

Watchpoint Maintenance

A watchpoint causes the execution of a Natural object to be interrupted whenever the value of a variable changes. In addition, you can make the interruption dependent on a condition related to a specific variable value as described under Watchpoint Operators (Set Watchpoint) below.

The use of watchpoints allows you to detect unintended alterations of variables caused by objects that contain errors.

A variable is considered to have changed either when its current value differs from the value recorded when the watchpoint was last triggered or when it differs from the initial value. Comparative validation of watchpoint values is restricted to a field length of 253 bytes. For large variables that exceed the maximum length, only the first 253 bytes are used in the comparison.

A watchpoint is defined by specifying the name of the Natural object or GDA (global data area) to be processed and the local or global variable it is to refer to.

The unique identifier for a breakpoint is the Spy Number as assigned by the Natural Debugger.

Once a watchpoint has been specified, it remains set for the entire Natural session, unless you delete it.

Below is information on:

- Invoke Watchpoint Maintenance
 - Activate Watchpoint
 - Deactivate Watchpoint
 - Delete Watchpoint
 - Display Watchpoint
 - Modify Watchpoint
 - Set Watchpoint
-

Invoke Watchpoint Maintenance

 **To invoke the Watchpoint Maintenance menu**

- On the Debug Main Menu, enter Function Code **W**.
Or enter the direct command **WM**.

The Watchpoint Maintenance menu provides the following functions:

- Set Test Mode ON/OFF
(see the relevant section)
- Activate Watchpoint
- Deactivate Watchpoint
- Delete Watchpoint
- Display Watchpoint
- Modify Watchpoint
- Set Watchpoint

Activate Watchpoint

 **To set the current state of specified watchpoints to "active"**

- On the Watchpoint Maintenance menu, enter Function Code **A**, an object name and a variable name.
Or enter the direct command `ACTIVATE WATCHPOINT object and variable`
(see also the syntax of `ACTIVATE` in Command Summary and Syntax).

If you do not specify an object or a variable (or leave the default asterisk in the field Variable), **all** watchpoints are activated.

Deactivate Watchpoint

▶ **To set the current state of specified watchpoints to "inactive"**

- On the the Watchpoint Maintenance menu, enter Function Code **B**, an object name and a variable name.
Or enter the direct command `DEACTIVATE WATCHPOINT object and variable`
(see also the syntax of `DEACTIVATE` in Command Summary and Syntax).

If you do not specify an object name or a variable (or leave the default asterisk in the field Variable), **all** watchpoints are deactivated.

Delete Watchpoint

▶ **To delete specified watchpoints**

- On the Watchpoint Maintenance menu, enter Function Code **C**, an object name and a variable name.
Or enter the direct command `DELETE WATCHPOINT object and variable`
(see also the syntax of `DELETE` in Command Summary and Syntax).

If you do not specify an object name or a variable (or leave the default asterisk in the field Variable), **all** watchpoints are deleted.

Display Watchpoint

▶ **To display specified watchpoints**

- On the Watchpoint Maintenance menu, enter Function Code **D**, an object name and/or a variable name.
Or enter the direct command `DISPLAY WATCHPOINT object and/or variable`
(see also the syntax of `DISPLAY` in Command Summary and Syntax).

If a unique watchpoint has been specified, the Display Watchpoint screen appears and all specifications of this watchpoint are displayed. The Display Watchpoint screen is identical to the Modify Watchpoint screen. For an explanation of the fields, see Display/Modify Watchpoint Screen below.

If no unique watchpoint has been specified, a list displays all watchpoints set for the current environment.

On the list, you can activate, deactivate, display, modify or delete a watchpoint by marking it with the line command AC, DA, DI, MO or DE respectively.

If you want to know whether, or what kind of, a condition for the watchpoint to be activated has been specified, you can display the corresponding value and watchpoint operator (see below) by choosing either PF10 (if you want to display the value in alphanumeric format) or PF11 (if you want to display the value in hexadecimal format). PF22 takes you back to the Display Watchpoint screen.

If you do not specify an object name or a variable (or leave the default asterisk in the field Variable), **all** watchpoints are displayed.

Modify Watchpoint

▶ To modify specified watchpoints

- On the Watchpoint Maintenance menu, enter Function Code **M**, an object name and a variable name. Or enter the direct command `MODIFY WATCHPOINT object and a variable name` (see also the syntax of `MODIFY` in Command Summary and Syntax).

If a unique watchpoint has been specified, the Modify Watchpoint screen (see below) appears and the watchpoint specifications can be modified. The Modify Watchpoint screen is identical to the Display Watchpoint screen. For an explanation of the fields, see Display/Modify Watchpoint Screen below.

If no unique watchpoint has been specified, a list displays all watchpoints set for the current environment. On the list, you can activate, deactivate, display, modify or delete a watchpoint by marking it with the line command AC, DA, DI, MO or DE respectively.

If you want to modify the condition for the watchpoint to be activated, you can modify the corresponding value and watchpoint operator (see below) by choosing either PF10 (if you want to modify the value in alphanumeric format) or PF11 (if you want to modify the value in hexadecimal format). PF22 takes you back to the Modify Watchpoint screen (see Display/Modify Watchpoint Screen below).

- On the Modify Watchpoint screen (see Display/Modify Watchpoint Screen below), choose PF3/Exit or PF5/Save to save any modification. If you choose PF12/Canc, the watchpoint remains unchanged.

If you do not specify an object name or a variable (or leave the default asterisk in the field Variable), **all** watchpoints are displayed for selection and modification.

Below is information on:

- Display/Modify Watchpoint Screen

Display/Modify Watchpoint Screen

Field	Explanation
Spy Number	A unique number assigned by the Natural Debugger when setting the watchpoint.
Initial State	Specifies the initial state of the watchpoint: active or inactive. Default: active
Watchpoint Name	The name of the watchpoint. The default name for watchpoints is the name of the variable concerned. Names that exceed the field size will be truncated after 12 characters. Valid input: range from 1 to 12 characters.
Object Name	The name of an object available in the current library or one of its steplibs.
Variable Name	The name of a user-defined, global or system variable. If the variable is part of a structure, it may be prefixed by the structure name. For an array, an index description has to be specified (watchpoints can be defined for single elements only). Use Asterisk (*) notation for a selection list of variables. See also Variable Maintenance for further details.

Skips before Execution	Determines that the watchpoint is not to be executed until the condition set for the watchpoint has been fulfilled (see also Watchpoint Operators below). Valid input: range from 0 (default) to 32767.
Max Number Executions	Any value greater than zero (0) determines the maximum number of watchpoint executions. Valid input: range from 0 (default) to 32767.
Number of Activations	Indicates how many times the watchpoint condition for the variable was met as specified with the watchpoint operator (see below). The counter is reset when a program is started at Level 1.
Persistent	Marks a watchpoint as persistent. Persistent watchpoints are not restricted to the Natural object for which they are defined, but apply additionally to all subordinate program levels. Persistent watchpoints only make sense for variables that are passed to a subprogram "by reference" and not BY VALUE RESULT: see the relevant parameter description in CALLNAT, Parameters - operand2, in the Natural Statements documentation. Restriction: Persistent watchpoints are not allowed for variables defined in a parameter or context clause. Valid input: Y (Yes) or N (No). Default: N.
Act. Level	Refers to Persistent above. Indicates the program level at which a persistent watchpoint was activated automatically.
Commands	Up to six debug commands. Enter one command per line. For a summary of all available commands, see Command Summary and Syntax. Attention: If you delete the command BREAK and you do not enter any command that issues a dialog, there is no way for the Natural Debugger to receive control during program interruption.

Set Watchpoint

To add a watchpoint to a session

- On the Watchpoint Maintenance menu, enter Function Code **S**, an object name and a variable name.
Or enter the direct command `SET WATCHPOINT object variable`
(see also the syntax of SET in Command Summary and Syntax).
Or, **before** executing a Natural object:
 - Invoke the List Object Source screen (see the relevant section).
 - In the Source column, position the cursor at a variable name and choose PF18/Se Wp.

If object name and variable names are specified correctly, the watchpoint is set immediately and a corresponding confirmation message is displayed on the screen. The watchpoint receives the default command (BREAK), its initial and current state are set to "active" and no execution restrictions are specified. Note that if you delete the default command BREAK when setting a watchpoint and you do not enter any command that issues a dialog, there is no way for the Natural Debugger to receive control during program interruption.

If you specify not an object name but a valid variable name, the name of the default object (see the section Start the Natural Debugger) is assumed and the watchpoint is also set immediately. If there is no default object defined, a selection window appears that displays all objects available in the current library.

Below is information on:

- Watchpoint Operators

Watchpoint Operators

To specify a condition for the watchpoint to be activated

- On the Set Watchpoint or Modify Watchpoint screen, choose PF10 if you want to specify the value in alphanumeric format,
Or, on the Set Watchpoint or Modify Watchpoint screen, choose PF11 if you want to specify the value in hexadecimal format.
- In the left input field, enter any of the watchpoint operators listed below.
In the right input field, enter the value to be compared with the variable.

For watchpoints with operators specified for dynamic variables (alphanumeric or binary), the values will be compared from left to right. Since the field length of a dynamic variable varies, up to 253 bytes can be entered as comparative value. If the current length of the dynamic variable is shorter than the maximum comparative length of 253 bytes, the comparison is made only in the current length of the dynamic variable.

- Choose PF22 to return to the Set Watchpoint screen.

Valid watchpoint operators are:

Operator	Explanation
MOD	Modification. Activates the watchpoint each time a modification of the variable occurs. This is the default setting.
EQ	Equal. Activates the watchpoint when the variable has been modified and when the current value of the variable is equal to the specified value.
NE	Not Equal. Activates the watchpoint when the variable has been modified and when the current value of the variable is not equal to the specified value.
GT	Greater Than. Activates the watchpoint when the variable has been modified and when the current value of the variable is greater than the specified value.
GE	Greater or Equal. Activates the watchpoint when the variable has been modified and when the current value of the variable is greater than or equal to the specified value.
LT	Less Than. Activates the watchpoint when the variable has been modified and when the current value of the variable is less than the specified value.
LE	Less or Equal. Activates the watchpoint when the variable has been modified and when the current value of the variable is less than or equal to the specified value.
INV	Invalid Contents. Activates the watchpoint each time the value assigned to a variable of the Type N, P, D or T does not comply with the following conditions: N Numeric unpacked. P Packed numeric. D Date range from 1582-01-01 to 2700-12-31. T Time range from 1582-01-01 00:00:00.0 to 2700-12-31 23:59:59.9.