3**.

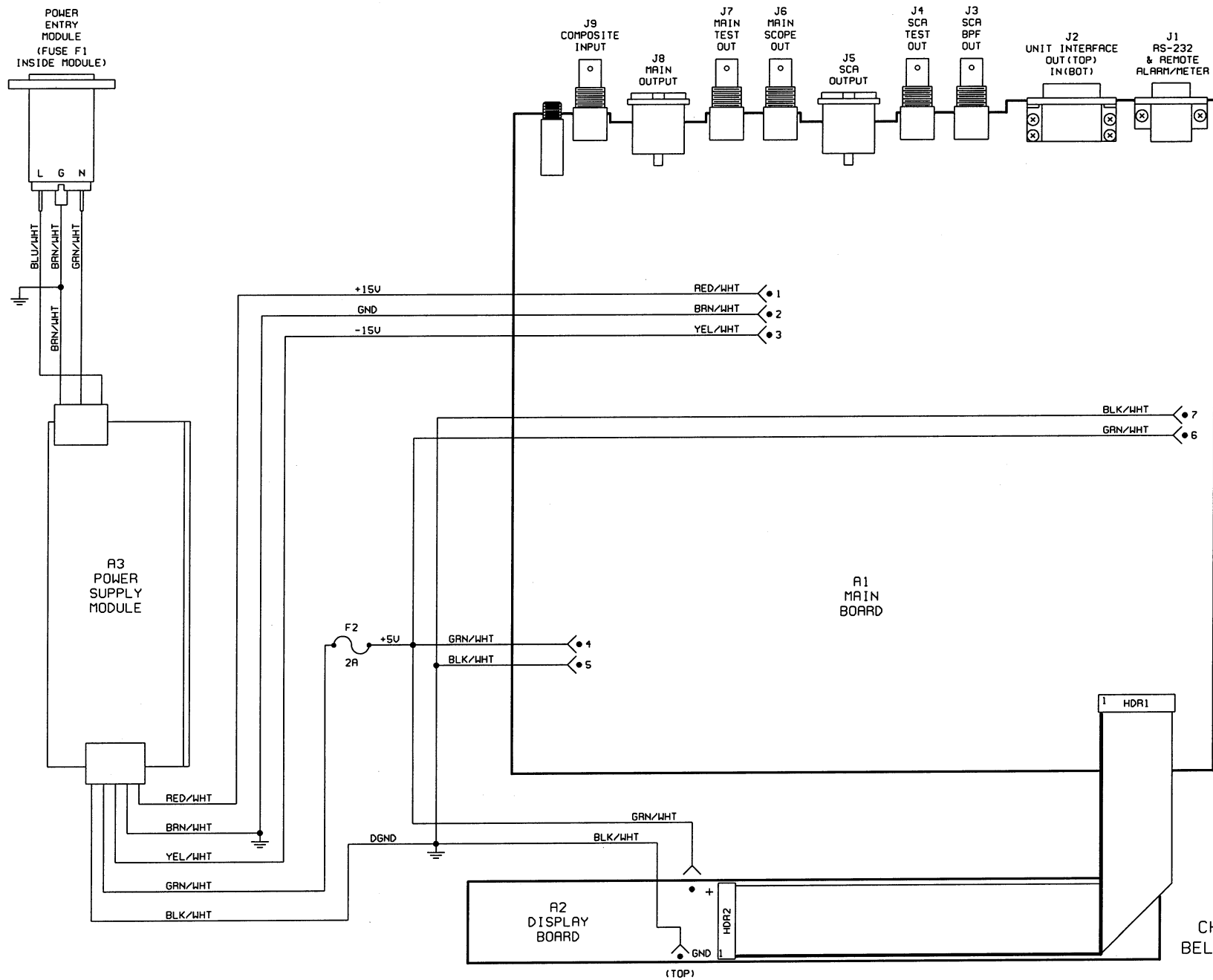


SCMA-1 FRONT & REAR VIEW
BELAR ELECTRONICS

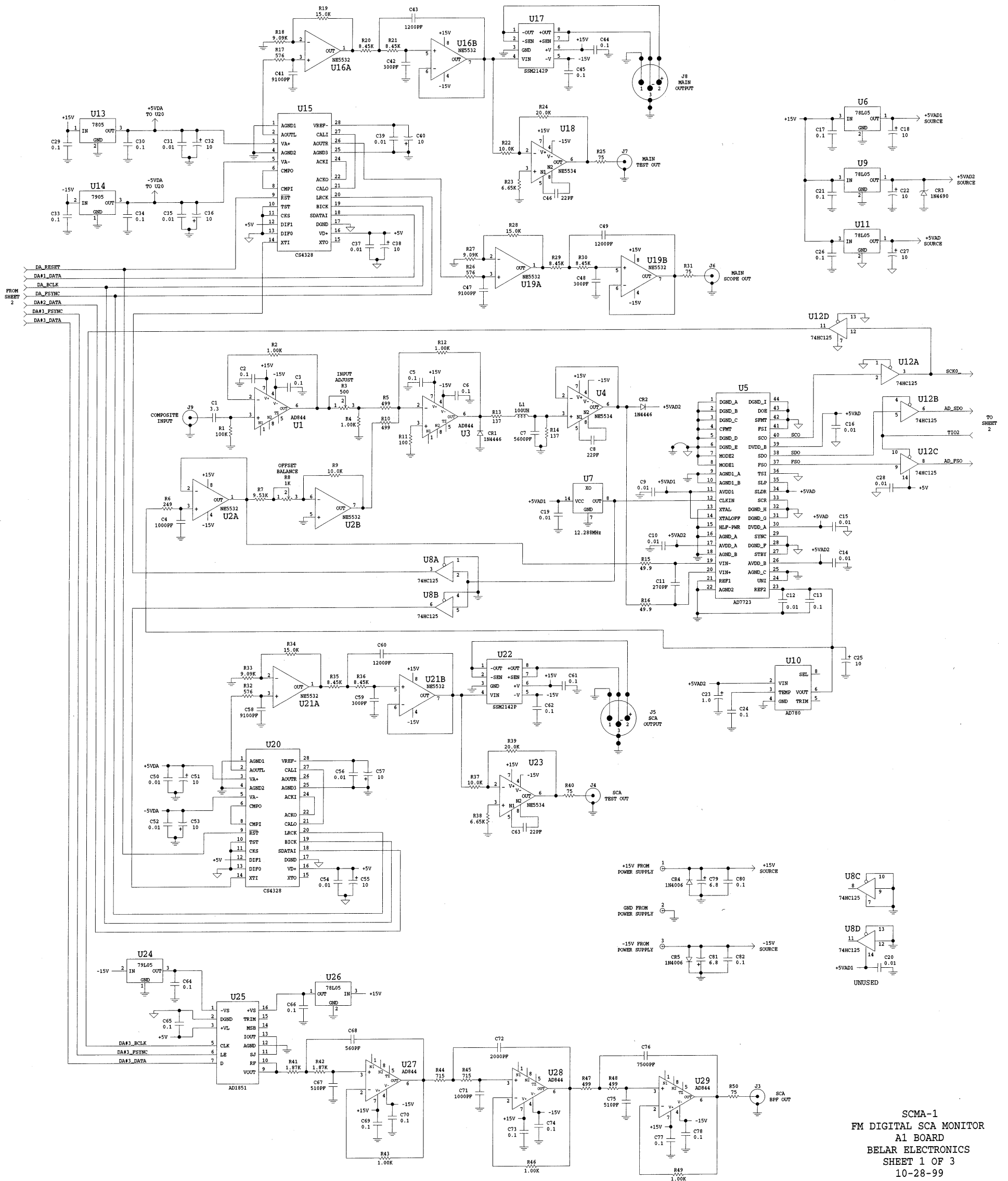
SCMA-1 PARTS LISTS

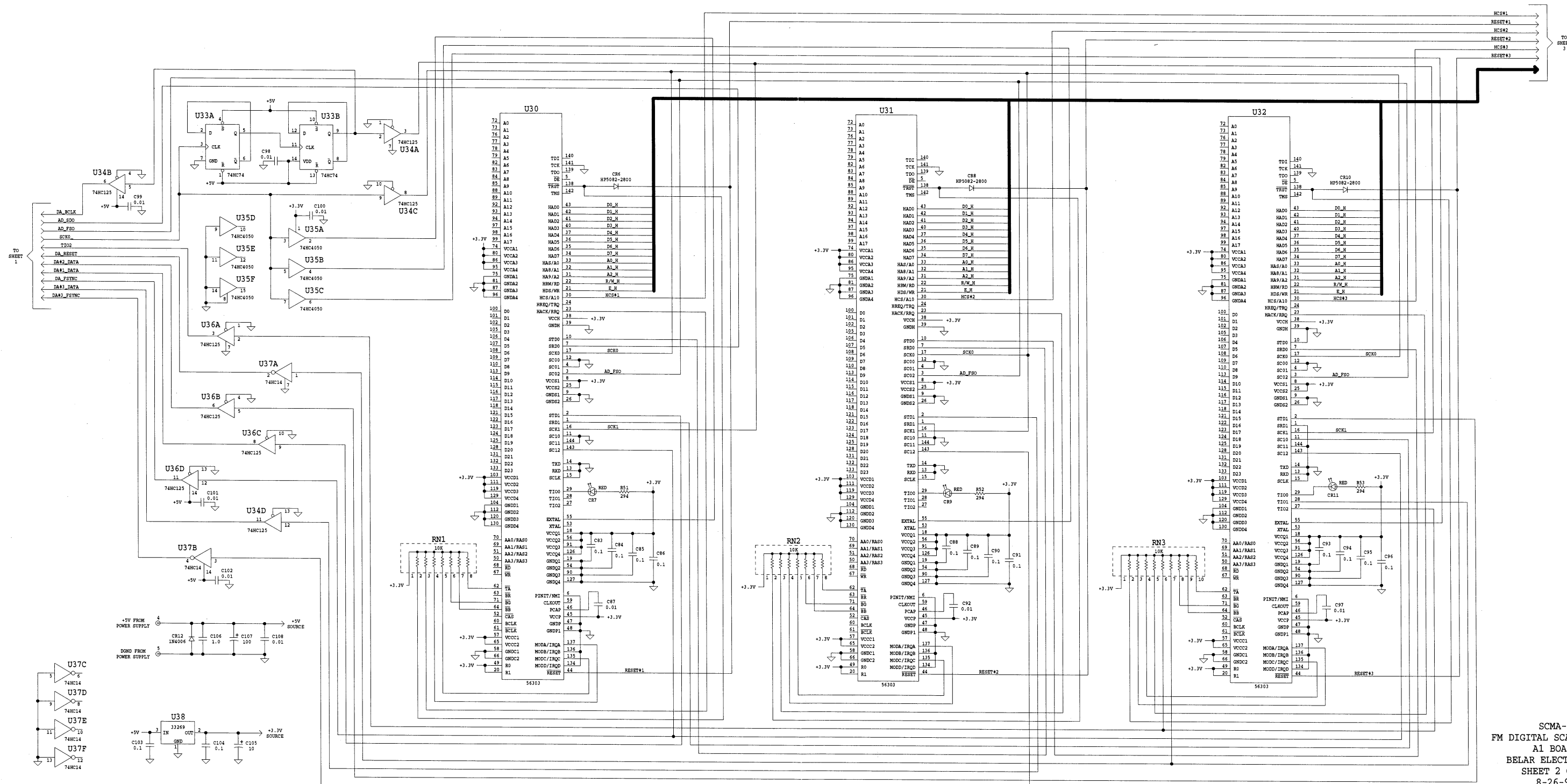
MAIN CHASSIS

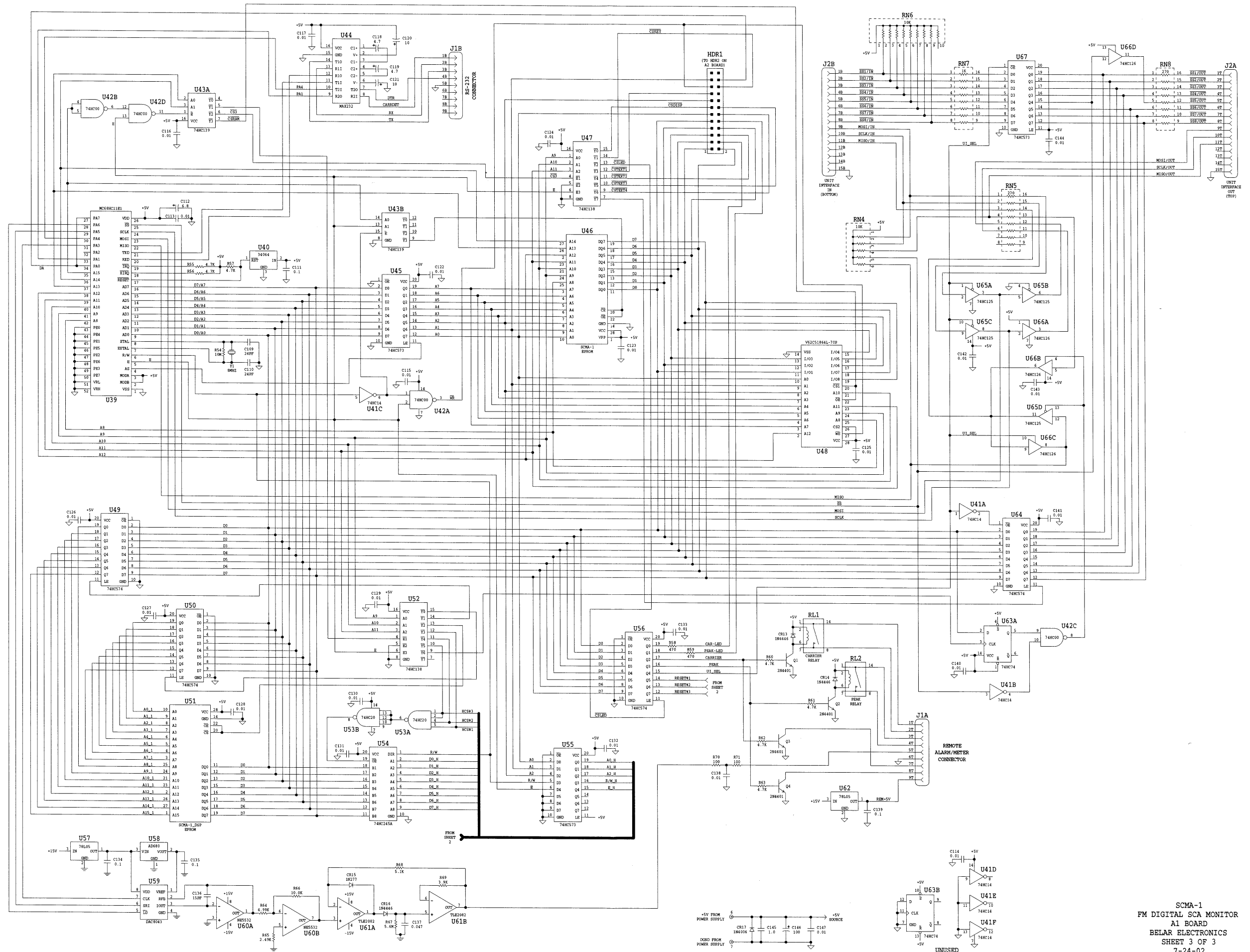
Reference Designation	Description	Part Number
A3	POWER SUPPLY MODULE: 30W	4005-0020A
--	POWER ENTRY MODULE: 6EGG1-1	0360-0021
F1	FUSE: GMA-3A 250V(UL/CSA) or T3.15A-250V(IEC)	2110-0009
--	FUSE HOLDER: CHASSIS MOUNT	2110-0010
F2	FUSE: AGC-2A 250V	2110-0006
--	FLAT CABLE ASSEMBLY: 24 CONDUCTOR	8900-0019
--	LINE CORD (115 Vac line voltage)	8120-0002
--	LINE CORD (230 Vac line voltage)	8120-0004

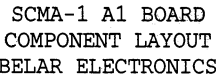


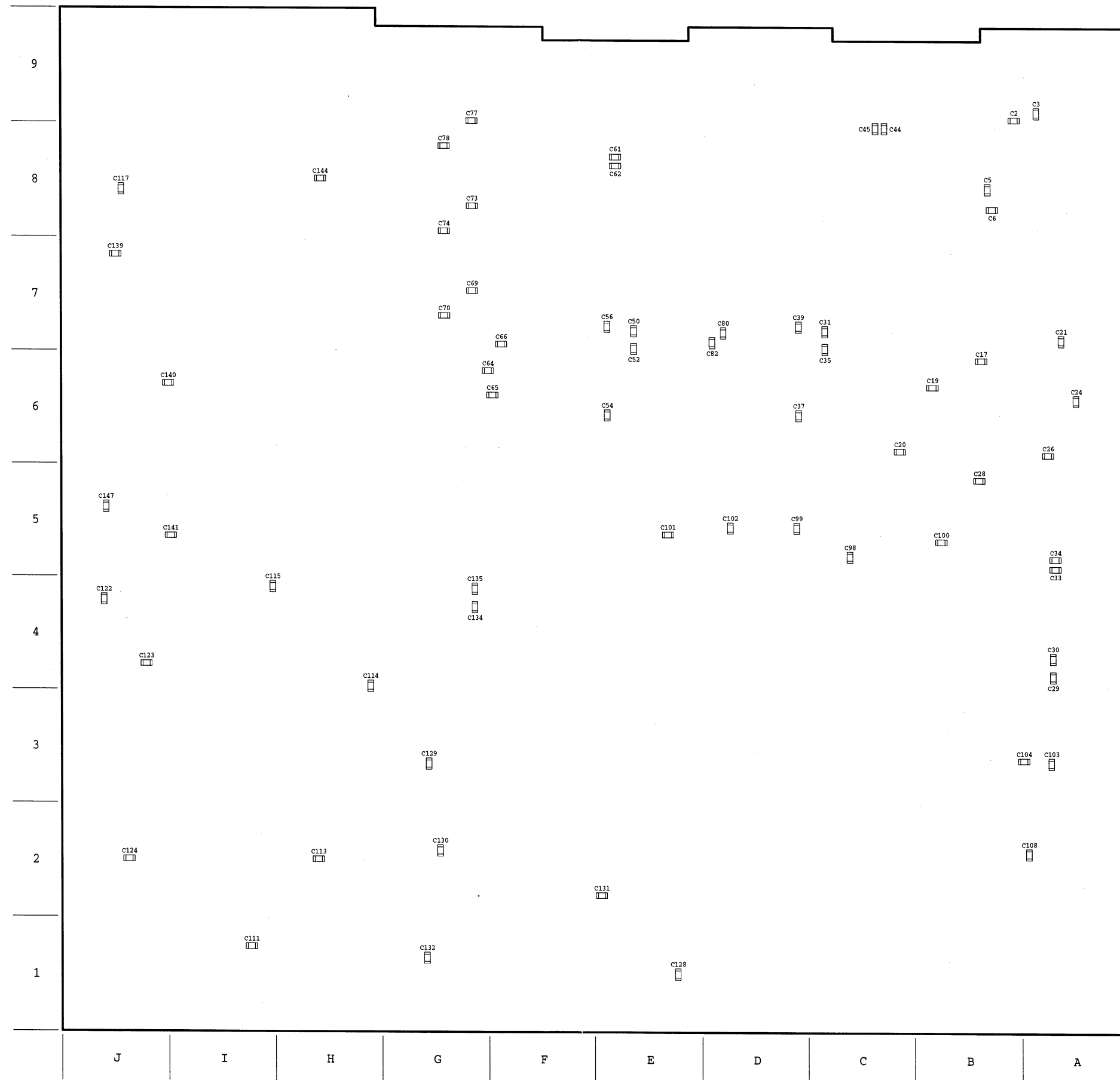
SCMA-1
FM DIGITAL
SCA MONITOR
CHASSIS WIRING
BELAR ELECTRONICS
8-26-98











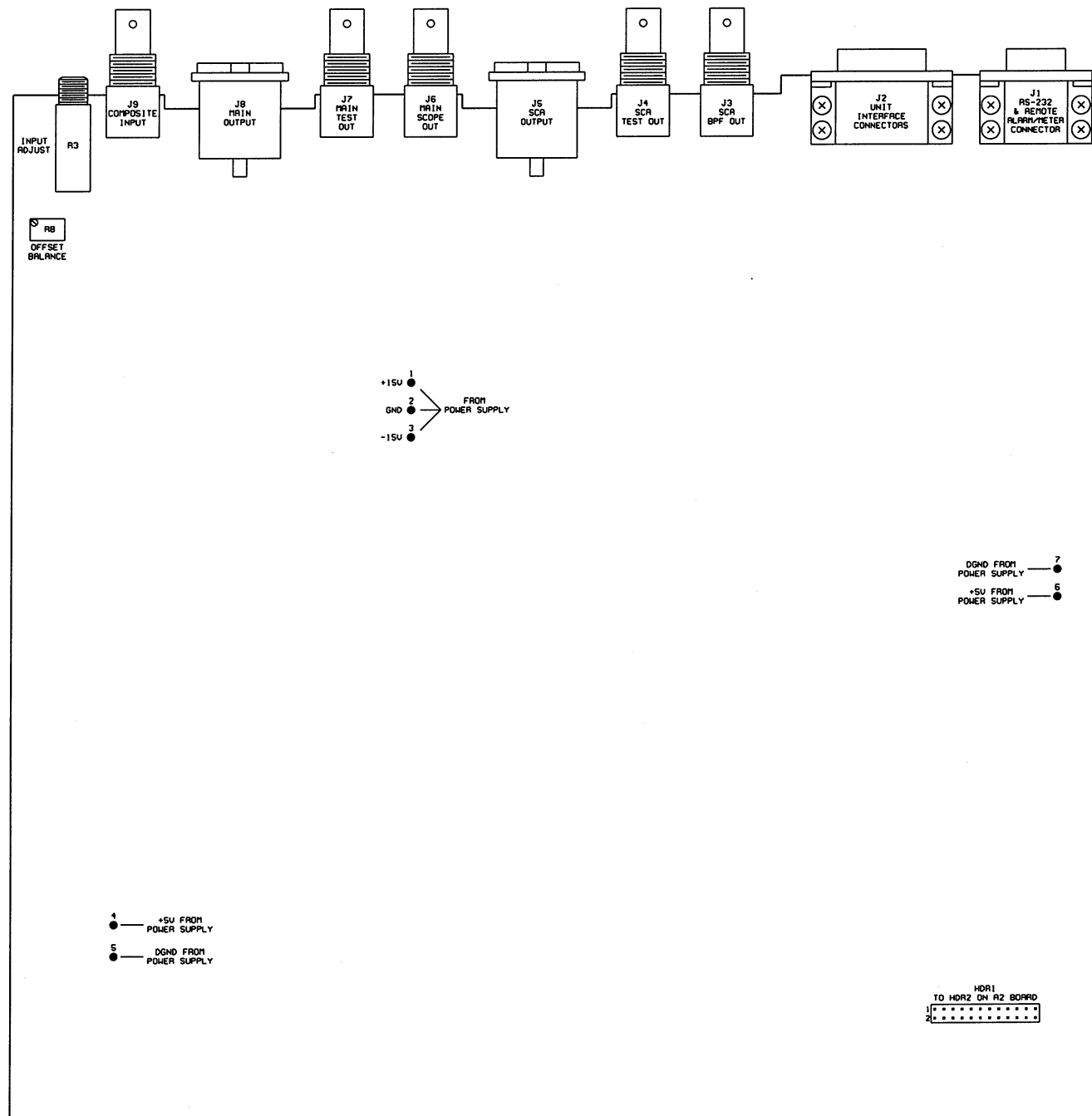
SCMA-1 A1 BOARD
PART LOCATIONS

<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>
C1	B9	C40	D7	C79	E7	C118	J8	CR9	C3	R11	A8
C2	B9*	C41	C7	C80	D7*	C119	J8	CR10	F3	R12	B8
C3	A9*	C42	C8	C81	E7	C120	J8	CR11	E3	R13	B8
C4	A8	C43	C8	C82	D7*	C121	J9	CR12	B2	R14	B7
C5	B8*	C44	C8*	C83	B4	C122	J4*	CR13	H6	R15	B7
C6	B8*	C45	C8*	C84	B3	C123	J4*	CR14	I6	R16	B7
C7	B8	C46	D8	C85	C4	C124	J2*	CR15	F5	R17	C7
C8	B7	C47	D7	C86	B4	C125	J3	CR16	G6	R18	C7
C9	B6	C48	D7	C87	B3	C126	C1	CR17	J5	R19	C7
C10	B6	C49	E8	C88	C4	C127	D1			R20	C8
C11	B6	C50	E7*	C89	D3	C128	E1*	HDR1	I1	R21	C8
C12	A6	C51	E7	C90	D4	C129	G3*			R22	C8
C13	A6	C52	E7*	C91	D4	C130	G2*	J1	J9	R23	C8
C14	A6	C53	E7	C92	D3	C131	E2*	J2	H9	R24	C8
C15	A6	C54	E6*	C93	E4	C132	G1*	J3	G9	R25	C8
C16	B6	C55	F6	C94	E3	C133	I5	J4	F9	R26	D8
C17	B6*	C56	E7*	C95	F4	C134	G4*	J5	E9	R27	D8
C18	B6	C57	F7	C96	E4	C135	G4*	J6	D9	R28	D8
C19	B6*	C58	F7	C97	E3	C136	F5	J7	D9	R29	D8
C20	C6*	C59	F8	C98	C5*	C137	G5	J8	C9	R30	D8
C21	A7*	C60	E8	C99	D5*	C138	J6	J9	B9	R31	D9
C22	A6	C61	E8*	C100	B5*	C139	J7*			R32	E7
C23	A6	C62	E8*	C101	E5*	C140	I6*	L1	B8	R33	E7
C24	A6*	C63	F8	C102	D5*	C141	I5*			R34	E7
C25	A6	C64	F6*	C103	A3*	C142	H8	Q1	H6	R35	E8
C26	A6*	C65	F6*	C104	A3*	C143	I9	Q2	I6	R36	E8
C27	A6	C66	F7*	C105	A3	C144	H8*	Q3	J7	R37	E8
C28	B5*	C67	G7	C106	B2	C145	J5	Q4	J7	R38	F8
C29	A4*	C68	F7	C107	B2	C146	J5			R39	F8
C30	A4*	C69	G7*	C108	A2*	C147	J5*	R1	A9	R40	F9
C31	C7*	C70	G7*	C109	H1			R2	B9	R41	G7
C32	C7	C71	G7	C110	H1	CR1	B8	R3	A9	R42	G7
C33	A5*	C72	F8	C111	I1*	CR2	B7	R4	A9	R43	G7
C34	A5*	C73	G8*	C112	H2	CR3	A6	R5	A8	R44	G7
C35	C7*	C74	G8*	C113	H2*	CR4	D7	R6	A7	R45	G8
C36	C7	C75	G8	C114	H4*	CR5	D7	R7	A8	R46	G8
C37	D6*	C76	F9	C115	I4*	CR6	C3	R8	A8	R47	G8
C38	D6	C77	G9*	C116	I3	CR7	B3	R9	A8	R48	G8
C39	D7*	C78	G8*	C117	J8*	CR8	D3	R10	A8	R49	G9

*note: these locations are on bottom of pc board.

SCMA-1 A1 BOARD
PART LOCATIONS
cont.

<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>
R50 G9	U6 B7	U46 I4
R51 B4	U7 B6	U47 J2
R52 C4	U8 B6	U48 I3
R53 E4	U9 A7	U49 C1
R54 H1	U10 A6	U50 D1
R55 I1	U11 A6	U51 D1
R56 I1	U12 B5	U52 G3
R57 H1	U13 A4	U53 G2
R58 J1	U14 A5	U54 E2
R59 J1	U15 C6	U55 G1
R60 I6	U16 C8	U56 J5
R61 I6	U17 C8	U57 G4
R62 J6	U18 C8	U58 G4
R63 J6	U19 D8	U59 F4
R64 F5	U20 E6	U60 G5
R65 G5	U21 E8	U61 G5
R66 G5	U22 E8	U62 J7
R67 G5	U23 F8	U63 I6
R68 F5	U24 F6	U64 I5
R69 G6	U25 G6	U65 I8
R70 J6	U26 F7	U66 I8
R71 J7	U27 G7	U67 H8
	U28 G8	
RL1 H6	U29 G9	Y1 H1
RL2 I6	U30 B4	
	U31 D4	<u>pins</u>
RN1 C4	U32 E4	1 D7
RN2 E4	U33 C5	2 D7
RN3 F4	U34 D5	3 D6
RN4 I7	U35 B5	4 A2
RN5 I7	U36 E5	5 A2
RN6 H7	U37 D5	6 J5
RN7 H8	U38 A3	7 J5
RN8 H9	U39 H2	
	U40 I1	
U1 B9	U41 H4	
U2 A8	U42 I4	
U3 B8	U43 I3	
U4 B7	U44 J8	
U5 B6	U45 J4	



SCMA-1 A1 BOARD
CONNECTIONS & ADJUSTMENTS
BELAR ELECTRONICS

A1 BOARD SCMA-1

Reference Designation	Description	Part Number
C1	C: FIXED CERAMIC 3.3uF 50V	0151-0011
C2, C3	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C4	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C5, C6	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C7	C: FIXED POLY 5600pF 2.5% 160V	0130-5622
C8	C: FIXED MICA 22pF 5%	0140-2205
C9, C10	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C11	C: FIXED MICA 270pF 5%	0140-2715
C12	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C13	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C14 thru C16	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C17	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C18	C: FIXED TANT 10uF 16V	0185-0007
C19, C20	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C21	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C22	C: FIXED TANT 10uF 16V	0185-0007
C23	C: FIXED TANT 1.0uF 35V	0185-0006
C24	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C25	C: FIXED TANT 10uF 16V	0185-0007
C26	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C27	C: FIXED TANT 10uF 16V	0185-0007
C28	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C29, C30	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C31	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C32	C: FIXED TANT 10uF 16V	0185-0007
C33, C34	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C35	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C36	C: FIXED TANT 10uF 16V	0185-0007
C37	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C38	C: FIXED TANT 10uF 16V	0185-0007
C39	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C40	C: FIXED TANT 10uF 16V	0185-0007
C41	C: FIXED POLY 9100pF 2.5% 160V	0130-9122
C42	C: FIXED POLY 300pF 2.5% 160V	0130-3012
C43	C: FIXED POLY 1200pF 2.5% 160V	0130-1222
C44, C45	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C46	C: FIXED MICA 22pF 5%	0140-2205
C47	C: FIXED POLY 9100pF 2.5% 160V	0130-9122
C48	C: FIXED POLY 300pF 2.5% 160V	0130-3012
C49	C: FIXED POLY 1200pF 2.5% 160V	0130-1222
C50	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C51	C: FIXED TANT 10uF 16V	0185-0007
C52	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C53	C: FIXED TANT 10uF 16V	0185-0007
C54	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C55	C: FIXED TANT 10uF 16V	0185-0007
C56	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C57	C: FIXED TANT 10uF 16V	0185-0007
C58	C: FIXED POLY 9100pF 2.5% 160V	0130-9122
C59	C: FIXED POLY 300pF 2.5% 160V	0130-3012
C60	C: FIXED POLY 1200pF 2.5% 160V	0130-1222

A1 BOARD SCMA-1 cont.

Reference Designation	Description	Part Number
C61,C62	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C63	C: FIXED MICA 22pF 5%	0140-2205
C64 thru C66	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C67	C: FIXED POLY 510pF 2.5% 160V	0130-5112
C68	C: FIXED POLY 560pF 2.5% 160V	0130-5612
C69,C70	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C71	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C72	C: FIXED POLY 2000pF 2.5% 160V	0130-2022
C73,C74	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C75	C: FIXED POLY 510pF 2.5% 160V	0130-5112
C76	C: FIXED POLY 7500pF 2.5% 160V	0130-7522
C77,C78	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C79	C: FIXED TANT 6.8uF 25V	0185-0002
C80	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C81	C: FIXED TANT 6.8uF 25V	0185-0002
C82 thru C86	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C87	C: FIXED FILM 0.01uF 10% 100V	0122-1031
C88 thru C91	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C92	C: FIXED FILM 0.01uF 10% 100V	0122-1031
C93 thru C96	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C97	C: FIXED FILM 0.01uF 10% 100V	0122-1031
C98 thru C102	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C103,C104	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C105	C: FIXED TANT 10uF 16V	0185-0007
C106	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C107	C: FIXED TANT 100uF 6.3V	0185-0010
C108	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C109,C110	C: FIXED MICA 24pF 5%	0140-2405
C111	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C112	C: FIXED TANT 6.8uF 25V	0185-0002
C113 thru C117	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C118,C119	C: FIXED TANT 4.7uF 10V	0185-0001
C120,C121	C: FIXED TANT 10uF 16V	0185-0007
C122 thru C133	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C134,C135	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C136	C: FIXED MICA 15pF 5%	0140-1505
C137	C: FIXED FILM 0.047uF 10% 100V	0122-4731
C138	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C139	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C140 thru C144	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C145	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C146	C: FIXED TANT 100uF 6.3V	0185-0010
C147	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
CR1,CR2	DIODE: 1N4446	1900-0002
CR3	DIODE: 1N4690	1900-0031
CR4,CR5	DIODE: 1N4006	1900-0016
CR6	DIODE: HP5082-2800	1900-0026
CR7	LED: RED T-1	1910-0004
CR8	DIODE: HP5082-2800	1900-0026
CR9	LED: RED T-1	1910-0004

A1 BOARD SCMA-1 cont.

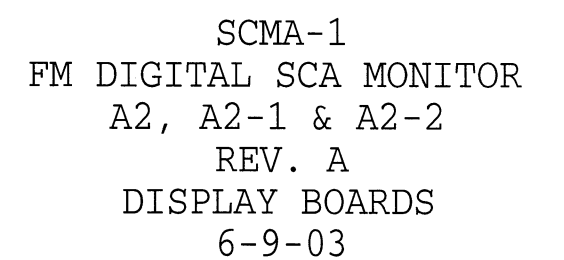
Reference Designation	Description	Part Number
CR10	DIODE: HP5082-2800	1900-0026
CR11	LED: RED T-1	1910-0004
CR12	DIODE: 1N4006	1900-0016
CR13, CR14	DIODE: 1N4446	1900-0002
CR15	DIODE: 1N277 GERMANIUM	1900-0001
CR16	DIODE: 1N4446	1900-0002
CR17	DIODE: 1N4006	1900-0016
HDR1	HEADER: 24 PIN	0361-0024
J1	CONNECTOR: "D" DUAL 9 PIN	0360-0034
J2	CONNECTOR: "D" DUAL 15 PIN	0360-0033
J3, J4	CONNECTOR: BNC PC MOUNT	0360-0014
J5	CONNECTOR: "XLR" MALE	0360-0046
J6, J7	CONNECTOR: BNC PC MOUNT	0360-0014
J8	CONNECTOR: "XLR" MALE	0360-0046
J9	CONNECTOR: BNC PC MOUNT	0360-0014
L1	CHOKES: 100uH	9141-0020
Q1 thru Q4	TRANSISTOR: 2N4401	1850-0028
R1	R: METAL FILM 100k 1%	0721-1003
R2	R: METAL FILM 1.00k 1%	0721-1001
R3	R: VAR COMP 500, 10 TURN	2100-0028
R4	R: METAL FILM 1.00k 1%	0721-1001
R5	R: METAL FILM 499 1%	0721-4990
R6	R: METAL FILM 249 1%	0721-2490
R7	R: METAL FILM 9.53k 1%	0721-9531
R8	R: VAR COMP 1k, 10 TURN	2100-0021
R9	R: METAL FILM 10.0k 1%	0721-1002
R10	R: METAL FILM 499 1%	0721-4990
R11	R: METAL FILM 100 2% 1/4W	0751-1012
R12	R: METAL FILM 1.00k 1%	0721-1001
R13, R14	R: METAL FILM 137 1%	0721-1370
R15, R16	R: METAL FILM 49.9 1%	0721-49R9
R17	R: METAL FILM 576 1%	0721-5760
R18	R: METAL FILM 9.09k 1%	0721-9091
R19	R: METAL FILM 15.0k 1%	0721-1502
R20, R21	R: METAL FILM 8.45k 1%	0721-8451
R22	R: METAL FILM 10.0k 1%	0721-1002
R23	R: METAL FILM 6.65k 1%	0721-6651
R24	R: METAL FILM 20.0k 1%	0721-2002
R25	R: METAL FILM 75 2% 1/4W	0751-7502
R26	R: METAL FILM 576 1%	0721-5760
R27	R: METAL FILM 9.09k 1%	0721-9091
R28	R: METAL FILM 15.0k 1%	0721-1502
R29, R30	R: METAL FILM 8.45k 1%	0721-8451
R31	R: METAL FILM 75 2% 1/4W	0751-7502
R32	R: METAL FILM 576 1%	0721-5760
R33	R: METAL FILM 9.09k 1%	0721-9091

A1 BOARD SCMA-1 cont.

Reference Designation	Description	Part Number
R34	R: METAL FILM 15.0k 1%	0721-1502
R35,R36	R: METAL FILM 8.45k 1%	0721-8451
R37	R: METAL FILM 10.0k 1%	0721-1002
R38	R: METAL FILM 6.65k 1%	0721-6651
R39	R: METAL FILM 20.0k 1%	0721-2002
R40	R: METAL FILM 75 2% 1/4W	0751-7502
R41,R42	R: METAL FILM 1.87k 1%	0721-1871
R43	R: METAL FILM 1.00k 1%	0721-1001
R44,R45	R: METAL FILM 715 1%	0721-7150
R46	R: METAL FILM 1.00k 1%	0721-1001
R47,R48	R: METAL FILM 499 1%	0721-4990
R49	R: METAL FILM 1.00k 1%	0721-1001
R50	R: METAL FILM 75 2% 1/4W	0751-7502
R51 thru R53	R: METAL FILM 294 1%	0721-2940
R54	R: FIXED CARBON 10M 5% 1/4W	0683-1065
R55 thru R57	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R58,R59	R: METAL FILM 470 2% 1/4W	0751-4712
R60 thru R63	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R64	R: METAL FILM 4.99k 1%	0721-4991
R65	R: METAL FILM 2.49k 1%	0721-2491
R66	R: METAL FILM 10.0k 1%	0721-1002
R67	R: FIXED CARBON 5.6M 5% 1/4W	0683-5655
R68	R: METAL FILM 5.1k 2% 1/4W	0751-5122
R69	R: METAL FILM 3.9k 2% 1/4W	0751-3922
R70,R71	R: METAL FILM 100 2% 1/4W	0751-1012
RL1,RL2	RELAY: JWD-107-1 (or HE721A6341)	1600-0007
RN1,RN2	R: NETWORK 8 PIN 10k	0908-1032
RN3	R: NETWORK 10 PIN 10k	0910-1032
RN4	R: NETWORK 6 PIN 10k	0906-1032
RN5	R: NETWORK 16 PIN DIP 270	0908-2712
RN6	R: NETWORK 10 PIN 10k	0910-1032
RN7	R: NETWORK 16 PIN DIP 1k	0908-1022
RN8	R: NETWORK 16 PIN DIP 270	0908-2712
U1	IC: AD844A	1826-0052
U2	IC: NE5532	1826-0037
U3	IC: AD844A	1826-0052
U4	IC: NE5534	1826-0025
U5	IC: AD7723	1880-0002
U6	IC: 78L05CP	1826-0012
U7	IC: XO, 12.288 MHz	0415-1228
U8	IC: 74HC125	1822-0045
U9	IC: 78L05CP	1826-0012
U10	IC: AD780	1826-0064
U11	IC: 78L05CP	1826-0012
U12	IC: 74HC125	1822-0045
U13	IC: 7805CT	1826-0014
U14	IC: 7905CT	1826-0056
U15	IC: CS4328	1830-0004

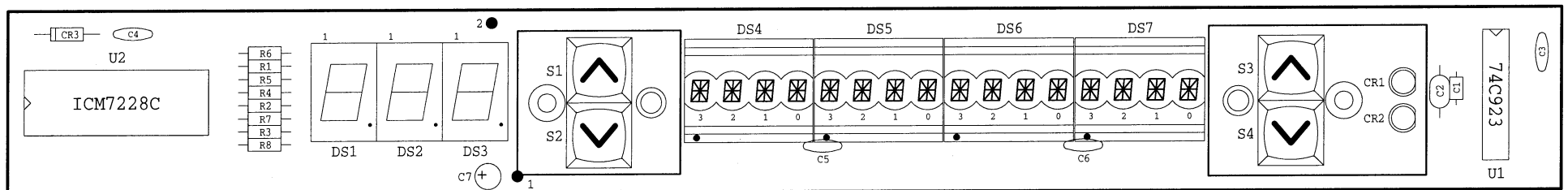
A1 BOARD SCMA-1 cont.

Reference Designation	Description	Part Number
U16	IC: NE5532	1826-0037
U17	IC: SSM2142P	1827-0005
U18	IC: NE5534	1826-0025
U19	IC: NE5532	1826-0037
U20	IC: CS4328	1830-0004
U21	IC: NE5532	1826-0037
U22	IC: SSM2142P	1827-0005
U23	IC: NE5534	1826-0025
U24	IC: 79L05CP	1826-0017
U25	IC: AD1851	1827-0012
U26	IC: 78L05CP	1826-0012
U27 thru U29	IC: AD844A	1826-0052
U30 thru U32	IC: 56303PV100	1890-0005
U33	IC: 74HC74	1822-0067
U34	IC: 74HC125	1822-0045
U35	IC: 74HC4050	1822-0079
U36	IC: 74HC125	1822-0045
U37	IC: 74HC14A	1822-0042
U38	IC: MC33269T-3.3	1826-0065
U39	IC: MC68HC11E1	1840-0010
U40	IC: MC34064	1826-0048
U41	IC: 74HC14A	1822-0042
U42	IC: 74HC00	1822-0039
U43	IC: 74HC139A	1822-0048
U44	IC: MAX232	1823-0001
U45	IC: 74HC573A	1822-0052
U46	IC: SCMA-1 EPROM	1840-0011F
U47	IC: 74HC138	1822-0047
U48	IC: V62C51864L-70P	1840-0005
U49, U50	IC: 74HC574A	1822-0053
U51	IC: SCMA-1 DSP EPROM	1840-0014A
U52	IC: 74HC138	1822-0047
U53	IC: 74HC20	1822-0060
U54	IC: 74HC245A	1822-0078
U55	IC: 74HC573A	1822-0052
U56	IC: 74HC574A	1822-0053
U57	IC: 78L05CP	1826-0012
U58	IC: AD680	1826-0051
U59	IC: DAC8043	1830-0001
U60	IC: NE5532	1826-0037
U61	IC: TLE2082	1826-0069
U62	IC: 78L05CP	1826-0012
U63	IC: 74HC74	1822-0067
U64	IC: 74HC574A	1822-0053
U65	IC: 74HC125	1822-0045
U66	IC: 74HC126A	1822-0046
U67	IC: 74HC573A	1822-0052
Y1	XTAL: 8 MHz	0411-0005



6-9-03

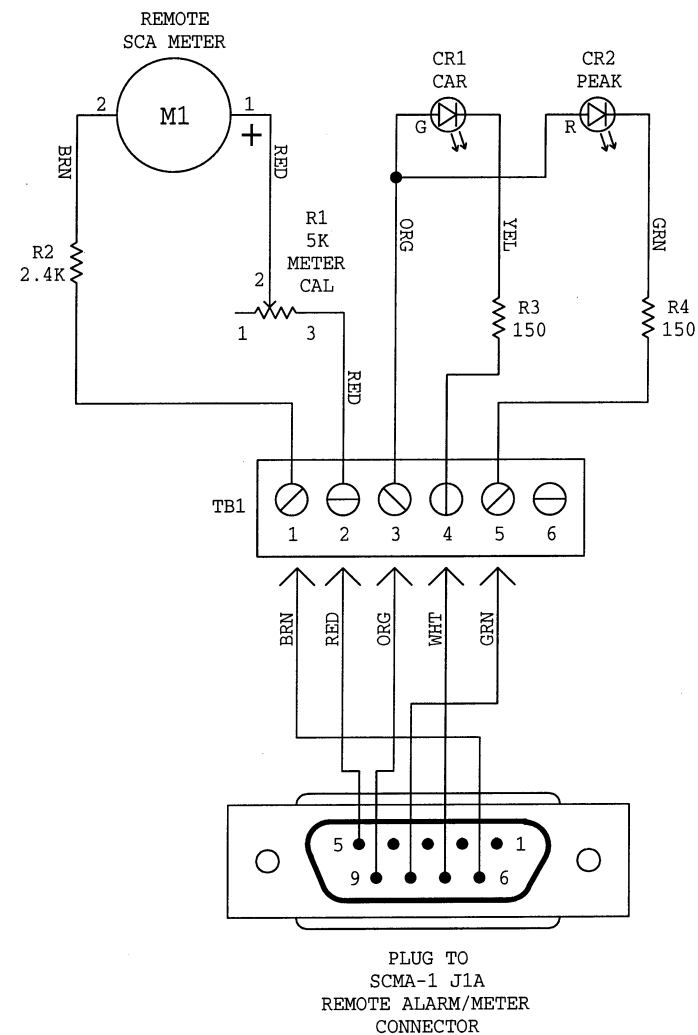
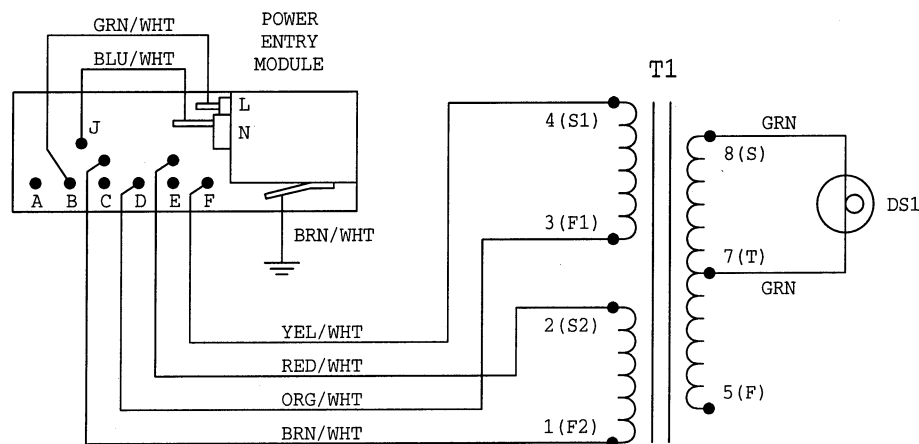
HDR2 ON REAR



SCMA-1 A2 BOARD
REV. A
COMPONENT LAYOUT
BELAR ELECTRONICS

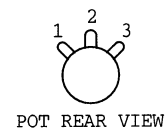
A2 BOARD SCMA-1, REV. A

Reference Designation	Description	Part Number
C1	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C2	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C3 thru C6	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C7	C: FIXED TANT 6.8uF 25V	0185-0002
CR1	LED: GREEN T1-3/4	1910-0003
CR2	LED: RED T1-3/4	1910-0001
CR3	DIODE: 1N4006	1900-0016
DS1 thru DS3	DISPLAY: HP5082-7651	1930-0007
DS4 thru DS7	DISPLAY: HPDL2416	1930-0005
DS4 thru DS7*	DISPLAY: HDLO-2416	1930-0008
(prior to rev. A, DS4 thru DS7 were the HPDL2416 display, Belar P/N 1930-0005. These parts are not interchangeable.)		
HDR2	HEADER: 24 PIN	0361-0024
R1 thru R8	R: METAL FILM 51 2% 1/4W	0751-5102
S1 thru S4	SWITCH: PUSHBUTTON, MOMENTARY (ON A2-1 & A2-2 BOARDS)	3105-0001
U1	IC: 74C923	1823-0006
U2	IC: ICM7228C	1823-0002



MP-16 NOTES:

1. SEE THE MP-16 PARTS LIST SHEET FOR THE LINE VOLTAGE SELECTION PROCEDURE.
2. TO CALIBRATE: TURN ON THE SCMA-1 CALIBRATOR. NOTE THE READING ON THE SCMA-1 MODULATION DISPLAY. ADJUST POTENTIOMETER R1 ON THE REAR OF THE MP-16 SO THAT THE REMOTE MODULATION METER READS THE SAME PERCENTAGE.
3. EACH REMOTE LED IS DRIVEN BY AN OPEN COLLECTOR CIRCUIT IN THE MONITOR WHICH GOES LOW WHEN THE MONITOR LED'S ARE ACTIVATED.



MP-16
SCMA-1 REMOTE METER PANEL
BELAR ELECTRONICS
6-9-99

MP-16 PARTS LIST

Reference Designation	Description	Part Number
CR1	LED: GREEN T1-3/4	1910-0003
CR2	LED: RED T1-3/4	1910-0001
DS1	LAMP: 755	2140-0005
--	SOCKET: LAMP	1450-0012
--	POWER ENTRY MODULE: 6J4	0360-0020
F1	FUSE: AGC 1/4A 250V	2110-0002
M1	METER: MOD 0-133%	1120-0012
R1	R: VAR COMP 5K	2100-0008
R2	R: METAL FILM 2.4k 2% 1/2W	0771-2422
R3,R4	R: METAL FILM 150 2% 1/2W	0771-1512
T1	TRANSFORMER: DP 241-4-10	9100-0024
TB1	TERMINAL BLOCK: 6 SCREW	0360-0003
--	LINE CORD (115 Vac line voltage)	8120-0002
--	LINE CORD (230 Vac line voltage)	8120-0004

MP-16 LINE VOLTAGE SELECTION PROCEDURE

1. Unplug line cord.
2. Open fuse compartment door.
3. Move fuse pull lever to left to remove fuse. Leave fuse pull lever in the leftmost position.
4. Using needle nose pliers, pull the voltage select board straight out of the power entry module.
5. While facing the rear of the unit, orient the voltage select board so the desired line voltage is up and reads correctly ("120" for 115Vac operation, "240" for 230Vac operation).
Note: The "100" and "220" positions on the opposite side of the board are not used.
6. Plug the voltage select board into the power entry module.
7. Install the fuse (F1).
8. Close fuse compartment door.
9. Plug line cord in.