

**BEFORE PROCEEDING WITH COMPLETE UNPACKING AND SETUP,
CONSULT UNPACKING AND INSPECTION INSTRUCTIONS ON PAGE 4**

**model 201
DISPLAY INTERFACE MAINFRAME**



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SECTION I

INTRODUCTION



FIGURE 1. MODEL 201 MAINFRAME FRONT PANEL.
(With Model 2010 Plug-in Inserted.)

1.1 DESCRIPTION.

The Model 201 is a mainframe designed to accept all UREI 2000-Series plug-in modules. The unit interfaces readily with most X-Y displays, with storage or long persistence oscilloscopes, recorders or plotters, and has many applications in the laboratory, for production testing and in audio equipment maintenance.

The 201 adds a new dimension of flexibility to those users who may not need the hard-copy capability of the UREI 200 X-Y Recorder, or who already own a DC-coupled plotter with which to use the 2000-Series plug-ins.

Modules are interchangeable in moments, and the convenience of front-panel controls is maintained. Measurements performed with any of the 2000-Series plug-in modules may be continuously viewed on the user's oscilloscope; then a hard-copy plot may be made on his X-Y recorder of only that data of which a permanent record is appropriate.

In addition to conventional X- and Y-axis DC outputs, the Model 201 provides a reversible polarity Z-axis output for retrace blanking of oscilloscopes, or recorder pen-lift information.

All outputs are buffered through isolation amplifiers. The characteristics, precision and accuracy of the plugged-in 2000-Series modules are fully preserved, and its rugged construction protects the modules from rough environments. Output levels are easily calibrated to most display devices through recessed front-panel screwdriver adjustments, and the output amplifiers are immune to severe capacitive loading or long interconnecting lines. The internal power supply is fully regulated and conservatively rated to perform under adverse AC mains conditions.

1.2 SPECIFICATIONS.

ELECTRICAL:

INPUT: To accept any plug-in module of the UREI 2000 Series.

ACCESSORY INPUT: RCA jack at rear of chassis.

OUTPUT CONNECTORS: BNC (3).

OUTPUTS: DC (3; X Y Z) buffered with amplifiers for isolation and continuous short circuit protection.

OUTPUT IMPEDANCE: 100 ohms resistive, insensitive to capacitive loading.

OUTPUT LEVEL: X-axis, 0 V to +10 V, $\pm 10\%$
Y-axis, 0 V to ± 10 V, $\pm 10\%$
Z-axis, 0 V to +10 V, $\pm 10\%$
(Z axis sense reversible).

POWER REQUIREMENTS: 100 - 125 VAC or 200 - 250 VAC, 50/60 Hz;
Less than 10 W (with any plug-in module).

ENVIRONMENT: Operating, 0°C to +50°C; if not otherwise specified for the plug-in module;
Storage, -20°C to +60°C.

CONTROLS: Recessed potentiometers for individual level calibration adjustments;
Logic sense selector switch for Z-axis, power OFF-ON.

PHYSICAL:

DIMENSIONS: 272 mm x 214 mm; depth behind panel 221 mm
(10.7 x 9.5 x 8.7 inches).

WEIGHT: 5.0 kg (11 pounds).

SHIPPING WEIGHT: 5.9 kg (13 pounds).

FINISH: Front panel -- aluminum, with light gray
baked enamel, to match 2000 plug-ins.
Housing -- aluminum, with dark gray, scuff-
resistant baked enamel.

1.3 ACCESSORIES.

Audio Frequency Graph Paper; UREI order number: 200 G.

NOTE: Similar paper is available from Keuffel and Esser,
order number: 46 6882.

Metric paper for use on the X-Y recorder has the following
specification:

"Logarithmic frequency paper for Audio Conception,"
according to DIN 45 408, Number 666 356, 437-1/2.
UREI order number 200 M.

Rack mount front panel, 201 R (See Installation Instructions,
Section II, Paragraph 2.6.).

SECTION II

INSPECTION AND INSTALLATION

2.1 UNPACKING AND INSPECTION

Your Model 201 was carefully packed at the factory, and the container was designed to protect the unit from rough handling. Nevertheless, we recommend careful examination of the shipping carton and its contents for any sign of physical damage which could have occurred in transit.

If damage is evident, do not destroy any of the packing material or the carton, and immediately notify the carrier of a possible claim for damage. Shipping claims must be made by the consignee.

The shipment should include:

Model 201 Display Interface Mainframe

UREI Instruction Manual (this book)

Two-part Warranty Card bearing the same serial number as the Model 201.

2.2 ENVIRONMENTAL CONSIDERATIONS

The system will operate satisfactorily over a range of ambient temperatures from 0°C to +50°C (+32°F to 122°F), and up to 80% relative humidity.

If the system is installed in an equipment rack together with high heat producing equipment (such as power amplifiers), adequate ventilation should be provided to prolong the life of components. Also, while circuitry susceptible to hum pick-up is sufficiently shielded from moderate electromagnetic fields, installation should be planned to avoid mounting the system immediately adjacent to large power transformers, motors, etc.

2.3 POWERING

The 201 may be operated from either 100-125 VAC or 200-250 VAC mains (50 or 60 Hz, single phase.) As indicated in section 2.4, the nominal line voltage may be selected with a rear panel switch. BE SURE TO VERIFY BOTH THE ACTUAL LINE VOLTAGE, AND THE SETTING OF THE VOLTAGE SELECTOR SWITCH BEFORE CONNECTING THE 201 TO THE MAINS.

To comply with most Electrical Codes, the 201 is supplied with a three-wire AC cord, the grounding pin of which is connected to the chassis. In some installations this may create ground-loop

problems. If ground problems are experienced, check for the possibility of ground loops by using a 3-prong to 2-prong AC adapter. This ungrounds the Model 201, and will sometimes cure the problem, but is not a substitute for proper grounding. Be aware that unless the Model 201 mainframe is properly grounded, a safety hazard can exist. UREI accepts no responsibility for legal actions or for direct, incidental or consequential damages that may result from violation of any electrical codes.

2.4 LINE VOLTAGE SWITCH

Unless a tag on the line cord specifies otherwise, the Model 201 was shipped ready for operation with nominal 115 VAC power mains. In order to change this for nominal 230 V (50 or 60 Hz), slide the VOLTAGE SELECTOR switch on the rear panel to the 230 position. The voltage is visible in a window next to the switch slot. Be sure to change the fuse to the correct value: 1/8-amp slo-blo when changing to 230 V operation or 1/4-amp slo-blo for 115 V operation. A small screwdriver should be used to move the recessed switch.

2.5 EXTERNAL CONNECTIONS

The BNC connectors for the X-channel, Y-channel and Z-channel (pen lift or retrace blanking) are located on the Model 201's front panel. They should be connected through good quality cables to the display device input. Using "T"-type adapters enables the user to connect two devices, for example an X-Y recorder and a storage oscilloscope, simultaneously.

All UREI 2000-Series plug-in modules will fit into the right-hand opening of the 201 Mainframe. The edge connectors provide the necessary power to the plug-in and accept the output signals for further processing.

An additional RCA-type "Accessory Input" is on the rear panel of the Model 201. Its function is to provide an input for external signals to certain plug-in modules, for example the Warble Tone from the Model 20 to the Model 2000 Frequency Response Module.

2.6 RACK MOUNTING ACCESSORY

The 201 Display Interface Mainframe may be mounted with a larger size front panel in a standard 19-inch rack. After removing the four rubber feet under the chassis, the housing can be pushed backward far enough to be flush with the inside chassis' front surface. Additional holes in the bottom of the housing are provided to re-mount the rubber feet.

The regular-size light gray front panel should be replaced by the larger-size front panel, 201 R. It is necessary to remove the six black button-head screws (Allen 6 x 32) and replace them securely after the front panels have been exchanged.

SECTION III

OPERATING INSTRUCTIONS

With 2000 or 2010 Modules

3.1 GENERAL

It is suggested that the user read the appropriate instruction manual for the plug-in module to be operated in the Model 201 Display Interface Mainframe. The plug-in may never be inserted or pulled out of the mainframe while the power switch is ON.

The calibration procedure should be performed before making any measurements, to assure that specified accuracy will be maintained. Although the Model 201 does not need a warm-up period in order to stabilize, warm-up may be necessary for the plug-in module in use. During long periods of continuous use, we recommend that the calibration points be checked occasionally.

3.2.0 CALIBRATION: USE WITH AN OSCILLOSCOPE

3.2.1 Initial Setup.

To avoid any interaction between the various instruments of the system, it is best to first calibrate the oscilloscope. No cables should be attached initially. Select a sensitivity range of 1 volt per centimeter for both the X- and Y-axis, and adjust the spot with the position controls of the scope to be over the left and center of the graticule.

CAUTION: If a bright spot on the CRT of the display device is left stationary at high intensity, it may burn the screen. Reduce intensity!

The 2000-Series plug-in modules generate calibration points for specific positions. For example, the Models 2000 and 2010 provide references for 20 Hz, 100 Hz, 1 kHz, and 10 kHz along the X-axis, and a precision $\Delta 10$ dB change for the Y-axis calibration.

3.2.2 HORIZONTAL (X-) Axis.

To calibrate the horizontal axis, connect a cable from the Model 201 "X" output to the scope input. Select the 20 Hz CAL mode of the plug-in module and align the spot over the left side of the graticule with the scope position control. Next, select the 10 kHz calibration and adjust the X-axis Level control of the Model 201 until the display appears over the ninth division of the graticule, assuming the graticule consists of ten divisions. Since the above adjustments interact slightly, they should be repeated until both points on the display are calibrated.

3.2.3 Logarithmic Frequency Scale versus Equal Division on the Display.

Most oscilloscope displays use ten equal divisions on the horizontal axis. This makes it difficult to read frequencies directly off the graticule, since the logarithmic nature of the DC voltage corresponding to frequency on the X-axis represents increments of equal percentage per division.

Several methods with differing degrees of accuracy may be utilized to facilitate frequency interpretation:

- a) The scale below provides a visual aid in reading the frequencies.



FIGURE 2. Frequency vs. Equal Division Chart.

- b) Note that for all practical purposes the divisions are at 1-octave intervals, that is, each division equals a 2:1 frequency change. Using this approximation and knowledge that 20 Hz and 20 kHz are the end points of the scale, the intermediate octave increments may be determined reasonably accurately without a logarithmic scale: 20, 40, 80, 160, 320 Hz...20.5 kHz. The above method yields a 2.5% error at 20 kHz (approximately the size of the spot).
- c) For a more accurate frequency reading we suggest the following simplified formula. It is assumed that 20 Hz is 0 and 20 kHz is position 10.

$$F = 20 \cdot (1.995262315)^n$$

(where "n" equals the screen position.)

EXAMPLE: Frequency spot is located 5.3 divisions from the left of the 20 Hz zero line.

$$F = 20 \cdot (1.995262315)^{5.3} = 778.09 \text{ Hz}$$

NOTE: If this extreme accuracy is not required, one may substitute 2 for the quantity 1.995....

- d) The above formulae were derived from the more general expression:

$$F = n_s \cdot 10^{(x_i/x_n) \cdot \log(n_f/n_s)}$$

(Where n_s = frequency at 0 scope units, = 20 Hz;

n_f = frequency at final scope unit, = 20 kHz;

x_n = number of total scope units, = 10;

x_i = incremental number of scope units.

EXAMPLE: What frequency is equivalent to the sixth division?

$$\begin{aligned} F &= 20 \cdot 10^{(6/10) \cdot \log(20 \text{ k}/20)} \\ &= 20 \cdot 10^{0.6 \cdot 3} \\ &= 20 \cdot 63.1 \\ &= 1261.91 \text{ Hz} \end{aligned}$$

- e) In other cases it may be desired to know at what position on the display a certain frequency is plotted. The following formula will give that information:

$$\text{Position} = 3.333\dots \cdot \log(f/20)$$

EXAMPLE: Where is the 1 kHz position?

$$\text{Position} = 3.333 \cdot \log(1000/20)$$

Position = 5.66... divisions from the left of the zero line.

3.2.4 VERTICAL (Y-) Axis.

To calibrate the vertical axis, connect a cable from the Model 201 "Y"-output to the scope input. Since most scopes use divisions which are either equal to (or approximately) 1 cm, we suggest the use of the metric calibration feature of the plug-in module; that is, a dB/cm sensitivity range.

With the Level control of the 201 CCW, verify that the spot is in the vertical middle of the graticule; then turn the Level control clockwise. Select the 4 dB/cm range on the plug-in module and supply approximately 1 volt AC-signal to the Receive input. Adjust the Receive Level control to align the spot once again with the middle of the vertical axis.

Depress "Δ10 dB" pushbutton and turn the "Y"-axis Level control on the Model 201 CCW until Δ10 dB causes a 2.5 division deflection. The more sensitive position of 2 dB/cm causes a change of five divisions.

NOTE: The maximum dynamic range of the modules 2000 and 2010 is approximately 60 dB, which is equivalent to an output voltage of ±3 V (Δ6 V) from the 201 Mainframe if the least sensitive range of the plug-in is selected (4 dB/cm or 10 dB/inch). Attempts to display a larger range will drive the isolation amplifiers of the Model 201 into clipping and result in erroneous readings.

3.2.5 INTENSITY MODULATION, Z-Axis.

The user is advised to consult the instruction manual for the particular display device. Some scopes require a positive voltage, others a zero voltage level at the Z-axis input to blank the trace. The Model 201 provides both levels, depending on the position of the Z-axis Polarity toggle switch.

3.3.0 CALIBRATION: USE WITH AN X-Y RECORDER

3.3.1 Initial Setup.

To avoid any interaction between various instruments in the system, it is best to first calibrate the recorder. Select an input sensitivity which enables the carriage to travel over the useful area of the graph paper. The voltage available for the horizontal axis varies from zero to +10 V, and the vertical axis output provides ±3 V for full deflection from the middle of the display area.

With no input signal applied to the recorder, adjust the zero position controls until the pen is over the left and center of the graph paper.

CAUTION: If the pen remains for an extended time in writing position on the paper, the ink will blot through the paper and stain the platen. Lift the pen!

The 2000-Series plug-in modules generate calibration points for specific positions. For example the Models 2000 and 2010 provide references for 20 Hz, 100 Hz, 1 kHz, and 10 kHz along the X-axis and a precision $\Delta 10$ dB change for the Y-axis calibration.

3.3.2 HORIZONTAL (X-) Axis.

To calibrate the horizontal axis, connect a cable from the Model 201 "X" output to the recorder input. Select the 20 Hz CAL mode of the plug-in module and align the pen over the left side of the writing area with the Zero Position control of the recorder.

Next, select the 10 kHz calibration and adjust the X-axis Level control of the Model 201 until the pen is over the 10 kHz line of the graph paper; assuming that Audio Frequency Graph Paper with a logarithmic calibration is used for the recorder.

NOTE: If linear paper is used, please calibrate the X-axis according to paragraphs 3.2.2 and 3.2.3.

Since the above adjustments interact slightly, they should be repeated until both points of the graph are calibrated. Please refer also to the appropriate section of the Instruction Manual supplied with the plug-in module in use.

3.3.3 VERTICAL (Y-) Axis.

To calibrate the vertical axis, connect a cable from the Model 201 "Y" output to the recorder input. With the Level control of the 201 CCW, verify that the pen is in the vertical middle of the graph paper. Turn the Level control clockwise. Depending on the type of graph paper used (either English or metric division) select the 10 dB/inch or 4 dB/cm range on the plug-in module. Supply approximately 1 volt AC-signal to the Receive input and adjust the Receive Level control to align the pen once again over the middle of the vertical axis.

Depress the "Δ 10 dB" pushbutton and turn the Y-axis Level control on the Model 201 CCW until Δ 10 dB causes a 1 inch or 2.5 cm deflection. The more sensitive positions of 5 dB/inch or 2 dB/cm cause a change of 2 inches or 5 cm respectively.

NOTE: The maximum dynamic range of the modules 2000 and 2010 is approximately 60 dB, which is equivalent to an output voltage of ±3 V (Δ 6 V) from the 201 Mainframe if the least sensitive range of the plug-in is selected (4 dB/cm or 10 dB/inch). Attempts to display a larger range will drive the isolation amplifiers of the Model 201 into clipping and result in erroneous readings.

3.4 PEN LIFT

The Z-axis output from the Display Interface Mainframe provides the necessary voltage to drive pen lift circuits. The Polarity switch on the front panel gives the option of activating the pen lift input with either a positive or a zero level. Source and sink capability of the Model 201 output amplifier is 10 mA. Please, check the instruction manual of the recorder in use to interface correctly. The levels provided by the 201 are 0 and +10 V.

3.5 WRITING THE GRAPH

Except for the purpose of exchanging a plug-in module, the Power switch should remain ON while working with the system. This assures constant readiness. After calibration has been performed according to the previous paragraphs, the operator may proceed to write or plot a graph.

How much interaction from the user is necessary depends on the module in the Model 201 Display Interface Mainframe, on the complexity of the device under test, and on the level of automation of the recording display unit. For later analysis and reference it is important to document as much information concerning the measurement as possible. This should include the device under test, additional test equipment used, calibration references, labeling and scaling of X- and Y-axes, environmental conditions, etc. Remember: A graph which is dated and bears the operator's signature becomes an engineering document. The same is true for a photograph taken from an oscilloscope display.

3.6 APPLICATIONS

Again, we would like to emphasize the importance of studying the appropriate sections in the instruction manuals, dedicated to the various components of the measurement system. Only then will the user be able to explore the full potential of various applications.

We at UREI appreciate your comments and experiences gained by working with the 200-System. Unusual applications which may present themselves are always of interest to us, and we appreciate the information. When submitting your data, please indicate if we are free to publish these in future application notes.

SECTION IV

THEORY OF OPERATION

4.1 GENERAL

All electronic components are on a single printed circuit board mounted to the back side of the inside chassis. A cable harness interconnects the PC board with the edge connectors and the output terminals. For details see the schematic diagram, Section VI.

4.2 AMPLIFIERS

A quad operational amplifier provides the different stages necessary to achieve additional gain and isolation of the X, Y, and Z-signals from the plug-in module. They also provide the low output impedance and protection necessary for any additional equipment connected to the output of the Model 201. Gain controls adjust the level of the output voltages for calibration purposes.

4.3 POWER SUPPLY

It was designed to provide the power for the internal circuitry and any of the 200 Series plug-in modules inserted in the Model 201 Mainframe. The regulators (VR 1 and VR 2) are short-circuit protected, and noise and ripple voltages are insignificant.

SECTION V

MAINTENANCE

5.1 GENERAL

The Model 201 Display Interface Mainframe is a ruggedly constructed unit, and is mechanically protected by its own housing. As such, the Model 201 should provide years of trouble free use with normal care. All parts are conservatively rated for their application, and workmanship meets the rigid standards you have learned to expect in UREI products.

NO SPECIAL PREVENTIVE MAINTENANCE IS REQUIRED.

5.2 REPAIRS AND WARRANTY

The instrument is factory warranted against defects in material and workmanship for one year after initial purchase. This Warranty must be activated at the time of purchase by returning the registry portion of the Warranty Card to the factory. Should a malfunction ever occur, the dealer from whom the unit was purchased will be glad to handle return for factory repair; alternately, for prompt service, ship the unit prepaid freight directly to the factory. Be sure that it is well packed in a sturdy carton, with shock-absorbing material such as foam rubber, styrofoam pellets, or "bubble-pack" completely filling the remaining space. Particular attention should be paid to protecting the protruding parts. Include a note describing the malfunction, and instructions for return. We will pay one-way return shipping costs on any in-warranty repair.

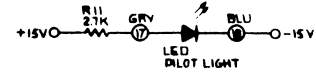
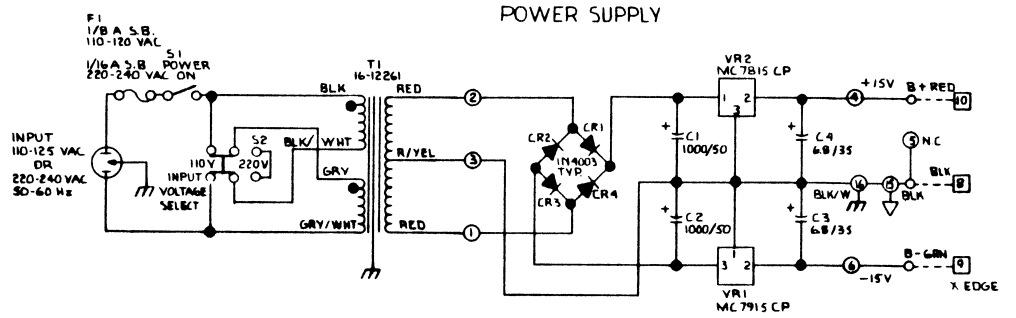
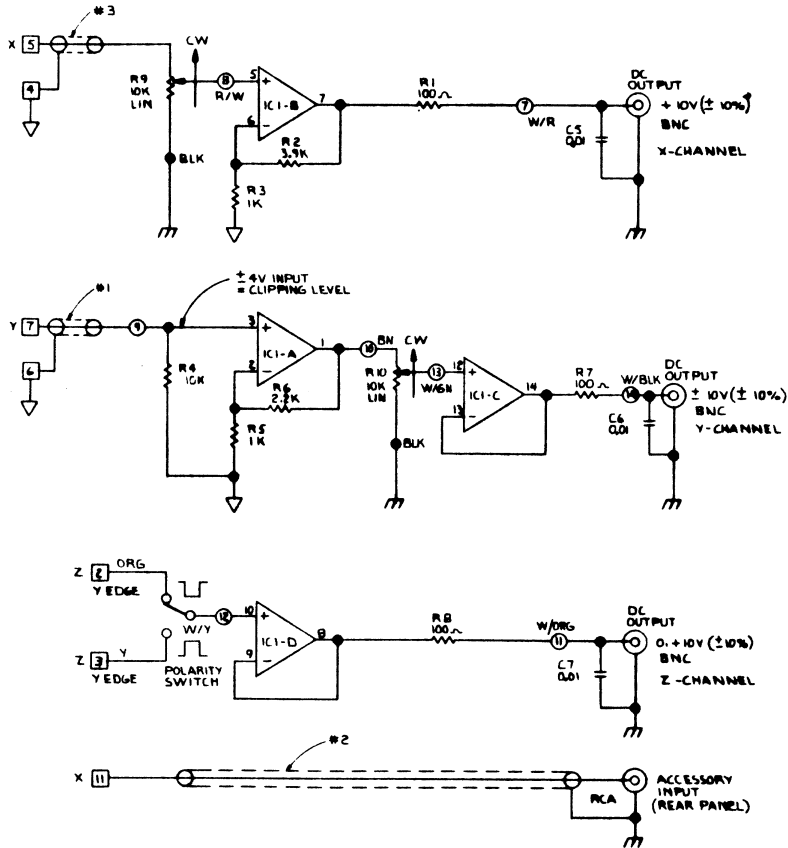
NOTE: Since the large opening in the front panel gives access to the inside, it should be covered for shipping purposes to prevent packing material from falling into the unit.

5.3 PERFORMANCE CHECKS

Every time the system is calibrated according to Section III, a complete performance check has been carried out. All necessary adjustments are accessible on the front panel, and no additional maintenance is necessary.

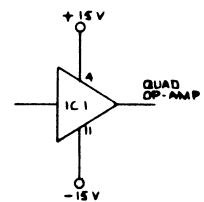
SECTION VI
SCHEMATIC DIAGRAM

| REVISIONS | | | |
|-----------|------|---|---------|
| ZONE | ITER | DESCRIPTION | DATE |
| A | | CHANGE CIRCUITRY | 1-3-78 |
| B | | ADD CAPACITOR C5, C6, C7, RESISTOR R4 WAS 100K IS 10K PER ED 0202 | 4-6-78 |
| C | | | 4-12-78 |



WIRING EDGE CONNECTOR

| X | Y | WIRE COLOR |
|----|----|------------|
| 7 | 5 | GND BLK |
| 12 | 10 | +10V W/R |
| 13 | 12 | -10V W/GN |
| 16 | 1 | RESET P |



- NOTES:
- RESISTOR VALUES ARE IN OHMS $\pm 5\%$ 1/2W
 - CAPACITOR VALUES ARE IN MICROFARADS
 - INDICATES CARD EDGE CONNECTION
 - INDICATES CHASSIS GROUND
 - INDICATES CIRCUIT GROUND
 - INTEGRATED CIRCUIT IC1 PREFERABLY TL084 OR 4741 (OR EQUIVALENT)

| | | | |
|---|--|----------------------|---------|
| UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES | | CONTRACT NO. | |
| MATERIAL | | APPROVALS | DATE |
| FINISH | | DRAWN R.P.M. | 12-2-77 |
| NEXT ASSY USED ON | | CHECKED | |
| APPLICATION | | DO NOT SCALE DRAWING | |

URE UNITED RECORDING ELECTRONICS INDUSTRIES

SCHMATIC
DISPLAY INTERFACE MAINFRAME

SIZE: MODEL NO: DRAWING NO:
D 201 12886C

SCALE: SHEET OF