

# 1.0 M-8000 INSTALLATION

## 1.1 LINE VOLTAGE SELECTION

**Before** connecting the M-8000 to the power mains, check that the voltage selection switch on the rear panel is set to the proper voltage. This switch is located directly below the power cord connector. If you are connecting the unit to 110-120 V.A.C. mains, the switch must be set so that "115V" is visible. For connection to 220-230 V.A.C. power, the switch must be set so that "230V" is visible.

The switch setting may be changed by using a small screwdriver, paper clip, or fingernail. Make certain that the selector switch is set fully to the proper side before connecting the power cable. Do not change the setting of this switch unless the power cord is unplugged from the mains outlet.

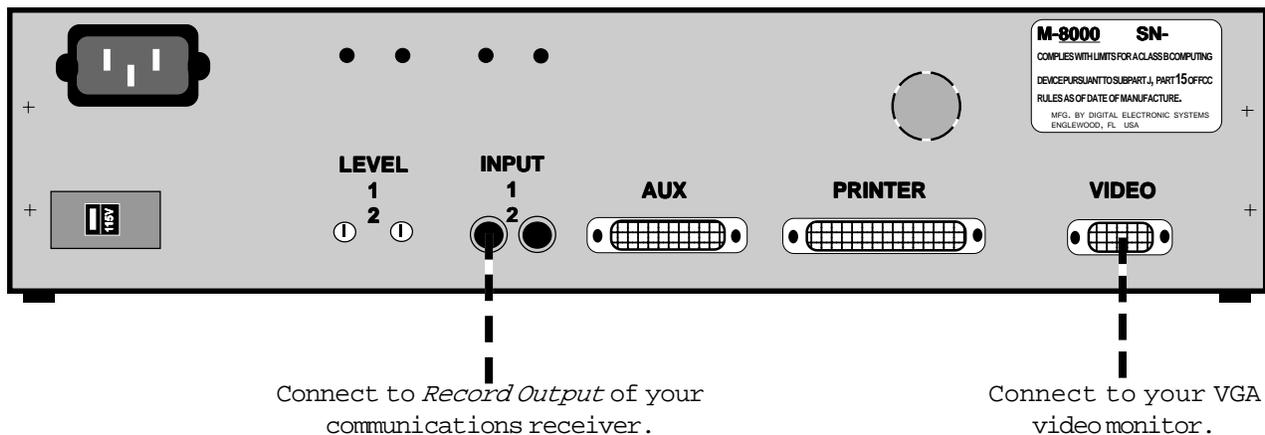


**Warning:** Attempting to operate the unit with the voltage selection switch improperly set may result in serious permanent damage to the equipment and/or serious personal injury.

## 1.2 RECEIVER CONNECTION

Any good quality communications receiver will suffice for use with the M-8000. However stability, sensitivity and selectivity are the most important attributes of a good RTTY communications receiver.

The best point of connection to your receiver would be the Record or Line output. If your receiver does not provide such outputs, then you may connect the M-8000 "INPUT" to the earphone or speaker outputs using the two conductor phone plug (supplied) and an appropriate length of two conductor wire. Shielded wire should be used for this cable.



## ■ RECEIVER INPUT LEVEL ADJUSTMENT

The M-8000 provides for a wide range of audio input levels from receivers. For proper operation of the unit, however, it is imperative that the input level of the M-8000 be set to correctly match the receiver to be used. This is quite simply done as follows:

1. Connect the audio output (record, line, speaker, phones, etc.) from your receiver to the 1 INPUT of the M-8000.
2. Turn on the M-8000 and receiver.
3. Tune in a fairly strong RTTY signal (precise tuning is not important at this point).
4. Adjust the LEVEL 1 control on the rear panel while observing the on-screen "INPUT 1" level display bar. The level control should be set so that the displayed level is at the border between the two green segments on the level bar. A small flat-blade screwdriver should be used to adjust the LEVEL control.
5. Repeat the above procedure for the second input by using INPUT 2 and LEVEL 2 and observing the "INPUT 2" level bar.

NOTE: Do not over-drive the input stages of the M-8000. Input levels which cause an input bar level to light the bright red segment (at the extreme right of the bar) may degrade the performance of the unit.

## 1.3 VIDEO MONITOR CONNECTION

The most important consideration in selecting a video monitor is to ensure that it is compatible with the M-8000 output. The M-8000 generates a full 640 x 480 16 color analog VGA graphics display with a nominal horizontal frequency of 31.5 kHz. and a vertical frequency of 60 Hz. The M-8000 employs the widely-used 15 pin mini-D for the video output connector.

The quality and sharpness of the displayed image depends upon the resolution of the video monitor. This resolution is controlled by two factors: video bandwidth and phosphor dot pitch. With bandwidth (measured in megahertz (MHz.)) the higher the number, the better the performance. When comparing dot pitch, however, the lower (smaller) the number is the better the quality will be. A dot pitch of 0.31 millimeters (mm) will give good results.

When selecting a video monitor for use with the M-8000, remember that monitors with an FCC Part 15 class "B" certification have been tested to tighter EMI and RFI emission standards than those with a class "A" emission rating, and as such radiate less interference to short-wave radio signals.

You may want to consider investing in a multi-sync monitor at this point. While these sophisticated monitors command a premium price, their flexibility may prove worthwhile as higher resolution displays become more prevalent.

The video monitor is connected to the "VIDEO" jack on the rear panel. If your video monitor is equipped with a connector other than the 15 pin mini-D, then an adapter must be used to mate your connector with the M-8000. These adapters are often available at local computer stores.

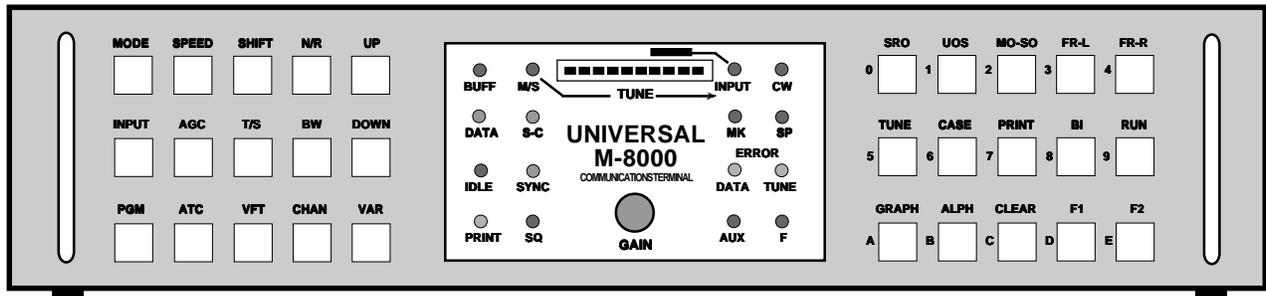
## ■ THE VIDEO SCREEN

The top 26 rows of the screen are reserved for displaying received text. Below this area is a graphics tuning indicator section. In modes where these tuning indicators are not usable (Morse, DataBit, FAX or Paging modes), this section of the screen is automatically converted for use as displaying additional text (graphics in FAX mode). This conversion to text may also be initiated manually, by user command, to provide a 30 line by 80 character display in any text mode, if the tuning aids are not needed. The bottom two lines of the screen are used as status lines to display the setting of the various operating parameters affected by the control keys.

## 2.0 OPERATING CONTROLS

### 2.1 POWER SWITCH

The power to the M-8000 is controlled by a toggle switch located behind the right hand rack handle. Up is *ON*, down is *OFF*.



### 2.2 KEYPAD FUNCTIONS

The M-8000 uses 30 push-button keys to control the majority of operating functions. Some of these keys are capable of providing more than one function by using them in conjunction with the **F1** or **F2** keys. These alternate functions are activated by pressing the **F1** or **F2** key and then pressing the appropriate multi-function key. When one of the alternate functions (F1 or F2) is active, the F LED will blink and the appropriate F on the status line will also blink. The alternate function enable will turn off as soon as any control key is pressed. To disable the alternate selection without performing an alternate function, simply press the appropriate **F** key a second time.

Whenever a key is pressed, a short beep tone (1000 Hz.) will be heard. If the pressed key has no function in the selected mode of operation, or if the limits to the function of that key have already been reached, then a lower frequency tone (500 Hz.) will be heard. These tones can be enabled or disabled by the user in the PROGRAM function.

Pressing and holding certain keys will cause the function of that key to repeat, just as if the key were pressed and released multiple times. Keys that do this are noted below by the {repeats} indication after the function description.

The functions associated with several of the keys have 'variable' capabilities. When these keys are pressed, in addition to performing the indicated operation, the status line indicator for that function will be highlighted. When a status line function is highlighted, the **UP** and **DOWN** keys may be used to step through the available values or vary the value of that function. The selected function will remain highlighted until another control key with variable capability is pressed or the **VAR** key is used to select another variable function. Keys that operate in this manner are noted below by the {variable} indication after the function description.

## LEFT HAND KEY ARRAY

<b>MODE</b>	Steps through the available operating modes in the following sequence: Baudot, ASCII, Packet, PACTOR, Sitor-A, Sitor-B, Autor, FEC-A, FEC-S, GMDSS, ARQ-M2, ARQ-M4, POL-ARQ, ARQ-E, ARQ-E3, ARQ-S, SWED, ARQ6-90, ASYNC, SYNC, ACARS, POCSAG, GOLAY, PICCOLO, FAX and Morse. {repeats} {var.}
<b>F1+ MODE</b>	Direct entry of mode.
<b>F2+ MODE</b>	Short-cut, expert mode.
<b>SPEED</b>	Steps through the available standard speeds of operation for the selected mode. {repeats} {variable}
<b>F2+ SPEED</b>	Direct entry of speed.
<b>SHIFT</b>	Steps through the six pre-set shifts of the high or low tone sets or through the seven pre-set tone pairs in the modem mode. {repeats} {variable}
<b>F2+ SHIFT</b>	Direct entry of shift.
<b>N/R</b>	Selects between Normal and Reverse sense of the demodulator.
<b>UP</b>	Increases the value of the currently selected variable parameter. {repeats}
<b>INPUT</b>	Switches between audio input 1 and input 2.
<b>F1+ INPUT</b>	Turns the DIiversity function on or off.
<b>AGC</b>	Selects AGC off, AGC on or LIMiter.
<b>T/S</b>	Selects the demodulator Tone Set as high tones, low tones or modem tones.
<b>F1+ T/S</b>	Selects external demodulators.
<b>F2+ T/S</b>	Direct entry of Mark tone frequency.
<b>BW</b>	Modifies the BandWidth of the demodulator filters from the NOMinal value in steps ranging from -3 (narrowest) to +3 (widest). {variable}
<b>DOWN</b>	Decreases the value of the currently selected variable parameter. {repeats}
<b>F2+ PGM</b>	Accesses the menu-driven programming function of the M-8000.
<b>ATC</b>	Turns the Automatic Threshold Circuit on or off.
<b>VFT</b>	Selects the Voice Frequency Telegraph demodulator mode (FDM).
<b>F2+ VFT</b>	Direct entry of Space tone frequency.
<b>CHAN</b>	Steps through the available VFT tone channels within the selected channelization mode. If VFT demodulator is not in use, CHAN selects the desired ARQ-M2 or ARQ-M4 channel to monitor.
<b>F1+ CHAN</b>	Selects the desired ARQ-M2 or ARQ-M4 channel to monitor.
<b>VAR</b>	Steps through the various operating parameters which are capable of variable operation: MODE, SPEED, SHIFT, BW or no variable functions.

## **RIGHT HAND KEY ARRAY**

<b>SRO</b>	(Speed Read Out) Initiates the speed evaluation function.
<b>UOS</b>	(Unshift On Space) Turns the UOS function on or off in all Baudot based codes. In ASCII selects parity operation. In Packet selects "pass all packets".
<b>MO-SO</b>	(Mark Only - Space Only) Enables the Mark filter or Space filter to operate alone or both filters to operate simultaneously.
<b>FR-L</b>	(FRame Left)
<b>FR-R</b>	(FRame Right)
<b>TUNE</b>	Activates the automatic demodulator filter tuning function.
<b>F2+ TUNE</b>	Activates the automatic filter tuning and speed setting function.
<b>CASE</b>	Manually steps through the cases for Baudot-based RTTY modes: Figures, Letters and National. (National in three-shift alphabets only).
<b>PRINT</b>	Selects the printer output mode to be: OFF, ON, SPC (space character), S-C (sel-cal) or SQU (squelch).
<b>F1+ PRINT</b>	Causes the indications on the status lines to be sent to the printer.
<b>F2+ PRINT</b>	Activates the retro-print function. The last 2048 characters received are placed in the printer output buffer and a printer selection of ON is assumed. The retro-print function will turn off when the printer buffer empties. While retro-print is active, the status line will indicate "PRN=RET".
<b>F1/F2+ BI</b>	Control the operation of the Baudot-based Bit Inversion decoding function.
<b>RUN</b>	Starts or stops the transfer of received data to the video screen and printers. This function operates only in the following modes: SYNC (databit) and FAX.
<b>GRAPH</b>	Sets the front panel LED bar-graph to indicate either the audio level to the tone filters or the output of the Mark / Space filters.
<b>F2+ GRAPH</b>	Controls whether the video display will be 80 x 26 text characters with graphic tuning aids or 80 x 30 text with status lines only. When the display is switched from one format to another, the screen is automatically cleared.
<b>ALPH</b>	Selects the desired Baudot or Baudot-based code ALPHabets of: ITA (ITA-2), TLX (Telex), MIL (Military) and CYR (Cyrillic).
<b>F1+ ALPH</b>	Switches the Literal code conversion option on or off.
<b>CLEAR</b>	Clears the video display screen.
<b>F1+ CLEAR</b>	Clears the printer buffers (except in FAX mode it clears the screen).
<b>F2+ CLEAR</b>	Clears the spectral display.

In addition to the above functions, each of the right-hand control keys is labeled with a number (0-9) or letter (A-E). These keys are also used for numeric entry and/or programming functions.

### 3.0 LED INDICATORS

<b>BUFF</b>	Indicates a printer buffer overflow condition.
<b>DATA</b>	Indicates that data is being received by the M-8000.
<b>IDLE</b>	When receiving synchronous codes, this LED turns on when idle or phasing signals are being received.
<b>PRINT</b>	Indicates when data is being transferred to one or both of the printer outputs.
<b>M/S</b>	Indicates that the LED bar-graph is displaying the tuning level of the Mark and Space filters. The signal should be tuned for maximum deflection to the right.
<b>SC</b>	Indicates reception of a user-programmed Sel-Cal.
<b>SYNC</b>	When receiving synchronous codes, this LED indicates the unit has acquired the proper phasing and sync to decode the signal.
<b>SQ</b>	When this LED is on it indicates that the squelch circuit is open, that is, sufficient signal is detected to allow data to flow to the video and printers.
<b>INPUT</b>	Indicates that the LED bar-graph is displaying the received audio level present at the input to the unit's pre-filters. Best operation is normally obtained when one of the LED's under the white block is illuminated.
<b>MK</b>	Indicates reception of a MARK tone.
<b>DATA ERROR</b>	Data being received by microprocessor does not meet specification selected by mode and speed controls.
<b>AUX</b>	Reserved for future use.
<b>CW</b>	Indicates when a "key down" Morse code signal is detected.
<b>SP</b>	Indicates reception of a SPACE Tone.
<b>TUNE ERROR</b>	Indicates improper tuning or reception.
<b>F</b>	This LED will blink when either the F1 or F2 function keys are active.

## 4.0 SCREEN INDICATORS

### 4.1 STATUS LINES

The bottom two display lines on the M-8000 are used to display the status of the various operating parameters which are controlled by the operating keys, as well as other pertinent operating information. Each portion of these status lines is dedicated to displaying a specific type of indicator as shown in the example below:

```
DIV  IN-1 AGC    HIGH  NOM  M+S UOS          F1 MK=2125
BAUDOT      75    170  NOR  ATC ITA  PRN=ON        F2 SP=2295 12/25 14:36
```

### 4.2 TUNING BARS

At the left side of the tuning graphics section of the screen are five bar-graph type indicators. These are 128 step multi-colored bars with a gray background. The top two bars indicate the level of the audio input to the unit. The indication on these bars is affected by the output of the receiver connected to the input and the setting of the input level controls at the rear panel. The rightmost color displayed corresponds to the following input conditions:

<b>ALL GRAY</b>	virtually no audio input
<b>RED</b>	extremely low input level
<b>BROWN</b>	low input level
<b>BLUE</b>	slightly low input level
<b>GREEN</b>	proper input level (low range)
<b>LT GREEN</b>	proper input level (high range)
<b>YELLOW</b>	slight limiting of input signal
<b>LT RED</b>	full limiting of input signal

These input level tuning bars may be removed from the display with option four under the Video menu in the programming mode.

The lower three bars serve to assist in tuning the received signal by indicating the output level of the Mark filter, Space filter and an average of the combined Mark and Space filters. These bars, labeled as MARK, SPACE and MK + SP respectively, indicate the tuning status as follows:

<b>ALL GRAY</b>	virtually no filter output
<b>RED</b>	extremely poor signal or tuning
<b>BROWN</b>	poor signal tuning
<b>YELLOW</b>	fair signal tuning
<b>LT BLUE</b>	good signal tuning
<b>LT GREEN</b>	optimum signal tuning

### 4.3 SPECTRUM DISPLAY

The middle area of the tuning graphics section is occupied by a frequency spectral display. This display gives a visual indication of the frequency spectrum applied to the demodulator filter inputs. The analysis covers the frequency range of approximately 1000 Hz at the left end to 3000 Hz at the right end of the graph. At the bottom of the display are two reference marks. The one on the left corresponds to the low tone mark frequency of 1275 while the right one corresponds to the high tone mark of 2125. The position of these reference indicators are approximate locations only and should not be used for fine tuning a signal.

A light red bar will appear against the gray background at a position corresponding to the received audio frequency. The height of the bar will correspond to the amount of time a signal of that frequency is present. The display does not present any signal amplitude information and as such is not a true spectral analysis. The display is weighted so that signals of relatively brief duration are suppressed. In order to obtain substantial frequency peaks, the duty cycle of each displayed tone must be in the range of 35% to 45% minimum. As a result, signals such as Sitor-A and SWED-ARQ will not produce a usable spectral display because these signals have an inherent transmit duty cycle of 50% or less, allowing an average of 25% or less per tone.

In normal RTTY operation there will be two distinct peaks on the display. The location and separation of these two vertical bars will indicate the approximate frequency and shift of the received signal. The closer the two bars are, the narrower the received shift is. The farther a bar is to the right, the higher the tone frequency is.

As you slowly tune your receiver across an RTTY signal, the bars of the Mark and Space tones will move across the display. Large or sudden changes, however, may take a few seconds to register. Additionally, it will take several seconds for the display to decay after leaving the signal. If you wish to *immediately* clear the spectral display press **F2** then the **CLEAR** button.

Remember the height of the bar is independent of the demodulator filter output and does not indicate proper tuning of the signal.

### 4.4 X-Y TUNING SCOPE

The right side of the tuning graphics section is used for a simulated X-Y RTTY tuning scope display. This square green box has two display lines which indicate the output amplitude of the demodulator tone filters: A horizontal line for the Mark tone and a vertical line for the Space tone.

Proper tuning is indicated by the horizontal and vertical lines being at maximum length and perpendicular to each other. As with the other graphic displays, large and/or sudden changes in tuning may not be immediately reflected in the display.

The X/Y display uses both averaged and instantaneous demodulator filter output signals to derive the displayed pattern. As a result of the averaged signal factor, pulsed or keyed signals, such as SITOR-A, Packet and SWED-ARQ may result in a distorted or erratic scope pattern.