AD FALCON API Manual

Output Variables in FEM Analysis

Javad Ghorbani

March 26, 2026

Contents

1 Output Variables in FEM Analysis **3**
1.1 Overview 3
1.2 Syntax 3
1.3 Supported output types 3
1.4 Example 4

1 Output Variables in FEM Analysis

1.1 Overview

Output variables define the quantities written to result files during a simulation. In **FALCON**, output variables are selected per step using `@@OutputTypes:` inside `% Step Definitions`.

1.2 Syntax

Output variables are configured inside `% Step Definitions` (not in a standalone section):

```
% Step Definitions
@Step 1:
  @@OutputTypes: <Var1> <Var2> <Var3> ...
%%%
```

- Use a **space/comma/semicolon-separated** list.
- Output type names are **case-insensitive**.
- A trailing `:` or `,` after a token is ignored (e.g. `EffStress,` is accepted).

Notes:

- Built-in output types are matched case-insensitively.
- UMAT custom state variables (when supported by the selected postprocessor) should be listed with the **same spelling** used when registering the variable name in the material.

1.3 Supported output types

Key (canonical)	Description	Notes / aliases
`Displacement`	Nodal displacement vector (`DisX`, `DisY`, `DisZ`)	
`ReactionForce`	Nodal reaction force vector on restrained displacement DOFs	Only nonzero where a displacement DOF is restrained
`EffStress`	Effective stress tensor at nodes	Aliases: `Stress`, `Effective Stress`
`NetStress`	Net stress tensor at nodes	
`TotalStress`	Total stress tensor at nodes	
`Strain`	Strain tensor at nodes	
`DStrain`	Incremental strain tensor at nodes	VTK/GenericXDMF export only

Key (canonical)	Description	Notes / aliases
`VelStrain`	Strain-rate-like tensor at nodes	VTK/GenericXDMF export only
`VoidRatio`	Void ratio (scalar)	Alias: `Void`
`Damping`	Damping (scalar)	VTK/GenericXDMF export only
`PW`	Pore-water pressure (scalar)	Reported as **total** pressure (initial + excess)
`EXPW`	Excess pore-water pressure (scalar)	Excess part only
`EXPA`	Excess pore-air pressure (scalar)	Excess part only
`PA`	Pore-air pressure (scalar)	Reported as **total** pressure (initial + excess)
`PC`	Suction / capillary pressure (scalar)	`PC = (PA_total) − (PW_total)`, alias: `Suction`
`Sw`	Degree of saturation (scalar)	Alias: `Saturation`
`PermW`	Water permeability tensor at nodes	
`PermA`	Air permeability tensor at nodes	
`Alpha_p_c`	Capillary-pressure parameter (scalar)	Alias: `AlphaPC`
`PWHead`	Hydraulic head for water (scalar)	`y + PW_total/(ρ_w g)`
`PAHead`	Hydraulic head for air (scalar)	`y + PA_total/(ρ_a g)`
Custom names	Any user-defined nodal custom state variable name	GiD export only

1.4 Example

```
% Step Definitions
@Step 1:
  @@StartStep: 0
  @@StepTime: 100.0
  @@NumberSteps: 10
  @@SolverType: Direct
  @@OutputControlType: ByStep
```

```
  @@OutputControlValue: 1
  @@OutputTypes: Displacement EffStress Strain VoidRatio PW EXPW PA PC Sw
PermW PermA TotalStress
%%%
```