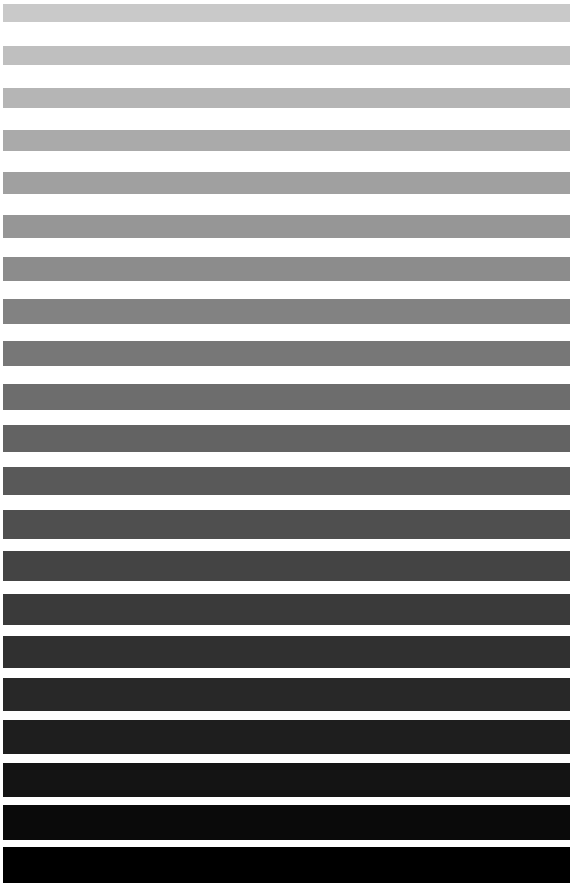
DENSO ROBOT

SUPPLEMENT

Main Software Enhancement (Version 1.7)

Ver.1.7 or later

Main Software Enhancement



This chapter describes "Main software enhancement provided in Version 1.7”.

Contents

Main Software Enhancement

Software PLC (Supervisory Task) [Ver. 1.7 or later]

1 Outline of Software PLC

System software version 1.7 newly supports programmable logic control software (software PLC) that runs as a supervisory task. The software PLC enables the robot controller to centralize control of an entire facility.

If defined as a supervisory task, a task program written in PAC can keep running independently of normal task programs and operation modes. You may define ten supervisory tasks (TSR0.PAC to TSR9.PAC) and operate them with the system software version 1.7 or later. It is useful to define programs described below as supervisory tasks.

For safety, names of supervisory tasks are restricted to TSR0.PAC to TSR9.PAC and any motion-control programs are prohibited in supervisory tasks.

Use the following as supervisory tasks:

(1) Customizing operation screens on the teach pendant, which can contain up to 500 buttons and 50 screens (Refer to the PROGRAMMER'S MANUAL, "Customizing TP Operation Screens.")

(2) Writing programs for automatic recovery process to be followed if an error occurs in facilities or robots

(3) Controlling facilities (As an alternative of sequencer for facility scale of 200 I/O points and approx. 100 steps in a rudder command)

Supervisory tasks feature:

(1) Written in PAC language. (Up to 10 programs may be defined and their names. are fixed to TSR0.PAC to TSR9.PAC.)

(2) Arithmetic/logical operation commands, I/O get commands, program control commands only executable.

(3) Highest priority (101) over all other normal task programs (whose priority will be automatically changed to 102 or more)

(4) Limited occupation time frame (Uses 2 ms every 8 ms).

Supervisory task start condition parameters

(1) Supervisory task enable/disable parameter

"Not Use Supervisor TASK" or "Use Supervisor TASK" in the Supervisor TASK Setting window

(2) INIT run mode parameter, whether or not to involve motor on and CAL

"INIT:(not [MOTOR ON + CAL])" or "INIT:(MOTOR ON + CAL)" in the INIT Setting window

(3) External speed parameter (10 or 100) for INIT run mode

"INIT Set SPEED 10" or "INIT Set SPEED 100" in the INIT Setting (SPEED) window

Starting supervisory tasks

Supervisory tasks may be started by any of the following operations or events provided that:

- the supervisory task mode has been enabled (by selecting the "Use Supervisor TASK" in the Supervisory TASK Setting window) and
- any supervisory task program (TSR0 to TSR9) exists.

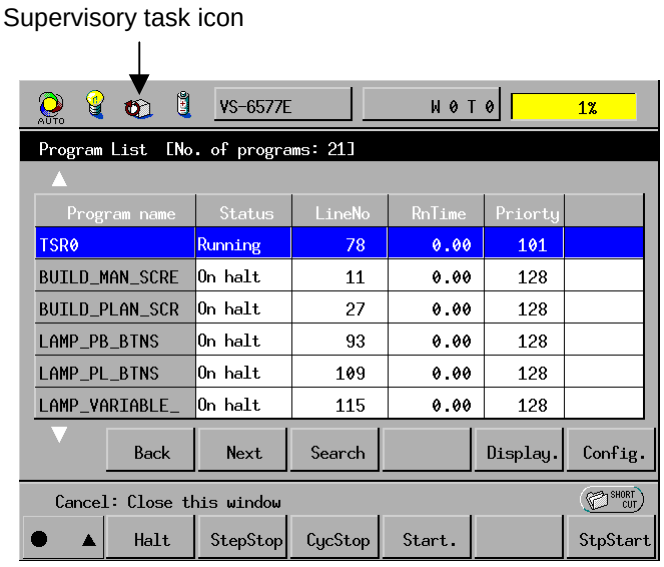
(1) Turning the robot controller on

(2) Switching the operation mode from Manual to Auto

(3) Pressing the [F1 START] in the Supervisor TASK Setting window

(4) Selecting and starting a supervisory task in the Program List window in Auto or Teach Check mode

If a supervisory task is initiated, the supervisory task icon will appear in the task bar as shown below.



Terminating supervisory tasks

Supervisory tasks will terminate if any of the following events occurs:

(1) Turning the robot controller off
(2) Pressing the [F6 STOP] in the Supervisor TASK Setting window
(3) Loading or compiling a project
(4) Error in a supervisory task itself
(5) Level 4 error or higher one
(6) Reading or writing from/onto a floppy disk
(7) Receiving a file from WINCAPSII
(8) Making the supervisory task mode inactive to delete it from optional features

Supervisory task commands

(1) `INIT` (Initialize the robot controller)

This command may turn the motor power on and execute CAL depending upon the INIT run mode setting.

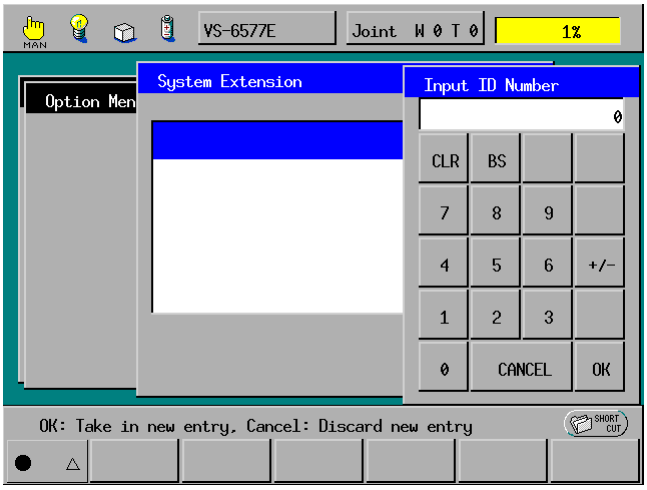
2 Using Supervisory Tasks

[1] Making the supervisory task mode active

The supervisory task mode is an optional feature, so you need to make it active according to the procedure given below.

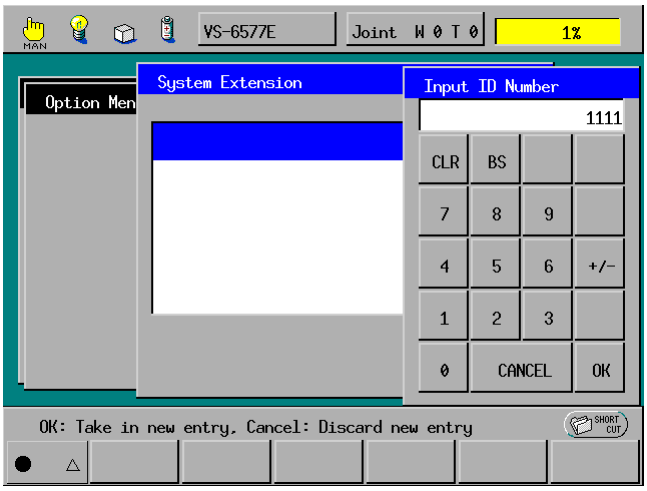
(1) Calling up the System Extension window

Access: [F6 Set]—[F7 Options.]—[F8 Extnsion]—[F5 Input ID] from the top screen of the teach pendant

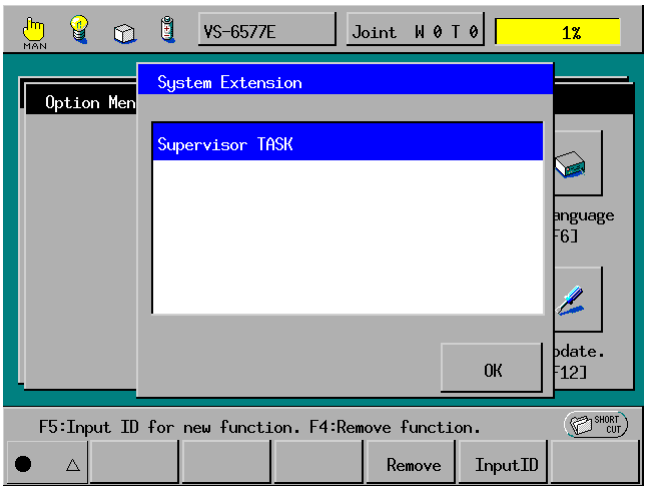


(2) Adding a supervisory task mode

Enter "1111" from the numeric keypad.



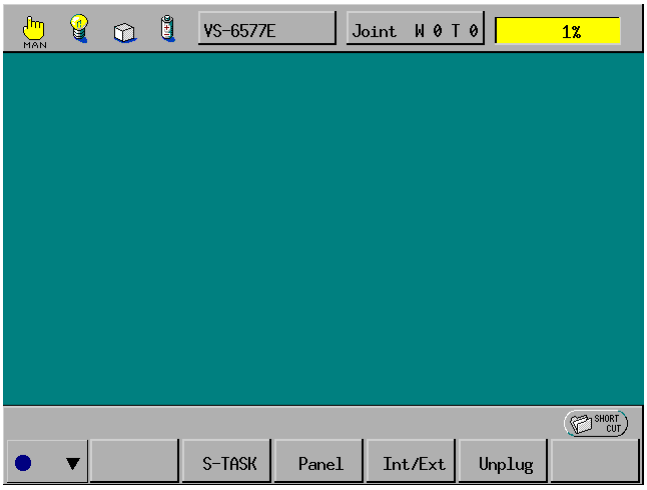
Press the OK button. The supervisory task mode will be added.



(3) Restarting the robot controller

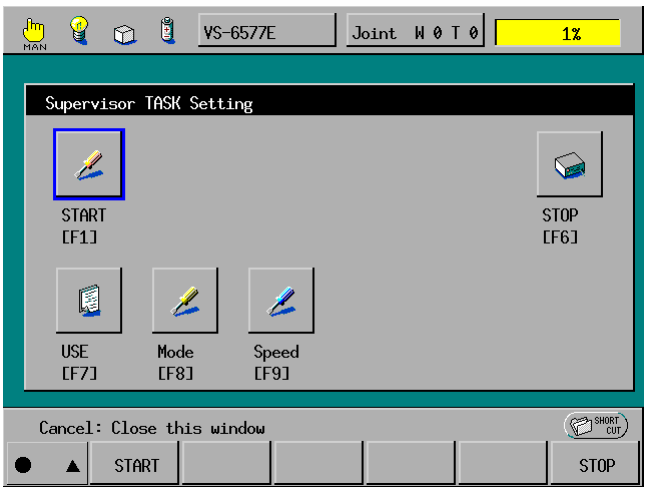
Turn the controller off and then on. The supervisory task mode becomes active and you may make supervisory task settings.

On the top screen, press the SHIFT key and check that the S-TASK is displayed in F8 of the menu bar.



F8

Press [F8 S-TASK]. The Supervisor TASK Setting window appears as shown below.



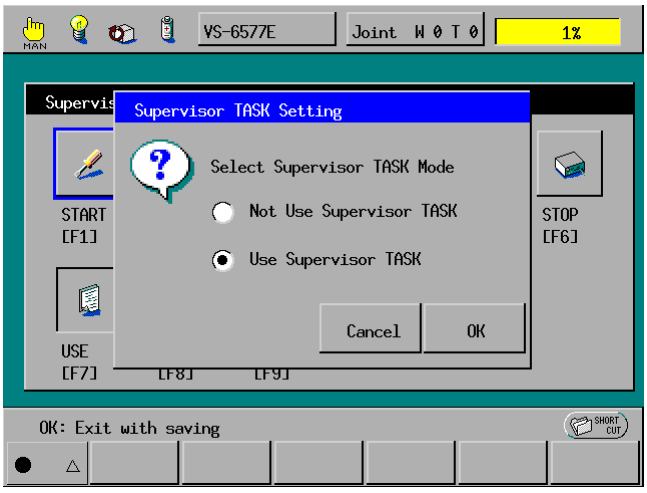
[2] Setting supervisory task parameters

(1) Supervisory task enable/disable parameter

This parameter enables or disables the supervisory task mode.

Access: [F8 S-TASK]—[F7 USE] from the top screen of the teach pendant

In the Supervisor TASK Setting window shown below, choose the desired setting and press the OK. To make no change, press the Cancel.

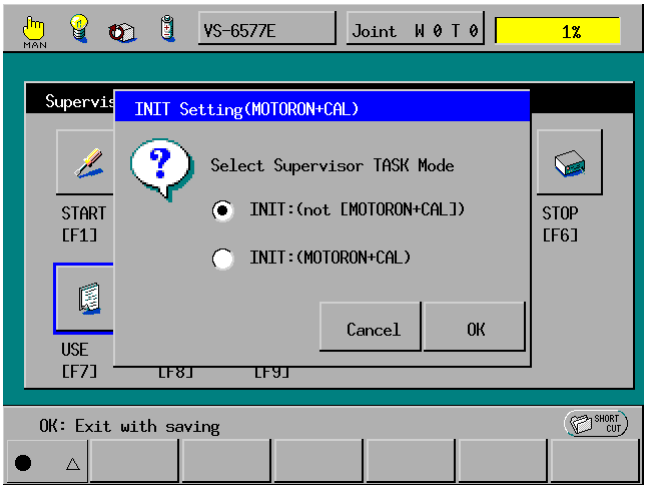


(2) INIT execution mode parameter

This parameter specifies whether or not the execution of the INIT command will involve turning on motors and performing CAL.

Access: [F8 S-TASK]—[F8 Mode] from the top screen of the teach pendant

In the INIT Setting (MOTOR ON + CAL) window shown below, choose the desired setting and press the OK. To make no change, press the Cancel.

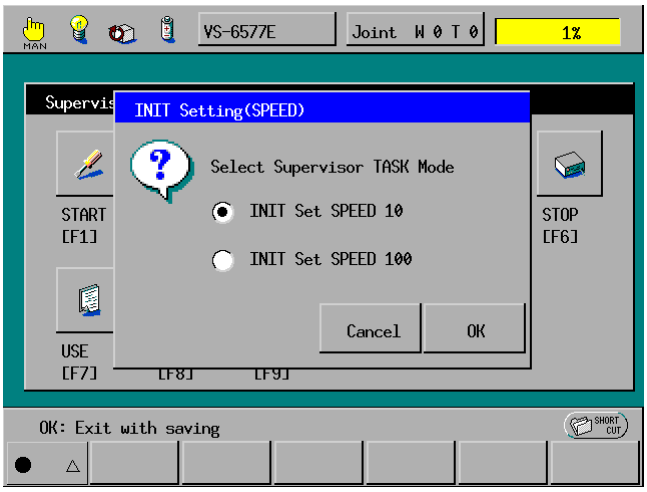


(3) INIT external speed parameter

This parameter determines whether the external speed will be 10 or 100 at execution of INIT command.

Access: [F8 S-TASK]—[F9 Speed] from the top screen of the teach pendant

In the INIT Setting (SPEED) window shown below, choose the desired setting and press the OK. To make no change, press the Cancel.



[3] Starting supervisory tasks

Turn the robot controller on.

Supervisory tasks will start automatically provided that:

- the supervisory task mode has been enabled by selecting the "Use Supervisor TASK" in the Supervisory TASK Setting window and
- any supervisory task program (TSR0 to TSR9) exists.

NOTE: Under the above conditions, supervisory tasks will be started even in Manual or Teach Check mode.

To start no supervisory task, turn the controller on while holding down the deadman switch.

Switch the operation mode from Manual to Auto from the teach pendant or an external I/O.

Supervisory tasks will start automatically provided that:

- the supervisory task mode has been enabled by selecting the "Use Supervisor TASK" in the Supervisory TASK Setting window and
- any supervisory task program (TSR0 to TSR9) exists.

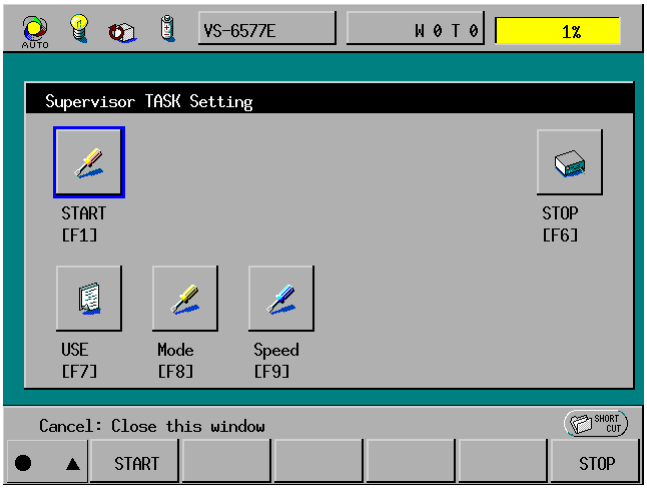
Switching the operation mode from an external I/O when the controller is placed in the external mode will also start supervisory tasks. Before doing this, make sure that no normal programs are running.

NOTE: Switching to Auto mode by using Enable Auto signal and Robot Error Clear signal will also start supervisory tasks.

Press the START button in the Supervisor TASK Setting window.

From the top screen of the teach pendant, choose [F8 S-TASK]—[F1 START] under the following conditions:

- the supervisory task mode has been enabled by selecting the "Use Supervisor TASK" in the Supervisory TASK Setting window and
- any supervisory task program (TSR0 to TSR9) exists.



Select and start a supervisory task in the Program List window in Auto or Teach Check mode.

From the Program List window, choose a desired supervisory task program(s) (TSR0 to TSR9) and start it, provided that any supervisory task program(s) exists.

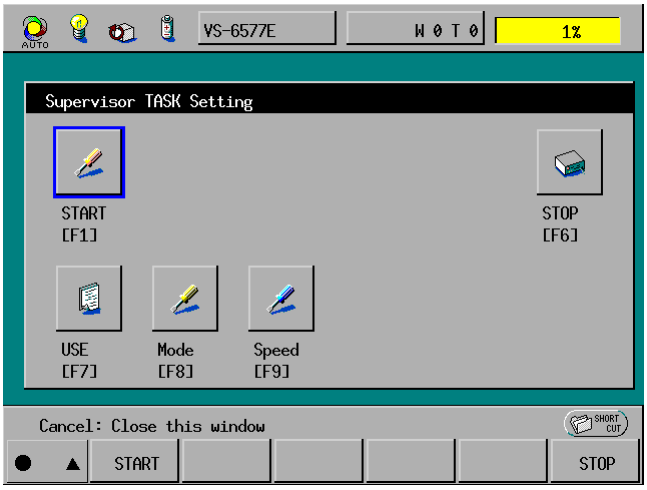
[4] Terminating supervisory tasks

If any of the following operations takes place or any of the following errors occurs when a supervisory task program is running, then the supervisory task will terminate.

Turn the robot controller off

Press the STOP button in the Supervisor TASK Setting window

Access: [F8 S-TASK]—[F6 STOP] from the top screen of the teach pendant



Load or compile a project

Access: [F6 Set]—[F1 Load!] from the top screen of the teach pendant

or

Access: [F1 Program]—[F6 Aux.]—[F12 Compile] from the top screen of the teach pendant in Manual mode

Error in a supervisory task itself

If any error occurs in a supervisory task itself, the supervisory task currently running will terminate.

Level 4 error or higher one

If an error at level 4 or above occurs in supervisory tasks, normal tasks, or robot controller system, then the supervisory task currently running will terminate.

Read or write from/onto a floppy disk

Reading data stored in a floppy disk to the robot controller or writing data stored in the robot controller to a floppy disk will terminate the currently running supervisory task.

Access: [F6 Set]—[F3 FD.]—[F1 Read.] from the top screen of the teach pendant

Access: [F6 Set]—[F3 FD.]—[F2 Write.] from the top screen of the teach pendant

Receive a file from WINCAPSII

Receiving an execution file or parameters from WINCAPSII will terminate the supervisory task currently running.

Make the supervisory task mode inactive to delete it from optional features

Access: [F6 Set]—[F7 Options.]—[F8 Extnsion]—[F4 Remove] from the top screen of the teach pendant

Note that the supervisory task setting remains enabled.

3 Restrictions on the Use of Supervisory Tasks

The purpose of a supervisory task is to centralize control of an entire facility. It involves placing some restrictions on the use of it.

[1] Restrictions on the normal program operation

(1) No motion commands or vision commands are executable in a supervisory task. To execute those commands, make a user program containing them and run it as a supervisory task.

(2) A supervisory task may support robot stop and start commands, but not support Temporary stop, Instantaneous stop, Step stop, or Break point stop. It also ignores the SUSPEND command.

(3) If you want to start a supervisory task only when the robot controller is turned on, then use internal I/Os to bypass the overlapped initiation of the supervisory task.

(4) If a supervisory task is started by any other supervisory task, then no priority options or cycle options are supported. This means that these supervisory tasks may conflict with each other.

(5) A supervisory task is so designed that it cannot be self-started repeatedly. To repeat it, use loop commands.

(6) In Teach Check mode, releasing the deadman switch will not stop running supervisory tasks.

(7) A supervisory task does not support Step check or Step back.

(8) A HOLD command for a supervisory task will be ignored.

(9) A normal task cannot manage any supervisory task by using KILL or SUSPEND command or other means.

(10) During execution of a supervisory task, you may make vision board settings. However, it may block the operation of the supervisory task.

(11) If an error occurs or an emergency stop signal is inputted, a supervisory task cannot run any normal task.

[2] Rules for using a supervisory task

(1) Avoid using the following commands in a loop to repeat them in a supervisory task. Otherwise, the supervisory task itself may not terminate. This is because a supervisory task has higher priority over normal task programs.

INIT, RUN, KILL, SUSPEND commands

(2) Avoid simultaneous execution of RUN and SUSPEND commands or that of RUN and KILL commands to a same program in a supervisory task. Doing so may freeze the robot system, skip a Stop command, or cause any other failures. To recover from such states, you need to restart the robot controller.

(3) If a semaphore (priority order) is specified in a supervisory task, there is a possibility that a lower priority task may get a semaphore. This is because using a semaphore may cause a supervisory task to lose highest priority 101.

(4) If a supervisory task that repeats normal tasks runs, then mode switching from the external equipment may become no longer possible.

To recover from such states, stop the supervisory task from the teach pendant.

To prevent such states,

- design programs so that they will conditionally start according to Auto mode or External mode, or
- design a supervisory task itself so that it will be terminated from external input.

Starting a user program during switching to External mode may issue an alarm. Correct the program so that it will conditionally start according to the mode, just as above.

[3] Rules for a supervisory task mode not in use

When a supervisory task mode is not in use, programs named TSR0 to TSR9 execute as normal task programs. To debug supervisory task programs, therefore, disable a supervisory task mode and use Teach Check mode or Break Point function.

4 Supervisory task commands

INIT

Function

Turns on motors, carrier out CAL, and sets the speed according to the preset supervisor task parameters.

Syntax

```
INIT
```

Descriptions

(1) If the supervisor task mode is disabled ("Not Use Supervisor TASK" parameter is selected), then the `INIT` command causes no operation.

(2) If the supervisor task mode is enabled ("Use Supervisor TASK" parameter is selected), then the `INIT` command causes the following:

When the INIT run mode is set to "without motor on and CAL":

If the INIT speed has been set to 10 or 100, this command sets the external speed of the robot controller to 10 or 100, respectively.

When the INIT run mode is set to "with motor on and CAL":

If the INIT speed has been set to 10 or 100, this command sets the external speed of the robot controller to 10 or 100, respectively, turns motors on and carries out CAL.

Example

```
'!TITLE "Initialization"
PROGRAM TSR1
      INIT                    'Turn motors on, execute CAL,
                              'and set the speed.
END
```

Notes

(1) Do not concurrently run robot motion programs and supervisory task programs that run only INIT commands. Doing so will enter the system in an infinite loop.

(2) During execution of an INIT command, the status display of running programs may show " On standby." Be careful with restart of those programs.

(3) Do not run INIT commands simultaneously in more than one supervisor task.