

# **NAKED MINI® 4 AUTOLOAD OPERATIONS MANUAL**

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## REVISION HISTORY

| <u>Revisions</u> | <u>Issue Date</u> | <u>Comments</u>                                                                                                                                          |
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| A0               |                   | No history                                                                                                                                               |
| A1               | June 1977         | Miscellaneous revisions                                                                                                                                  |
| B0               | June 1980         | Incorporates types 2, 3, and 4 AutoLoad and provides information to AutoLoad the Mini-Flexible disk. This manual replaces 90-93016-01A0 AutoLoad Manual. |
| B1               | Jan. 1981         | Clarifies the use of Channels 5 and 6 for AutoLoad types 2, 3, and 4.                                                                                    |

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## SECTION 1. INTRODUCTION

NAKED MINI® 4 AutoLoad program is used to load programs into memory from peripheral devices and initiate execution of these programs if necessary. The NAKED MINI® 4 AutoLoad program is preprogrammed into a Read Only Memory (ROM) chip (a product of National Semiconductor Part No. 74S472) and installed in the AutoLoad socket provided on the NAKED MINI® processors. Socket locations vary on each processor board and are described in the reference manuals listed below. Computer Automation offers several NAKED MINI® 4 AutoLoad ROM chips for the AutoLoad program.

### TYPE 1 AUTOLOAD

ROM chip 01-49599-09 loads programs for the following devices:

- Teletypewriter Paper Tape Reader (under Distributed I/O)
- High-Speed Paper Tape Reader (under Distributed I/O)
- Magnetic Tape (under Distributed I/O)
- Floppy Disk Drive (both single and quad density)
- Medium Capacity Disk Drive (fixed or removable platters)
- High Capacity Disk Drive

### TYPE 2 AUTOLOAD

ROM chip #01-49682-37 or ROM chip #01-49682-95 loads programs from the following devices:

- Magnetic tape drive (under Distributed I/O)
- Medium Capacity Disk Drive (fixed or removable platters)
- High Capacity Disk Drive
- Mini-Flexible Disk Drive, unit 0 or 1 (under Distributed I/O)
- Floppy Disk Drive (both single and quad density)

### TYPE 3 AUTOLOAD

ROM chip #01-49682-38 or ROM chip #01-49682-96 loads programs from the following devices:

- Teletypewriter Paper Tape Reader (under Distributed I/O)
- High-Speed Paper Tape Reader (under Distributed I/O)
- Floppy Disk Drive (both single and quad density)

TYPE 4 AUTOLOAD

ROM chip #01-49682-39 or ROM chip #01-49682-97 loads programs from the following devices:

- Teletypewriter Paper Tape Reader (under Distributed I/O)
- High-speed Paper Tape Reader (under Distributed I/O)
- Mini-Flexible Disk Drive, unit 0 or 1 (under Distributed I/O)

REFERENCES

The following documents provide supplementary information to users of the AutoLoad program:

|                                                     | <u>Order<br/>Number</u> |
|-----------------------------------------------------|-------------------------|
| <u>NAKED MINI® Division User Publications Index</u> | 21223-91                |
| <u>LSI 4/10 Computer Reference Manual</u>           | 20990-91                |
| <u>LSI 4/30 Computer Reference Manual</u>           | 20991-91                |
| <u>LSI 4/90 Computer Reference Manual</u>           | 20945-91                |

## SECTION 2. PROGRAM OPERATION

The NAKED MINI® 4 AutoLoad program is initiated manually from a programmer's console, a remote console or an operator's console, using the procedures described in Section 3. Once initiated, the operational sequence is the following:

1. The computer reads the 256-word contents of the AutoLoad ROM into memory locations :0000 through :00FF.
2. The computer starts executing at memory location :0000, which contains the first instruction of the AutoLoad program.
3. The AutoLoad program searches for the end of writable memory and transfers the program into the last 256-word locations of writable memory.
4. Based on the state of the SENSE indicator and the contents of the Console Data Register, the AutoLoad program loads or bootstraps from the appropriate input device.

The device loaded determines the mode of operation. The NAKED MINI® 4 AutoLoad program provides three modes of operation:

- Loading binary format program tapes from a paper tape reader
- Bootstrapping from a magnetic device
- Loading from the first available device

## 2.1 PAPER TAPE LOADING

Information loaded from paper tape must be in the binary format described in the NAKED MINI® 4 Family Software Manual. The AutoLoad program allows type codes to cross record boundaries. The type codes used by the NAKED MINI® 4 AutoLoad program are:

| <u>TYPE CODE</u> | <u>DESCRIPTION</u>                          |
|------------------|---------------------------------------------|
| :02              | End program, ABS                            |
| :03              | End program, REL                            |
| :04              | Origin, ABS                                 |
| :05              | Origin, REL                                 |
| :06              | Data, ABS                                   |
| :07              | Data, REL                                   |
| :08              | Reserve and fill here                       |
| :09              | Byte address constant                       |
| :18              | Begin program, LSI-3/05                     |
| :40              | Null                                        |
| :4F              | List segment names (list location counters) |
| :69              | Location counter                            |
| :6D              | Note record                                 |
| :6F              | List segment attributes                     |

If a system contains more than one paper tape reader, the reader intended for loading must be the only reader in ready state. The program can be loaded into any available memory locations, except the last 256 word locations of writable memory. These locations are occupied by the AutoLoad program.

A paper tape can be loaded at either an absolute or a relative location. When loaded at an absolute location, a relocation offset of zero is used for sections of code following relative origins. When loaded at a relative location, the contents of the Q Register are added to any relocation bias in the program.

When a tape is loaded, the AutoLoad program checks bit 0 of the Console Data Register to determine if the loaded program should be executed. When bit 0 is on and an execution address is provided on the paper tape, the program begins executing at that address. When bit 0 is off, the AutoLoad program halts. The execution address occupies the X Register; the highest address loaded is contained in the Q Register; and the Extended Addressing (XA) bit is set to "1" in the Status Register. When a halt occurs, the execution of the loaded program can be initiated manually, or another program can be loaded from paper tape.

When the computer halts, another program can be loaded by altering the contents of the Console Data Register with a new load address, and pressing the RUN switch. The AutoLoad program can load several paper tape programs without destroying the contents of low memory.

To load from a magnetic device after loading from paper tape, the AutoLoad program must be re-initiated.

## 2.2 MAGNETIC DEVICE BOOTSTRAPPING

The AutoLoad program reads the first record of a magnetic device into memory, beginning at location :0000. This record should contain a bootstrap which continues the loading process. The user can determine whether the bootstrap is executed automatically or manually. (See Section 3.)

The location and length of the first record is defined as follows:

| <u>DEVICE</u>        | <u>RECORD SIZE</u> | <u>RECORD LOCATION</u>                               |
|----------------------|--------------------|------------------------------------------------------|
| Mini-Flexible Disk   |                    |                                                      |
| Unit 0               | 64 words           | Unit 0, Track 0, Head 0, Sector 1                    |
| Unit 1               | 64 words           | Unit 1, Track 0, Head 0, Sector 1                    |
| Magnetic Tape        | 200 words          | First record on the tape                             |
| Floppy Disk          | 256 words          | Unit 0, Cylinder 0, Head 0, Sector 1-4               |
| Medium Capacity Disk |                    |                                                      |
| fixed platter        | 256 words          | Unit 0, Cylinder 0, Head 0, Sector 0                 |
| removable platter    | 256 words          | Unit 0, Cylinder 0, Head 2, Sector 0                 |
| High Capacity Disk   | 256 words          | Unit 0, Cylinder 0, Head 0, Sector 0<br>or<br>Head 2 |

A 256-word record is read from any device except magnetic tape. Although the size of the first record on a magnetic tape depends on the amount of words written and the contents of the bootstrap, the record size is limited to 200 words. A larger record size would cause the contents of the standard magnetic tape interrupt location (:C8) to be overwritten.

## 2.3 FIRST AVAILABLE DEVICE LOADING

When the SENSE indicator on the console is "on", or if a console is not installed, the AutoLoad program loads from the first available device following the order shown below. For first available device loading, only the device intended for loading should be in a "ready" state.

### Type 1 AutoLoad

1. Paper Tape Reader (high-speed or teletypewriter)
2. Medium or High Capacity Disk Drive
3. Floppy Disk Drive
4. Magnetic Tape

### Type 2 AutoLoad

1. Floppy Disk Drive
2. Magnetic Tape
3. Medium or High Capacity Disk Drive
4. Mini-Flexible Disk Drive (Unit 0)

Type 3 AutoLoad

1. Paper Tape Reader (high-speed or teletypewriter)
2. Floppy Disk Drive

Type 4 AutoLoad

1. Paper Tape Reader (high-speed or teletypewriter)
2. Mini-Flexible Disk Drive (Unit 0)

The AutoLoad program initially tests the device with the highest polling sequence. If the device is in a ready state, the AutoLoad program loads from it. If the device is not installed or is not ready for loading, loading is attempted from the device with the next highest polling sequence. After loading is attempted from all devices, the AutoLoad program tries the first device again. If the first device is not in a ready state, the AutoLoad program continues trying devices until a device in a ready state is found. A magnetic tape is in a ready state only when it is at load point.

NOTE

AutoLoad types 2, 3, and 4 expect a papertape reader PICOPROCESSOR on Channel 5 and a Mini-floppy PICOPROCESSOR on Channel 6. Other PICOPROCESSORS attached to Channels 5 or 6 cause AutoLoad failures.

### SECTION 3. INITIALIZATION PROCEDURES

The NAKED MINI® 4 AutoLoad is initiated manually from a programmer's console, remote console or operator's console.

- PROGRAMMER'S CONSOLE--The Programmer's Console is a full-function console. The Console allows the user to read data from or write data to selected registers and memory locations and to establish the operating mode of the processor. (Figure 3-1)
- REMOTE PROGRAMMER'S CONSOLE--The Remote Programmer's Console uses the Operator's Console as an interface to the CPU and provides the same features as the Programmer's Console. (Figure 3-2)
- OPERATOR'S CONSOLE--The Operator's Console is a minimum-function console that is intended for "turn-key" applications. The Console switches allow an operator to initiate or stop an operation. (Figure 3-3)

### 3.1 INITIATION FROM PROGRAMMER'S CONSOLE OR REMOTE CONSOLE

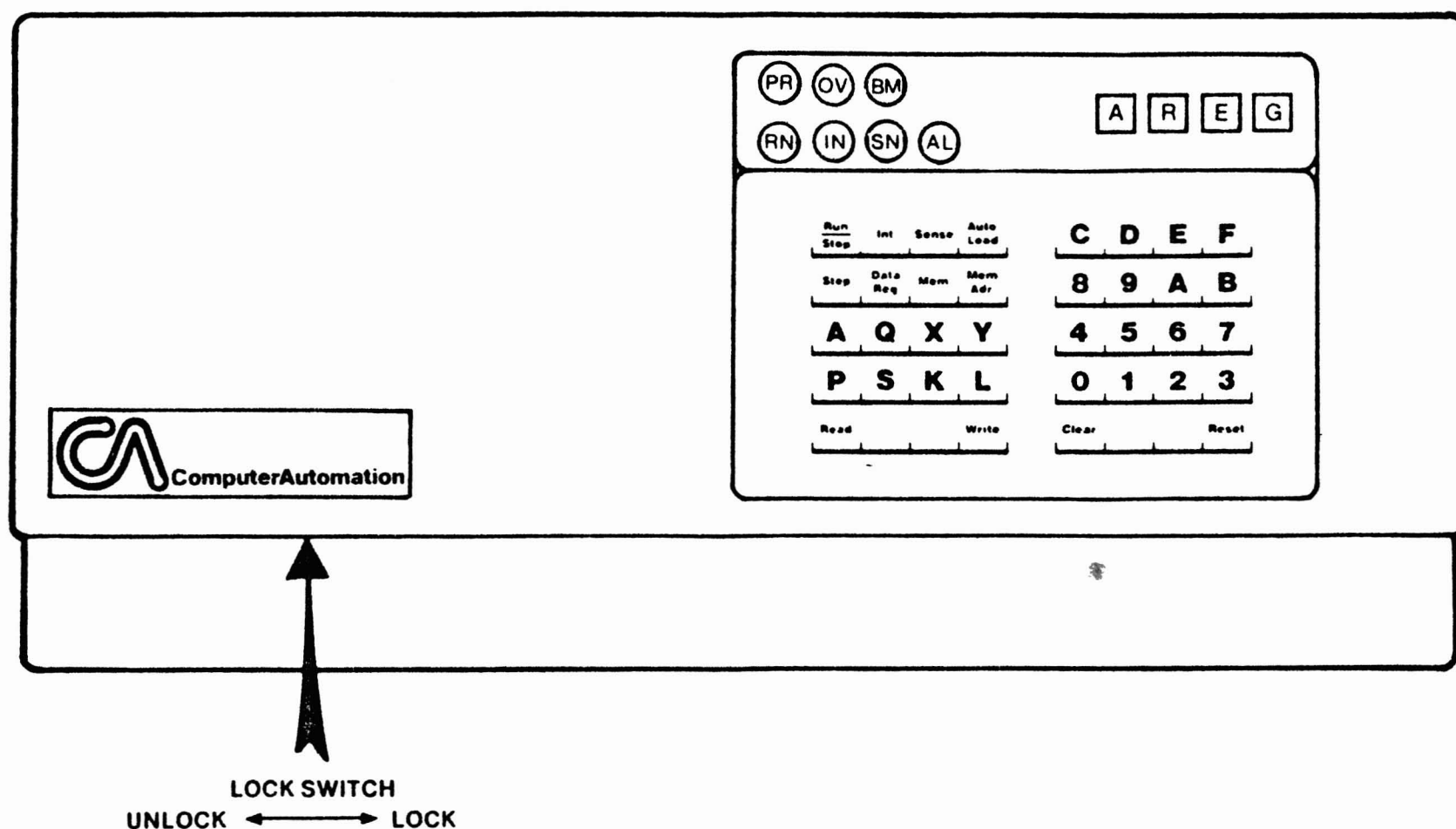


Figure 3-1. Programmer's Console

The following procedure is used to initiate the NAKED MINI® 4 AutoLoad program from the programmer's console or remote console:

1. Slide the CONSOLE LOCK switch to the unlock position.
2. If the RUN indicator light is on or if the display shows "IDLE", press the RUN/STOP switch. This action halts the computer, turns off the RUN indicator light, and RUN/STOP begins console operation.
3. Press the RESET switch to clear the computer. The display shows "RST".
4. If relocation of addresses is required, enter the relocation bias into the Q Register using the procedure below. This bias adds to any relocation bias in the program being loaded. The procedure is:
  - a. Press the CLEAR switch to clear the Console Data Register.

- b. Use the hexadecimal entry keyboard to enter the relocation bias into the Console Data Register putting the most-significant hex digit first.
  - c. Press the Q key. As the key is pressed, the display shows "QREG".
  - d. Press the WRITE switch. While pressed, the display again shows "QREG".
5. Indicate the input device for loading by selecting the SENSE indicator setting combined with the proper Console Data Register entry. The SENSE indicator and the Console Data Register combinations for the different input devices are shown in Table 3-1.

Table 3-1. Input Device Selection Table

| INPUT DEVICE<br>FROM WHICH LOADING IS<br>TO OCCUR  | SENSE INDICATOR<br>SETTING | MODES TO BE ENTERED<br>IN THE<br>CONSOLE DATA REGISTER |                |
|----------------------------------------------------|----------------------------|--------------------------------------------------------|----------------|
|                                                    |                            | LOAD                                                   | LOAD & EXECUTE |
| First Available Device                             | On                         | N/A                                                    | N/A            |
| Paper Tape Reader*, absolute                       | Off                        | :0002                                                  | :0003          |
| Paper Tape Reader, relative                        | Off                        | :0000                                                  | :0001          |
| Magnetic Tape*, unit 0                             | Off                        | :0008                                                  | :0009          |
| Floppy Disk*, unit 0                               | Off                        | :0006                                                  | :0007          |
| High Capacity Disk*, unit 0                        | Off                        | :0004                                                  | :0005          |
| Medium Capacity Disk*,<br>unit 0, fixed platter    | Off                        | :0004                                                  | :0005          |
| Medium Capacity Disk,<br>unit 0, removable platter | Off                        | :000A                                                  | :000B          |
| Mini-Floppy Disk*, Unit 0                          | Off                        | :000C                                                  | :000D          |
| Mini-Floppy Disk, Unit 1                           | Off                        | :000E                                                  | :000F          |

\*Applies to "first available device" mode

To load the Console Data Register:

- a. Press the CLEAR switch to clear the Console Data Register.
- b. Use the hexadecimal entry keyboard to enter the Mode Select code into the Console Data Register putting the most-significant hex digit first.

- c. Press the DATA REG switch. As the switch is pressed, the display shows "DATA".
- d. Press the WRITE switch. While pressed, the display again shows "DATA".
6. Prepare the input device. If a magnetic tape unit is used, make sure the tape is at load point because the AutoLoad program does not rewind the tape.
7. Press and release the AUTOLOAD switch to initiate the AUTOLOAD function. The display shows "AUTO".
8. Press and release the RUN/STOP switch to initiate the AutoLoad program. The AutoLoad indicator light illuminates.

During the AutoLoad program operation, the display shows the contents of the Console Data Register. When the load operation is completed, the AutoLoad indicator turns off. The Extended Addressing (XA) bit of the Status Register, Bit 6, is reset to logic 0, and the Y Register contains the value :0040.

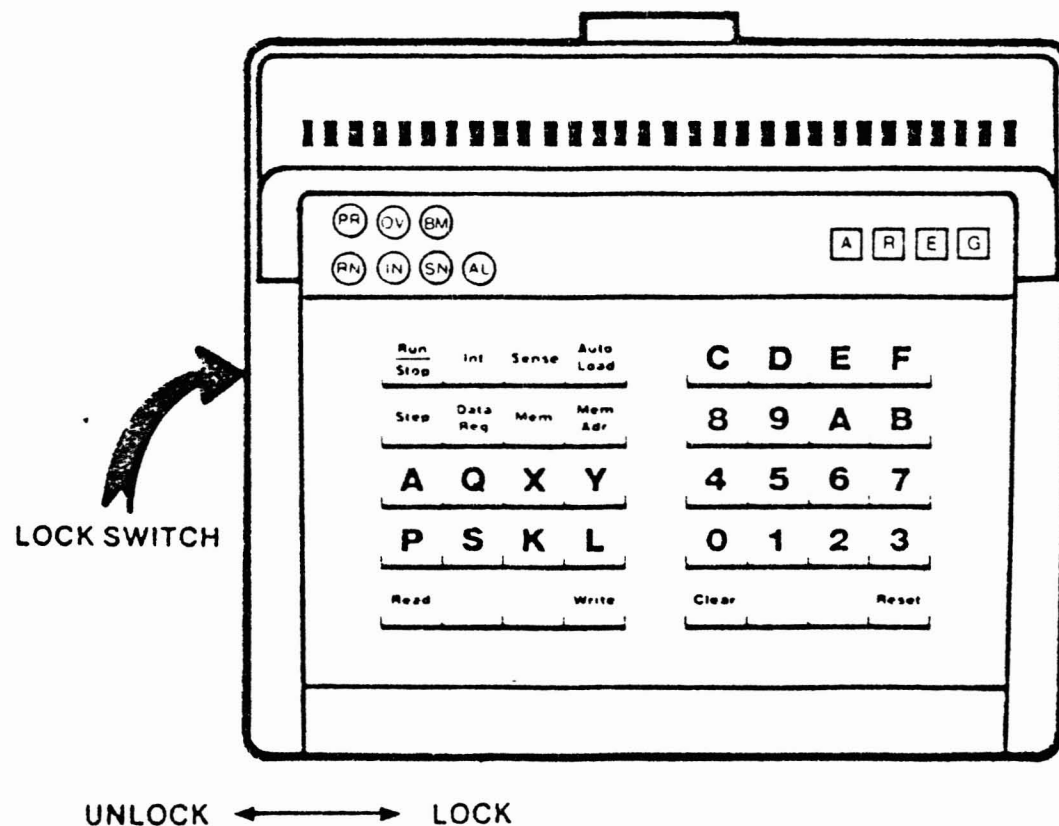


Figure 3-2. Remote Console

### 3.2 INITIATION FROM OPERATOR'S CONSOLE

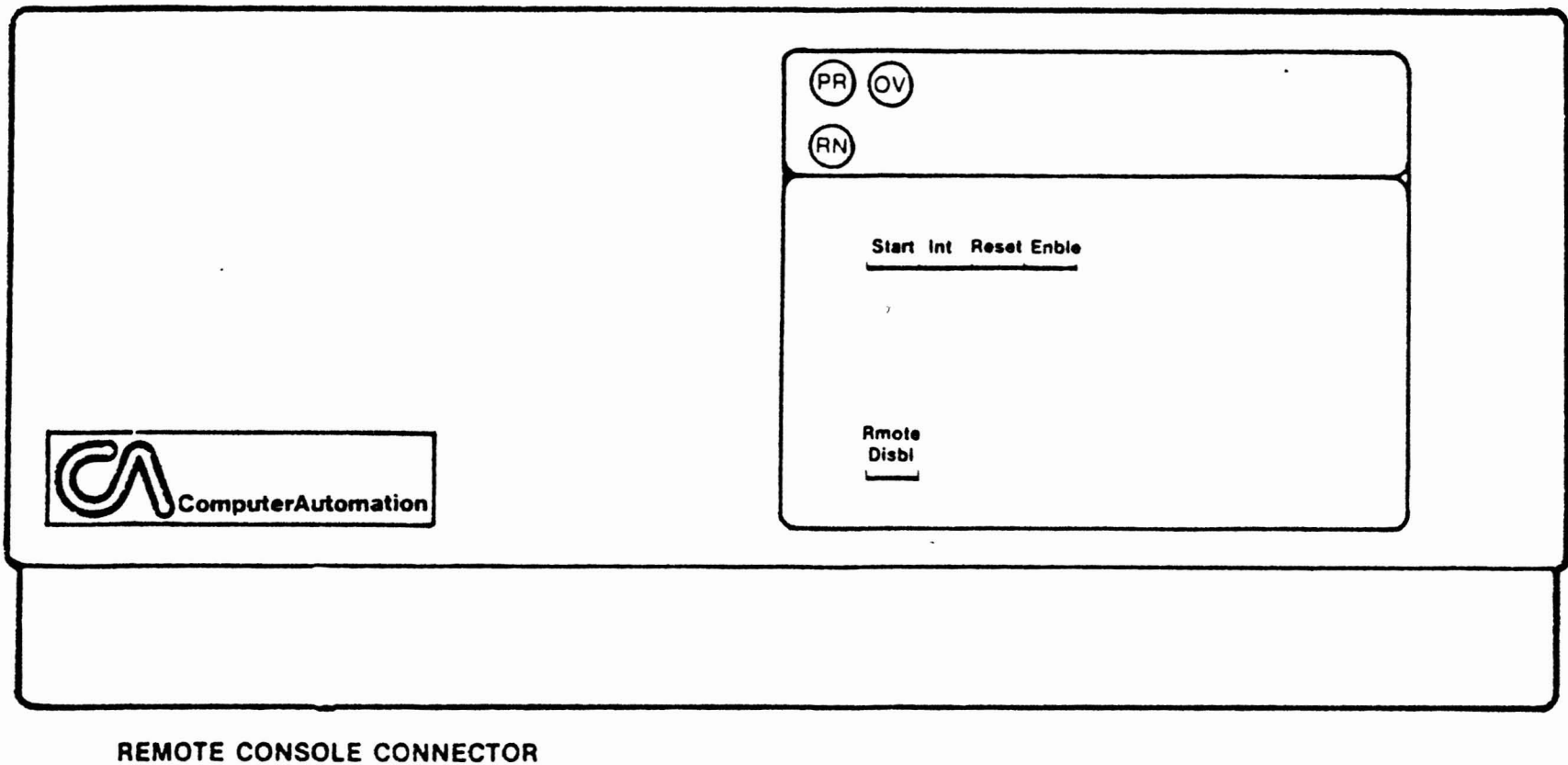


Figure 3-3. Operator's Console

The following procedure is used to initiate the NAKED MINI® 4 AutoLoad program from the Operator's Console:

1. While pressing the ENABLE switch, press the RESET switch to clear the computer.
2. Prepare the desired input device; make sure that no other devices are in a ready state.
3. While pressing the ENABLE switch, press the START switch to initiate AutoLoad.

Pressing the START switch initiates absolute loading in "first available device" mode, followed by automatic execution of the loaded program. The Operator's Console limitations do not permit a user to alter the contents of the Console Data Register, the SENSE indicator, or the Q Register.

### 3.3 INITIATION WITHOUT CONSOLE

The AutoLoad program can be initiated externally. The reference manuals listed in Section 1 provide the information necessary to initiate the AutoLoad program in this manner.

