Executed in a Program:

Function keys may be executed as instructions in a program. Some function keys that are most often used in or are unique to programming applications are shown below:

- **PAUSE** Stops program execution for approximately 1 second, displays contents of X-register, then resumes program execution.
- **X<>Y** Swaps values in X and Y registers.
- **X<->Y** Swaps values in X and Y registers.
- **X<>Y** X<->Y X=Y X=Y X<Y X>Y X<0 X>0 X<0 X<>0
- **Conditional** Each tests value in X-register against 0 or value in Y-register as indicated. If true, calculator executes instruction in next line of program memory. If false, calculator skips one line before resuming execution.

- **RTN** Return. Halts program execution and returns control to the keyboard unless executed as a result of a **GSB** instruction. In this case, the calculator returns to the line after the **GSB** instruction and continues execution.

**Line 00.** If program control goes to line 00, either as a result of a **GTO** or by incrementing from line 49, calculator stops execution unless in a subroutine. In this case the calculator executes a **RTN** and continues execution at the line number after the **GSB**.

- **R/S** Run/stop. Stops program execution.
- **GTO** Go to. Followed by line numbers 00-49 causes calculator to go to designated line and begin execution there.
- **GSB** Go to subroutine. Followed by line numbers 01-49 causes calculator to go to designated line and execute that section of program memory as a subroutine. Subroutines can be nested up to three levels deep.

**ERROR MESSAGES**

- **Error 0:** Illegal argument to math routine.
- **Error 1:** Storage register overflow.
- **Error 2:** Storage register arithmetic to nonexistent storage register.
- **Error 3:** Improper statistical operation.
- **Error 4:** **GTO** or **GSB** to an illegal number.
- **Error 9:** Self check failure.
- **Pr Error:** Continuous memory cleared by power failure (HP-33C only).
\[
\text{STO} \to n \quad x \text{ value subtracted from contents of } R_n \text{ and difference stored in } R_n.
\]
\[
\text{STO} + n \quad x \text{ value added to contents of } R_n \text{ and sum stored in } R_n.
\]
\[
\text{STO} \times n \quad x \text{ value multiplied by contents of } R_n \text{ and product stored in } R_n.
\]
\[
\text{STO} \div n \quad \text{Contents of } R_n \text{ divided by } x \text{ value and quotient stored in } R_n.
\]

### Programming the HP-33E/33C

#### PROGRAM MEMORY

When the calculator is switched ON, program memory is filled with `GTO 00` instructions (keycode 13 00).

00 ▲ Automatic stop instruction.
01- 13 00
02- 13 00
03- 13 00
\vdots \vdots
46- 13 00
47- 13 00
48- 13 00
49- 13 00 ▲49 lines for your programs.

#### PROGRAM MODE

\[
\text{PRGM \[RUN}
\]

In program mode, only the following functions are active. All other functions are loaded into program memory when pressed.

- `GTO .nn` sets calculator to line nn of program memory.
- `STT` single step. Steps calculator forward one line in program memory.
- `BST` back step. Steps calculator back one line in program memory.
- `f CLEAR PRGM` clears program memory to line 00.
- `f CLEAR PREFIX` clears program memory to all `GTO` 00 instructions, sets calculator to line 00.

#### RUN MODE

\[
\text{PRGM \[RUN}
\]

Pressed From the Keyboard:

- `GTO .nn` sets the calculator to line nn of program memory.

- `GTO` followed by line number 00-49 causes calculator to go to designated line and stop there.
- `GSB` followed by line number 01-49 causes calculator to go to the line designated and begin execution from that line.
- `RTN` sets calculator to line 00 of program memory.
- `R/S` begins execution from current line of program memory. Stops execution if program is running.
- `F CLEAR PRGM` clears program. Acts same as `RTN`. Does not clear program when in RUN mode.

Some functions that are active in PROGRAM mode operate differently in RUN mode:

- `STT` single step. Displays line number and keycode of current line of program memory when held down; executes current instruction, displays result, and moves to next line when released. Used for single-step execution of program.
- `BST` back step. Moves to previous line and displays line number and keycode of that previous line of program memory when \text{BST} is held down; displays original contents of X-register when released. No instructions are executed.