INSTRUCTION MANUAL

LEVEL 2 FRONT PANEL
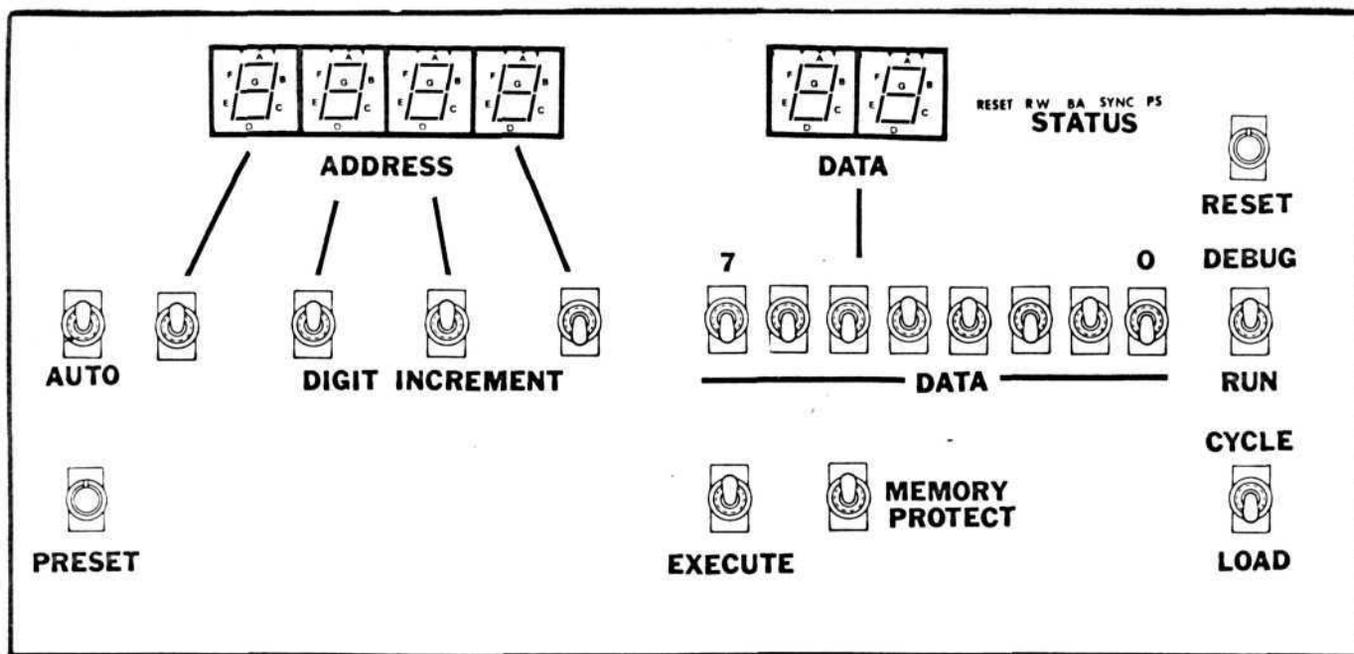
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INSTRUCTION MANUAL :   FRONT PANEL

<u>SPECIFICATIONS</u>

EIGHT BIT DATA LOADING CONTROL
        1.TTL LOGIC LEVELS
        2.BUFFERED OUTPUT LINES - 20 TTL LOADS
SIXTEEN BIT ADDRESS CONTROL
        1.TTL LOGIC LEVELS
        2.BUFFERED OUTPUT LINES - 20 TTL LOADS
        3.PRESET VECTOR CONTROL
        4.AUTOMATIC ADDRESS INCREMENT CONTROL
MULTI-MODE PROGRAM EXECUTION
        1.SINGLE CYCLE CONTROL
        2.RUN/HALT CONTROL (FULL SPEED OPERATION)
        3.SYSTEM RESET
REMOTE MEMORY PROTECT SWITCH

POWER CONSUMPTION :   5 VOLTS @ 880 MA.
CONNECTOR: 50 PIN DOUBLE ROW POST HEADER
            .100" CENTERS,PLUG COMPATIBLE WITH
          MICROPUTER^r AND MOTOROLA EXORCISER *

MECHANICAL :
GLASS EPOXY G-10 PLATED THRU CIRCUIT BOARD
BOARD SIZE : 54.75 x 10 inches.

* TRADEMARK OF MOTOROLA, INC.

INSTRUCTION MANUAL : FRONT PANEL

INTRODUCTION

        The CGRS FRONT PANEL is a direct memory access (DMA)
type microcomputer control panel. It is a totally hardware •
based microcomputer control that independently supplies
static logic levels to perform various control functions
and does not depend on microprocessor operation.

MEMORY READ AND WRITE: The CGRS FRONT PANEL can read or write
into any memory location by halting the microprocessor and
directly generating the address bus and control bus signals.
The address bus signals and the data information from the
memory are displayed on 6 seven-segment hexadecimal displays.
Information to be loaded into memory is entered on the eight
data switches in binary form and loaded into memory when a
load operation is executed.

SINGLE CYCLE PROGRAM EXECUTION: The CGRS FRONT PANEL can
control the microprocessor to allow it to execute its program
a single cycle at a time. This allows the user to watch
program flow in detail and immediately recognize incorrect
operation. The program can be stopped at anytime to read or
load memory.

FULL SPEED OPERATION: The CGRS FRONT PANEL allows the micro-
processor to execute its program at full speed. The program
can be stopped at anytime for single cycle operation or memory
operations.

SYSTEM RESET: The CGRS FRONT PANEL includes a system reset
that is used to restart program execution.

INTRODUCTION cont.

REMOTE MEMORY PROTECT SWITCH: The CGRS FRONT PANEL provides a remote memory protect switch that is used with most memory boards designed for the S-100 bus structure. Memory protect logic on each memory board can be set or reset by the switch. When the memory protect logic is set, the memory will not accept new data.

DESCRIPTION OF CONTROLS

1. AUTOMATIC INCREMENT/ NORMAL

     This toggle switch controls the operating mode of the
"electronic thumbwheel". When this switch is in the "automatic
increment" position, the digital counters in the "electronic
thumbwheel" are chained together to form a full sixteen bit binary
counter. This mode is used when loading or reading consecutive
memory locations. The counters are automatically incremented after
each load operation and will count in hexadecimal from 0000 to FFFF.
     When this switch is in the normal mode, each 4 bit digital
counter operates separately with no carry-over from one counter to
the next.

2. PRESET/NORMAL

     This switch is used to preset the "electronic thumbwheel"
address register to the value "FFFC". This is used when reading or
loading memory location "FFFC", the "restart vector".

3. ADDRESS DIGIT INCREMENT SWITCHES

     Four switches located immediately below the hexadecimal address
displays are used to increment the "electronic thumbwheel". Each
hexadecimal digit can be incremented individually with each switch.
The "electronic thumbwheel" can be operated as either a sixteen
bit binary counter or four individual four bit binary counters.

4. EXECUTE SWITCH

     The execute switch is used to execute control modes of the
microcomputer control panel. Two modes are possible: 1. This
switch is used to "write" into memory in the "load" mode.
2. This switch is used to "step" the microprocessor through a
program one cycle at a time in the "cycle" mode.

5. MEMORY PROTECT

     This switch is used either to set or to reset a "memory
protect" flip flop that often is available on memory boards
designed for the S-100 bus structure. When the "memory protect"
flip flop is set, that particular memory cannot be written into.
The status of the "memory protect" flip flop being addressed will
appear on the PS status light.

6. CYCLE/LOAD SWITCH

     This switch is used to change the control mode of the microcomputer
control panel. In the "cycle" mode, the panel will allow the
microprocessor to execute one single cycle of its program whenever
the execute switch is activated. The information on the microcomputer
bus lines is latched into the display during each cycle. In the "load"
mode, the panel will load the microcomputer memory whenever the
execute switch is activated. The memory location to be loaded is
entered on the "electronic thumbwheel" address register and the data
to be loaded in the memory location is entered in binary form on the
eight data switches. When the execute switch is moved downward,
the new data information will be loaded into memory.

7. RUN/DEBUG SWITCH

     When this switch is in the "run" mode, the microprocessor is
allowed to run at the full speed. In the "debug" position, the panel
will either load the memory or single-step the microprocessor
through a program depending on the position of the cycle/load switch.

8. RESET

     This switch is used to reset the microcomputer system. It
resets the microprocessor to initial conditions as well as resets
the "electronic thumbwheel" to 0000.

9. DATA SWITCHES

Eight switches are used to specify the binary words for the data bus when writing into the memory. The left hand switch is the most significant bit-D7.

10. ADDRESS DISPLAY

Four hexadecimal seven-segment L.E.D. displays are used to show address information of the address bus in hexadecimal format. The information is latched into the display at the end of each clock cycle.

11. DATA DISPLAY

Two hexadecimal seven-segment L.E.D. displays are used to show data information of the microcomputer data bus. The information is latched into the display at the end of each clock cycle.

12. CONTROL FUNCTION DISPLAY

Five lines of the microcomputer control bus are displayed with discrete L.E.D. indicator lights. They are from left to right:
1. RESET- the microcomputer reset line .
2. R/W - read/write
3. BUS AVAILABLE (HALT ACK.) - the microprocessor has halted and relinquished control of the microcomputer bus structure.
4. SYNC - an indication that that the microprocessor begins an instruction.
5. PROTECT STATUS - an indication of the "memory protect" flip flop available on most memory boards designed for the S-100 bus structure.

OPERATING INSTRUCTIONS :   FRONT PANEL

READING THE MEMORY

      Set the switches to the following positions:
1. Automatic/Normal - to normal or upward position.
2. Address Digit Increment - set all four switches to off
                                  or upward position.
3. Execute - to normal or upward position.
4. Run/Debug - to debug or upward position.
5. Load/ Cycle - to load or downward position.
      Turn the power on. The four digit hexadecimal address display
now shows the memory location addressed by the front panel and the
two digit data display shows the data information stored in that
memory location.
      Any memory location can be addressed from the front panel by
changing the "electronic thumbwheel". To change the "electronic
thumbwheel", move each Address Digit Increment switch downward and
hold it until the "electronic thumbwheel" reaches the desired value.
Each digit should be separately from right to left, least significant
to most significant.
      The "electronic thumbwheel" can be reset to $0000 by pressing
the Reset button and the "electronic thumbwheel" can be preset to
$FFFC by pressing the Preset button.

LOADING THE MEMORY

      Set the switches to the following positions:
1. Automatic/Normal - to normal or upward position.
2. Address Digit Increment - set all four switches to off
                                  or upward position.
3. Execute— to normal or upward position.
4. Run/Debug - to debug or upward position.
5. Load/Cycle - to load or downward position.
      Turn the power on. The four digit hexadecimal address display
now shows the memory location addressed by the front panel. The
two digit hexadecimal data display to the right shows the data

information stored in the addressed memory location. To change
the contents of the memory location, set the data switches to
indicate the desired value in binary (upward equals logic 1,
downward equals logic 0) and throw the execute switch to the
downward position. The new data will be loaded into the memory and
will appear on the hexadecimal data display. The R/W status light
will also momentarily turn off indicating that the read-write
control line on the microcomputer bus momentarily switched to
logic 0.

LOADING THE RESTART VECTOR

Every time the microprocessor reset line is momentarily
switched to logic 0, the 6502 microprocessor will begin program
execution at the memory location specified by the "restart
vector"(memory locations $FFFC and &FFFD). Memory location $FFFC
contains the eight lower order binary bits of the "restart vector"
and memory location &FFFD contains the eight higher order binary
bits of the "restart vector". For example, if the microcomputer
program starts at memory location $F000, load memory location
$FFFC with $00 and load memory location $FFFD with $F0.
To load the "restart vector", simply press the Preset
pushbutton and follow normal loading procedures. Pressing the
Preset button automatically sets the value $FFFC into the
"electronic thumbwheel".

AUTOMATIC INCREMENT LOADING

When loading several consecutive memory locations, the auto-
matic increment feature of this control panel will become useful.
When the Automatic Increment switch is placed in the automatic or
downward position, the "electronic thumbwheel" will automatically
increment its value after the existing memory location is loaded.
For example, if the address display shows location $F000, when the
execute switch is thrown, the data value specified by the data switches

will be loaded into memory location $F000 and the "electronic
thumbwheel" will increment to memory location $F001. Care
should be taken not to hold the Execute switch downward too long
as more than one memory location could be loaded.

WRITING A PROGRAM

A microprocessor program is stored in consecutive memory
locations. The microprocessor reads the memory, and executes the
instructions sequentially. A microcomputer instruction consists
of two parts, an operator and an operand. The operator portion of
the instruction tells the microprocessor what to do, and the
operand portion of the instruction tells the microprocessor where
to do it. Take for example the microprocessor instruction JUMP
TO MEMORY LOCATION $F000. The 6502 program code for this instruction
is: $4C   JUMP TO

             $00

             $F0   LOCATION $F000

The $4C is the operator and the $00,$F0 is the operand. If this
program is located in memory starting at location $F000, we have
a complete program.

ADDRESS	DATA
$F000	S4C
$F001	$00
$F002	$F0

The microprocessor reads the instruction, jumps to location $F000,
reads the instruction again and continues in a loop.
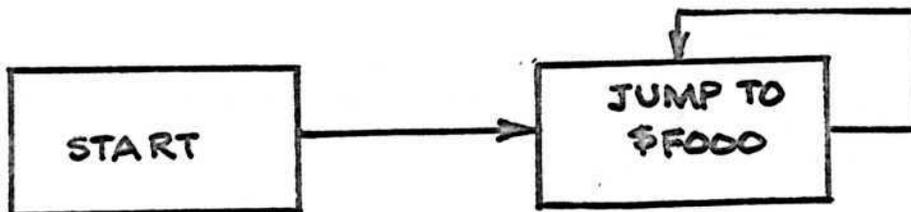
Further program examples are given in the next section.