Monsanto APPLICATIONS INFORMATION FOR MAN2815 ALPHANUMERIC DISPLAY

AN2001 Microprocessor Based MAN2815 Display System Application

(Here are pages 1 and 2 only of an eight-page Application Note which although 'quite dated' as to the technology used should clearly convey the "white paper" flavor of such a technically involved document. Hewlett-Packard was the principal competition at that time — around the year 1980 — but the considerations described therein are still applicable in the year 2000! Listed below are some explanatory background comments from the author, Raymond Sonoff:

— The original document was prepared in 1978 by Raymond Sonoff as part of a contract with Monsanto's Optoelectronics Division to produce two such workable demonstration units. About 5,000 copies of the application note were printed by Monsanto.

— Moreover, a ghostwritten version of this document appeared in the December 7, 1978 issue of McGraw-Hill's "Electronics" magazine, together with a description on the front cover page, "Microprocessor makes alphanumeric display smart" which listed WIlliam Otsuka, Monsanto Commercial Products Co., Palo Alto, Calif. as the author. That document was virtually identical to the MAN2815 Application Note, the first two pages of which are reproduced :

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The purpose of this application note is to present the display-based systems design engineer with insight as to considerations which should be taken into account when selection and application of multi-segment, multi-character, alphanumeric displays are undertaken.

An example of the steps involved for a specific application — that of a field sales demonstration unit having sophisticated editing capabilities and employing a full-size keyboard — is presented.

Emphasis is given to display considerations, especially interfacing, overall systems design, and operational features of the microprocessor-based system application.

MONSANTO'S MAN2815 EVOLUTION:

The advent of microprocessors, combined with the ever-expanding information explosion, brought about the requirement for creation of a display readout component offering three features:

1. Character font, size, and spacing which prove suitable for most applications where alphanumeric characters would be employed;
2. Straightforward interfacing to TTL or MOS compatible integrated devices, especially microprocessors, and
3. Reasonable cost per digit as an incentive to systems cost savings when production quantities become involved.

Monsanto's MAN2815 8-character (14 segments, plus decimal point per character) display product, contained in a 24-pin dual inline package, was specifically designed to meet all three features cited above.

ALPHA-NUMERIC DISPLAYS

Why consider a multi-segment display over a dot-matrix type?

A dot-matrix display, such as Monsanto's MAN2A which has a 5 x 7 matrix, will provide greater font generation capability than would a multi-segment display, such as Monsanto's more recent product, the MAN2815. For applications demanding this increase capability, the dot-matrix display will be employed.

However, where segmented representations or segmented approximations — as would be required for curved symbols — prove adequate, adoption of multi-segment, multi-character displays will result in significant reductions in:

a. per digit cost;

b. system power and heat-sinking requirements, and

C. Circuit complexity, e.g., for addressing and driving the fewer LED's — 15 (vs 35) per character position — involved.

The cost savings realizable in applications involving mode rate-to-high volume usage should clearly encourage use of these cost-effective displays in systems produced for sale in today's highly competitive marketplace.

Finally, since demonstration proves to be the best convincer, a microprocessor-based demonstration unit was designed and built, and this app note is a summary of that activity.

CONSIDERATIONS:

What are some of the considerations which should be taken into account when selection and application of a multi-segmented, multi-digit alphanumeric display are undertaken?

Primary emphasis should be given to obtaining acceptable answers to the following questions:

1 .What total range of characters will be required? Will an ASCII character set need to be satisfied, or at least approximated, or will other, more specialized characters have to be generated via either hardware or software controlled approaches?

2. What character height will be satisfactory for the intended viewing distance?

3. What character spacing will prove most acceptable for the number of characters needed?

4. If a special lensing effect is employed to magnify the individual characters, such as a bubble over each individual character, what kinds of problems will arise in reading the display at various angles other than the normal angle of incidence?

5. If more than eight character positions are required, will the particular display product prove easily stackable- and maintain uniform separation between character sets due to the package design?

6. Will the display product work at uniform, acceptable light intensity levels, e.g., when low-average values of forward current (such as one milliampere or less!!) either desired or demanded as a means to reduce power dissipation and total systems costs?

7. Can unique codes be applied to the device to suit particular, non-standard requirements you have now, or which you may have in the future? And, would "ASCII-ONLY" input prove to be a severe restriction to system design flexibility and subsequent expansion capabilities should you be considering this approach?

MAN2815 DESIGN FEATURES:

The MAN2815 device offers all of the features and capabilities which satisfactorily answer the questions enumerated under the section entitled "considerations" just presented. See the data sheet for specific features listed. (Ref. 1).

ADDITIONAL NOTE:

The decision to offer total flexibility in interfacing rather than dedicating the input to be "ASCII-ONLY" was prompted principally by two beliefs:

1. Today on-board electronics required for the "ASCII-ONLY" device would increase the per device cost, and
2. A wide market would be served if the display systems designer could have the option to decide what coding specification would best meet his requirements.

FUNDAMENTAL DESIGN OBJECTIVE:

The fundamental objective of this design task was to achieve a microprocessor-based field sales demonstration unit incorporating Monsanto's MAN2815 displays and having the following dominant features:

1. A sequence of canned messages which would illustrate the basic ASCII character set and provide the first-time user with sequential operating instructions for the unit.
2. Keyboard entry capability via a "user mode" for real-time field trials and font assessment of the MAN2815 display product. Thus, design, human factors, and engineering management personnel involved with display-based systems could immediately reach decisions on suitability of this product for their intended application(s).
3. Permit the user to create any of 215 possible characters using this 15-segment per character display — simply by performing a straightforward sequence of key depressions!

   Such capability would allow real-time character font generation/experimentation by the prospective user as has never before been offered and would permit him to generate, modify, and finally select those unique symbols which best meet his display readout requirements.
4. Capability to observe intensity changes associated with a 2:1 increase in the time-averaged forward current for any selected or created message, simply by a single keystroke operation!
5. Incorporate a display interface which allows treatment of the display "module" as an addressable peripheral device capable, for example, or straightforward connection to a microprocessor 1/0 bus.
6. Incorporate sufficient "processing power" that — in addition to performing the required display refresh, keyboard scanning, and sophisticated editing operations — would encourage designers to interface this basic system (after appropriate modifications, of course) either to additional sets of displays or to process control, instrumentation or data acquisition/analyses systems.

   For a demonstration-only system is not the "real world", and this inherent system expansion capability would encourage further investigation by the designer.

SUMMARY OF DESIGN CRITERIA
FOR THE DEMONSTRATION UNIT:

In the application described herein, a microprocessor was to be selected that would be able to:

1. Perform a 32-character (32 x 15 = 480 segments) display refresh at a rate of at least 200 Hz (to minimize flicker effects);
2. Scan a full-size ASCI I-encoded keyboard to determine if a key had been depressed, and if so;
3. Decode what key it was;
4. Perform a lookup table conversion (stored in programmable read-only memory (PROM)) for the decoded information;
5. Output the associated key's font (if the key depressed proved to be other than a keyboard command key) to the display; or
6. Execute the command desired if the key proved to be a command key;
7. Have "Processing power" remaining (in the form of idle time) should the system design be expanded to incorporate additional sets of MAN2815 displays or interfacing to other equipment or devices, such as programmable communications interfaces, analog-to-digital converters, and the like.

SUMMARY:

For this particular system design, the 8 X 300 microprocessor was chosen in order to minimize parts count and maximize computing power (time available for processing external inputs beyond that needed for the "intelligent" demonstration unit). It is noted that 8-bit microprocessors can be readily interfaced to MAN2815 displays, especially if an interface is constructed such as that shown in Figure 1. Any of the popular MOS microprocessors, such as the 8080, 6800, 2650, 6502, F8, SC/MPII, etc., would prove highly suitable for those applications where the microprocessor is either dedicated solely to display refresh and keyboard scanning operations, where less sophisticated editing is needed, and so on.

Moreover, with the coming of 16-bit MOS microprocessors (see Ref. 8) coupled with increasingly sophisticated "imart" peripheral I.C.'s (see Ref. 6, 7) — there should be minimal hesitance by display systems designers to examine each of the available microprocessors to see which best meets the desired design objectives.

In summary, each design has its own particular requirements and you may find-upon performing a similar analysis — that an 8-bit MOS microprocessor does all that you need; or, the forthcoming 16-bit MOS microprocessors will handle your situation, or, you might find that a dedicated hardware configuration, such as a programmable controller, will prove satisfactory.

So, don't neglect to look at all the available options!