



Wind Turbine Template (WTT)

Automation of a wind turbine is one of the primary tasks where the controller portfolio from Bachmann electronic GmbH supports the wind industry. Our customers include both manufacturers of wind turbines and operators of wind farms. To offer both groups an easy entry point for programming wind turbines or linking visualizations, Bachmann electronic GmbH has developed the "Wind Turbine Template" (WTT) software package.

Software toolbox

For many years Bachmann electronic GmbH has supported customers with hardware and software in the implementation of their turbine automation. In the course of these projects, it quickly became apparent that often the same functionalities are needed and that customers are confronted with the same challenges. To help our customers overcome these challenges and to provide our customers with standard functionalities, Bachmann electronic GmbH has created a software toolbox, namely, the "Wind Turbine Template", that the user can use directly for a wide variety of tasks involved in implementing the software for a wind turbine.

The components of the "WTT" software package are versatile and can be used in their entirety or only in part – to offer a solution for a wide range of applications.

Features

- Software package as configuration and templates
- Development of a comprehensive turbine software package in accordance with IEC 61400-25
- Prefabricated functionalities
 - Freely-configurable average values
 - Alarm/Event handling
 - Trends (short-/long-term)
 - Highly dynamic data logging
 - Wind distribution
 - Power curve
 - Access and user management
 - Historization of alarms / events / user logins
- Interface to HMI/SCADA in accordance with IEC 61400-25 structure

| Part type designation | Part number |
|-----------------------|-------------|
| WTT SDK License | 00027933-00 |
| WTT RT | 00026990-63 |
| WTT AMT | 00026990-70 |

Toolbox structure

The main component of the WTT software package is a description file (`project.wtt`). This description file is made available as a template via the SolutionCenter "WTT Configurator" plugin and is processed on the controller in the WTT_IO software module. The description file offers a complete project for a wind turbine pursuant to IEC 61400-25 with all variables and additional configurations for historical data recording as well as other aspects required by the standard.

This project can be edited with a text editor or a convenient table editor to add other user-specific variables for inputs/outputs, commands or parameters in accordance with the scheme specified in the IEC standard. After editing is completed, the project can be built in the SolutionCenter and a PLC project (WTT_MAIN) will be generated at the same time. This PLC project then contains the state machine according to 61400-25 with transitions (state transitions) that are easy to implement, as well as all variables, commands, parameters, event accesses previously defined in the `project.wtt` file.

The PLC project is provided with comment lines, between which the user can carry out their turbine-specific and component-specific implementations. If the `project.wtt` configuration file is subsequently adapted and built, then the generated PLC project will also be brought up to date – in this process the customer-specific logics and algorithms remain intact.

Visualization

In addition to generating the PLC project as an operations management program for a wind turbine, building the WTT project also triggers generation of an object type for the "Wind Power SCADA" system. After generation there is a folder with files that can subsequently be imported 1:1 into the SCADA system (WPS) with the `atvise®` builder development tool. With this step, the specific turbine type together with all variables, commands, parameters, events, as well as snapshot configurations, and other aspects will be directly available in the "Wind Power SCADA". Thanks to the established SCADA system with all directly available functionalities, the previously imported turbine object type can be directly instanced and it can be used immediately; this means that there is no need for laborious, manual configuring and saving of texts and values. Of course this also means that an enormous amount of development time is saved.

If a change in the WTT project is necessary, then the project can be rebuilt. The rebuild generates the WPS import files and they can again be imported into the SCADA project.

User management

Moreover, generation of the WTT project also produces a complete boot image for the M200 controller. This boot image can be conveniently transferred to the controller by means of a "Deployment Assistant" in the SolutionCenter. Likewise, user management is set up in the SolutionCenter. By default, a user file for editing is also created in the WTT project. In this file, the users and passwords, together with group rights and read and write access levels can be specified for each user.

If the project is built, an encrypted user file is produced from the previously edited data, which, once rolled out to the controller, is then checked by the WTT_ENC at runtime. This check of the login data is a cursory check to prevent this data from being recorded. The WTT_ACC software module is likewise controlled by a configuration file that can be edited in the SolutionCenter. This file contains information regarding IP-based priority handling for active status, as well as group rights, file-rights and variable rights, including access levels and it could also be encrypted.

Applications

Since the WTT software package has a modular structure, the application areas for the WTT can also vary. The entire package would be suitable for a complete turbine development, WTT_IO including the generated operations management program, WTT_MAIN. The system-extending user management and access management with WTT_ACC and WTT_ENC are always necessary.

For example, when retrofitting a SCADA system with WPS and the existing turbine is already equipped with Bachmann hardware and software the use of the WTT_IO module is sufficient. For this application case, the actual conditions of the existing controller must also be clarified in detail (hardware & software compatibility, any additional implementations, in the event that simple variable mapping in the WTT configuration is not sufficient).

Summary

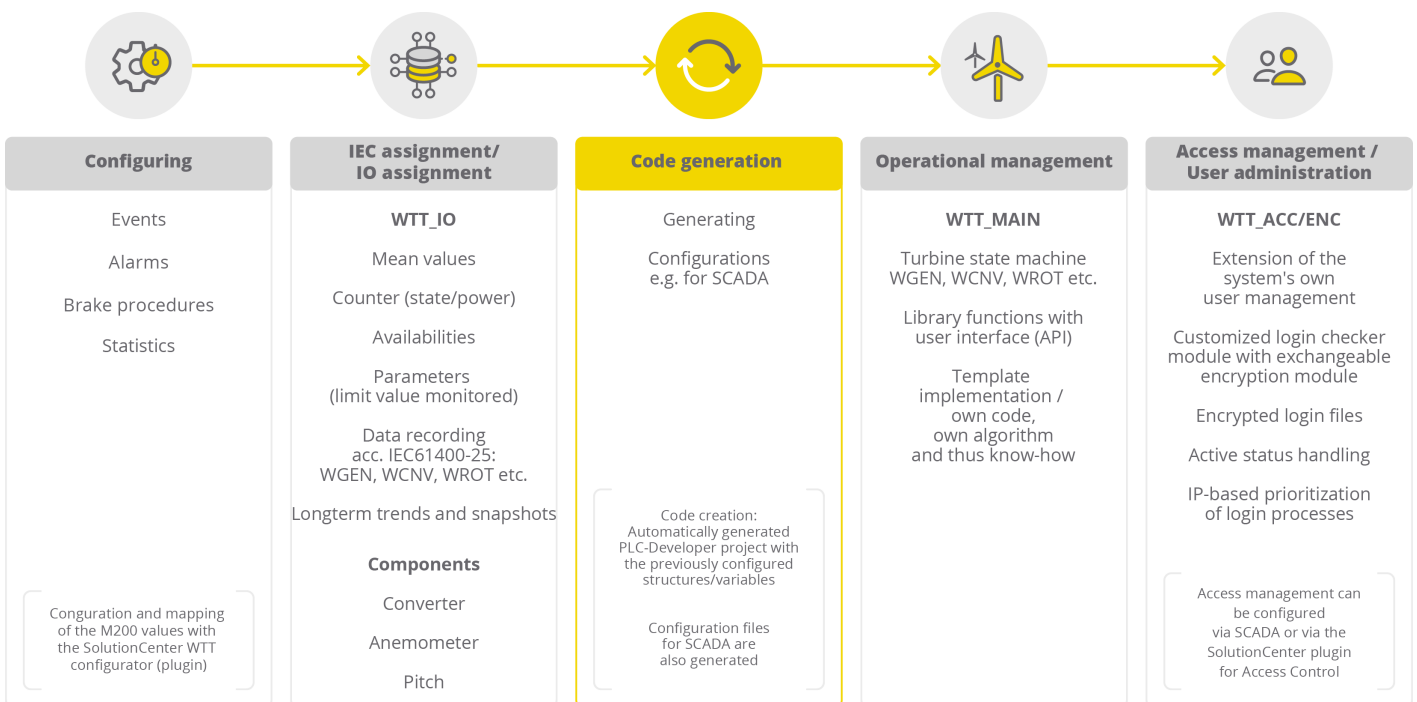
The WTT software package offers a direct entry point into the implementation of a turbine controller software program. The motto here is, "configuring instead of programming". This approach enables direct use of all known and necessary functions for a wind turbine, e.g. average values, power curves, event handling.

The programmer can concentrate on implementing the turbine-specific algorithms that are always specially matched to the turbine type, and has the necessary tools directly available.

Nevertheless, if special functions are lacking, which are preferably handled by separate logics, then with the libraries available in all programming languages, the user-specific software can be provided with a direct interface into the WTT_IO.

Compared to the conventional approach, with the WTT software package, development time and consequently development costs for turbine control software with SCADA connection are considerably reduced.

Software components and workflow



▼ Software components and workflow

Wind Turbine Template (WTT)

| Components | |
|----------------------------------|--|
| WTT_IO | M200 software module <ul style="list-style-type: none"> Central software interface as specified in IEC 61400-25 for all internal and external connections Configuring via SolutionCenter plugin |
| WTT_MAIN | M200 software module <ul style="list-style-type: none"> Operations management program as a template with state machine as specified in IEC 61400-25 and internal interface to the WTT_IO IEC 61131 – structured text |
| WTT_ACC | M200 software module <ul style="list-style-type: none"> WTT login checker and access management software Extended user management with IP-address priority handling and management of file rights and variable rights Active status |
| WTT_ENC | M200 software module <ul style="list-style-type: none"> User and password validator |
| WTTL_C | Library <ul style="list-style-type: none"> C API with internal interface to WTT_IO |
| WTTL_PLC | Library <ul style="list-style-type: none"> IEC 61131 API with internal interface to WTT_IO |
| WTTL_MAT | Library <ul style="list-style-type: none"> M-Target (MATLAB Simulink) with internal interface to WTT_IO |
| LIB | C template <ul style="list-style-type: none"> Creation of separate libraries for components with integrated interface to WTT_IO |
| Various component libraries | Activations, e.g. for anemometers and pitch systems (brands on request) |
| Project planning / configuration | |
| Development environments | <ul style="list-style-type: none"> WTT Configurator as SolutionCenter plugin with customer-specific perspective for configuration of the WTT_IO software module C Developer in SolutionCenter (template project for LIB) PLC Developer in SolutionCenter (automatically generated project template) MATLAB Simulink library M1AccessControl Configurator as SolutionCenter plugin with customer-specific perspective for managing users and user rights |

Functionality

| WTT_IO | |
|--|--|
| Interface according to IEC 61400-25 | SolutionCenter configurator template with all necessary data nodes and objects specified in the standard for use and extension |
| Average value calculation | Configurable in the <code>project.wtt</code> file; freely selectable average value categories (1 min, 10 min, etc.) |
| Dynamic data logging | Configurable in the <code>project.wtt</code> file, for each variable multiple recording requirements can be stored with freely definable sampling times and tolerances |
| Event-triggered logging (snapshots) | See dynamic data logging; the recording can be supplemented with events |
| Wind distribution / power curves | Configurable in <code>project.wtt</code> file |
| Statistics/counters | Configurable in <code>project.wtt</code> file |
| Alarm and event system | Configurable in <code>project.wtt</code> file |
| Access and user management | Configurable in M1AccessControl configurator |
| Automatic code generation | Generation of the WTT_MAIN (PLC project included in the WTT plugin) with the variable interface configured in <code>project.wtt</code> |
| Interface for Wind Power SCADA (WPS) | Configurable in the <code>project.wtt</code> file; the necessary data for the WPS import is generated at project build. |
| WTT_MAIN | |
| State machine according to IEC 61400-25 | Mapping of the individual operating states of a wind turbine in accordance with IEC 61400-25 as a template with transition conditions |
| Variable interface in accordance with IEC 61400-25 | Variables/events configured in the <code>project.wtt</code> file can be used directly in the PLC program |
| WTT_ACC/ENC | |
| Access control | IP-based priority handling for access to the controller, including checks of group access rights, file access rights, variable access rights; active status handling (sole write permission) |
| Login checker (validator) | Checks user names and passwords (encryption module); can also be implemented on a customized basis as needed. |