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# GALAHAD

# SYMBOLS

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USER DOCUMENTATION

GALAHAD Optimization Library version 2.6

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## 1 SUMMARY

This module does not directly provide an algorithm, but rather the definitions of *symbols* that are used throughout GALAHAD. A symbol is a publicly available predefined string which can be used as an integer value. The purpose of symbols is to allow meaningful names to be given to these integers, thus allowing a more natural expression of algorithmic or storage options, otherwise represented by integer values that may not be illuminating or mnemonic.

In order to avoid conflicts with other user variable names, all symbols are of the form GALAHAD\_NAME, where we refer to NAME as the name of this symbol.

**ATTRIBUTES — Versions:** GALAHAD\_SYMBOLS.

**Date:** March 2002. **Origin:** N. I. M. Gould, Rutherford Appleton Laboratory, and Ph. L. Toint, The University of Namur, Belgium. **Language:** Fortran 95 + TR 15581 or Fortran 2003.

## 2 HOW TO USE THE PACKAGE

Access to the package requires a USE statement such as

```
USE GALAHAD_SYMBOLS
```

Note that the symbol's name may be redefined in the use statement, as in

```
USE GALAHAD_SYMBOLS, DENSE => GALAHAD_DENSE
```

allowing the use of the shorter DENSE symbol within the code that uses the module. It is then good policy to make the DENSE symbol private to the code.

### 2.1 The GALAHAD symbols

The symbols provided by the SYMBOLS module are listed in Tables 2.1 and 2.2 with their associated integer value and by broad categories.

## 3 GENERAL INFORMATION

**Use of common:** None.

**Workspace:** None.

**Other routines called directly:** None.

**Portability:** ISO Fortran 95 + TR 15581 or Fortran 2003. The package is thread-safe.

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| Symbol                              | Value |
|-------------------------------------|-------|
| GALAHAD_DIAGONAL                    | -3    |
| GALAHAD_DENSE                       | -2    |
| GALAHAD_SPARSE_by_ROWS              | -1    |
| GALAHAD_COORDINATE                  | 0     |
| GALAHAD_INACTIVE                    | -2    |
| GALAHAD_STRUCTURAL                  | -1    |
| GALAHAD_ELIMINATED                  | 0     |
| GALAHAD_ACTIVE                      | 1     |
| GALAHAD_RANGE                       | 2     |
| GALAHAD_UPPER                       | 3     |
| GALAHAD_LOWER                       | 4     |
| GALAHAD_FREE                        | 5     |
| GALAHAD_POSITIVE                    | 1     |
| GALAHAD_NEGATIVE                    | -1    |
| GALAHAD_ALL_ZEROS                   | 0     |
| GALAHAD_ALL_ONES                    | 1     |
| GALAHAD_SILENT                      | 0     |
| GALAHAD_TRACE                       | 1     |
| GALAHAD_ACTION                      | 2     |
| GALAHAD_DETAILS                     | 3     |
| GALAHAD_DEBUG                       | 4     |
| GALAHAD_CRAZY                       | 5     |
| GALAHAD_NONE                        | 0     |
| GALAHAD_BASIC                       | 1     |
| GALAHAD_SEVERE                      | 2     |
| GALAHAD_UNDEFINED                   | -100  |
| GALAHAD_NONE                        | 0     |
| GALAHAD_USER_DEFINED                | 2     |
| GALAHAD_AUTOMATIC                   | 10    |
| GALAHAD_NEVER                       | 3     |
| GALAHAD_INITIAL                     | 4     |
| GALAHAD_ALWAYS                      | 5     |
| GALAHAD_UNCONSTRAINED               | 0     |
| GALAHAD_CONSTRAINED                 | 1     |
| GALAHAD_SUCCESS                     | 0     |
| GALAHAD_MEMORY_FULL                 | -1    |
| GALAHAD_FILE_NOT_OPENED             | -2    |
| GALAHAD_COULD_NOT_WRITE             | -3    |
| GALAHAD_TOO_FEW_BITS_PER_BYTE       | -4    |
| GALAHAD_FURTHER_PROGRESS_IMPOSSIBLE | -5    |
| GALAHAD_MAX_ITERATIONS_REACHED      | -6    |
| GALAHAD_NOT_INITIALIZE              | -7    |
| GALAHAD_WRONG_N                     | -8    |
| GALAHAD_WRONG_M                     | -9    |
| GALAHAD_SORT_TOO_LONG               | -10   |
| GALAHAD_NOT_DIAGONAL                | -11   |
| GALAHAD_REDUCE_SIZE                 | 1     |
| GALAHAD_FULL_PRESOLVE               | 2     |

| Symbol                        | Value |
|-------------------------------|-------|
| GALAHAD_TIGHTEST              | 0     |
| GALAHAD_NON_DEGENERATE        | 1     |
| GALAHAD_LOOSEST               | 2     |
| GALAHAD_GAUSS_NEWTON          | 0     |
| GALAHAD_NEWTON                | 1     |
| GALAHAD_ADAPTIVE              | 0     |
| GALAHAD_FULL                  | 1     |
| GALAHAD_CURRENT               | 0     |
| GALAHAD_SMALLEST              | 1     |
| GALAHAD_BEST_FIT              | 0     |
| GALAHAD_BEST_REDUCTION        | 1     |
| GALAHAD_FORCE_TO_ZERO         | 0     |
| GALAHAD_LEAVE_AS_IS           | 1     |
| GALAHAD_KEEP                  | 0     |
| GALAHAD_DELETE                | 1     |
| GALAHAD_1                     | 1     |
| GALAHAD_2                     | 2     |
| GALAHAD_3                     | 3     |
| GALAHAD_4                     | 4     |
| GALAHAD_5                     | 5     |
| GALAHAD_6                     | 6     |
| GALAHAD_7                     | 7     |
| GALAHAD_8                     | 8     |
| GALAHAD_9                     | 9     |
| GALAHAD_10                    | 10    |
| GALAHAD_11                    | 11    |
| GALAHAD_12                    | 12    |
| GALAHAD_EXACT                 | 0     |
| GALAHAD_FORWARD               | 1     |
| GALAHAD_CENTRAL               | 2     |
| GALAHAD_BFGS                  | 1     |
| GALAHAD_DFP                   | 2     |
| GALAHAD_PSB                   | 3     |
| GALAHAD_SR1                   | 4     |
| GALAHAD_CG                    | 1     |
| GALAHAD_DIAGONAL_CG           | 2     |
| GALAHAD_USERS_CG              | 3     |
| GALAHAD_EXPANDING_BAND_CG     | 4     |
| GALAHAD_MUNKSGAARD_CG         | 5     |
| GALAHAD_SCHNABEL_ESKOW_CG     | 6     |
| GALAHAD_GMPS_CG               | 7     |
| GALAHAD_BAND_CG               | 8     |
| GALAHAD_LIN_MORE_CG           | 9     |
| GALAHAD_MULTIFRONTAL          | 11    |
| GALAHAD_MODIFIED_MULTIFRONTAL | 12    |

Figure 2.1: GALAHAD symbols.

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| Symbol                         | Value | Symbol                          | Value |
|--------------------------------|-------|---------------------------------|-------|
| GALAHAD_ok                     | 0     | GALAHAD_error_allocate          | - 1   |
| GALAHAD_error_deallocate       | - 2   | GALAHAD_error_restrictions      | - 3   |
| GALAHAD_error_bad_bounds       | - 4   | GALAHAD_error_primal_infeasible | - 5   |
| GALAHAD_error_dual_infeasible  | - 6   | GALAHAD_error_unbounded         | - 7   |
| GALAHAD_error_no_center        | - 8   | GALAHAD_error_analysis          | - 9   |
| GALAHAD_error_factorization    | - 10  | GALAHAD_error_solve             | - 11  |
| GALAHAD_error_uls_analysis     | - 12  | GALAHAD_error_uls_factorization | - 13  |
| GALAHAD_error_uls_solve        | - 14  | GALAHAD_error_preconditioner    | - 15  |
| GALAHAD_error_ill_conditioned  | - 16  | GALAHAD_error_tiny_step         | - 17  |
| GALAHAD_error_max_iterations   | - 18  | GALAHAD_error_cpu_limit         | - 19  |
| GALAHAD_error_inertia          | - 20  | GALAHAD_error_file              | - 21  |
| GALAHAD_error_io               | - 22  | GALAHAD_error_upper_entry       | - 23  |
| GALAHAD_error_sort             | - 24  | GALAHAD_error_input_status      | - 25  |
| GALAHAD_error_unknown_solver   | - 26  | GALAHAD_not_yet_implemented     | - 27  |
| GALAHAD_error_qp_solve         | - 28  | GALAHAD_unavailable_option      | - 29  |
| GALAHAD_warning_on_boundary    | - 30  | GALAHAD_error_call_order        | - 31  |
| GALAHAD_error_integer_ws       | - 32  | GALAHAD_error_real_ws           | - 33  |
| GALAHAD_error_pardiso          | - 34  | GALAHAD_error_wsmp              | - 35  |
| GALAHAD_error_mc64             | - 36  | GALAHAD_error_mc77              | - 37  |
| GALAHAD_error_lapack           | - 38  | GALAHAD_error_permutation       | - 39  |
| GALAHAD_error_alter_diagonal   | - 40  | GALAHAD_error_access_pivots     | - 41  |
| GALAHAD_error_access_pert      | - 42  | GALAHAD_error_direct_access     | - 43  |
| GALAHAD_error_f_min            | - 44  | GALAHAD_error_unknown_precond   | - 45  |
| GALAHAD_error_schur_complement | - 46  | GALAHAD_error_technical         | - 50  |
| GALAHAD_error_reformat         | - 52  | GALAHAD_error_ah_unordered      | - 53  |
| GALAHAD_error_y_unallocated    | - 54  | GALAHAD_error_z_unallocated     | - 55  |
| GALAHAD_error_scale            | - 61  | GALAHAD_error_presolve          | - 62  |
| GALAHAD_error_qpa              | - 63  | GALAHAD_error_qpb               | - 64  |
| GALAHAD_error_qpc              | - 65  | GALAHAD_error_cqp               | - 66  |
| GALAHAD_error_dqp              | - 67  | GALAHAD_error_mc61              | - 69  |
| GALAHAD_error_mc68             | - 70  | GALAHAD_error_metis             | - 71  |
| GALAHAD_error_spral            | - 72  | GALAHAD_warning_repeated_entry  | - 73  |

Figure 2.2: GALAHAD symbols: error codes.

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