



Photo

Front view of the Simulator Trainer (Monitor not shown)





AUTOMATED COMPUTING MACHINERY S.L.

c/Playa de Lagoa, 1

28660 Boadilla del Monte Madrid

Phone: +34 605876613 Fax: (+34) 91 6323812

www.acm-sl.com

Document:

SHORT USER'S MANUAL

FOR THE

SIMULATOR-TRAINER

SIM1300

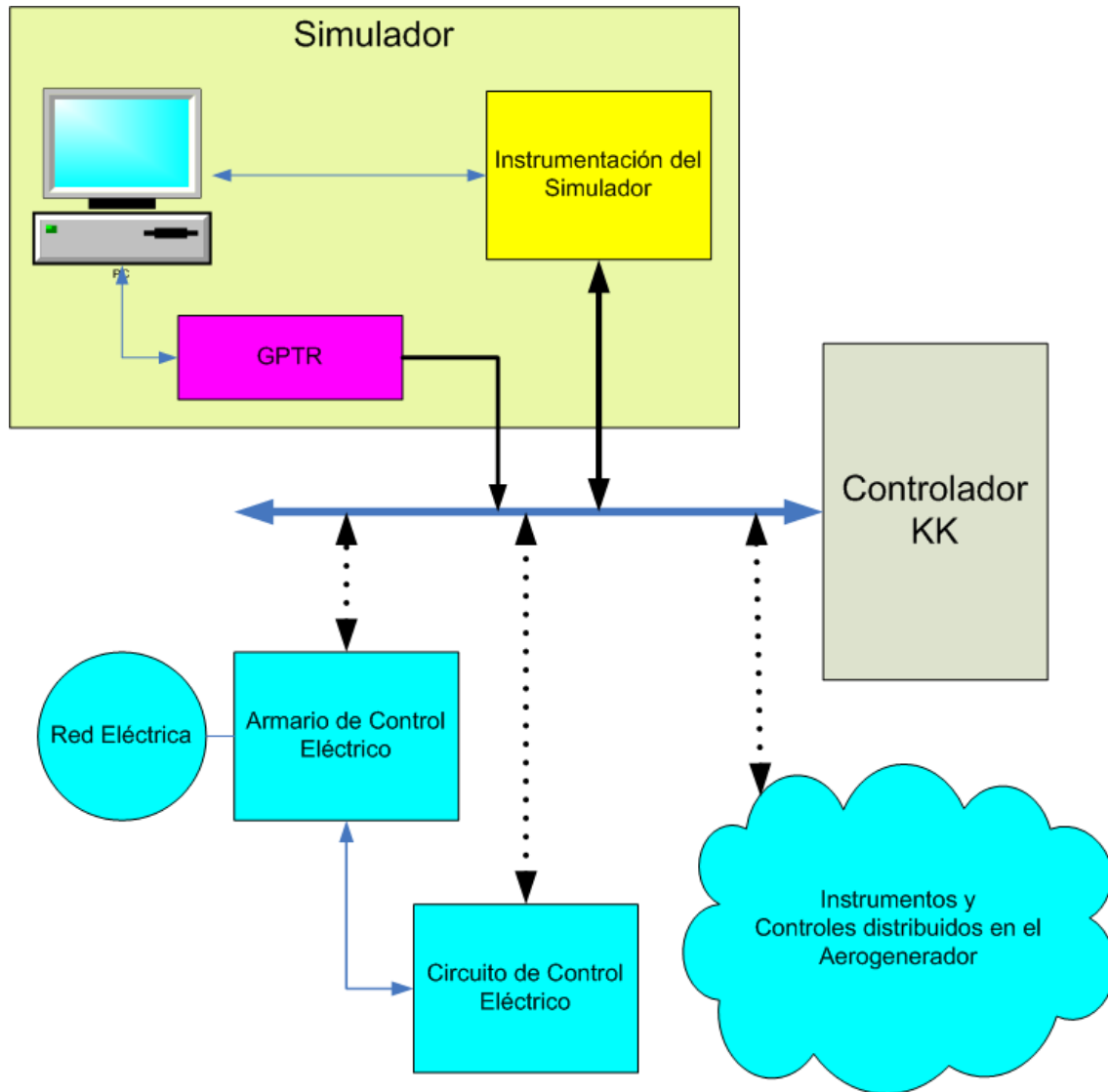
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Contents

Photo	3
Conceptual Building Block diagram.....	4
Introduction	5
Setting starting conditions.....	5
1. Switch on the General Switch.	5
2. Loggin.	5
3. Connect the instruments and controllers.	5
4. Start the Terminal emulator	6
5. Execute the Simulation program.....	6
6. Start the simulation.....	8
Playing with the system.....	10
1. Checking the capability of self orientation of the windmill	10
2. Start production	12
3. Changes while in production.....	16
Knowing the system.....	20
Hardware	20
Synoptics.....	21
Algorithms	21
Connectivity	23



Conceptual Building Block diagram



Dual view

The real components (represented in blue) of the windmill that are connected to the (two) KK Electronic Controllers (bottom and top), are replaced by a set of instruments and a control program that reads the outputs of the controllers and maneuver and set the input to these Controllers (upper part).



Introduction

The purpose of this document is to serve as a brief reminder of the most typical operations that can be performed by the SIM1300. This is, by no means, an exhausting listing of all its possibilities. Check please the "SIM1300 User's manual" for a complete description.

The main purposes are:

1. Generate all the signals that are input into the Controller.
2. Read the output signals coming from the Controller.
3. Present the values of all of these signals to the user.
4. Generate the evolution of the signals following the instruction of user, the Controller and the associated behavior of every subsystem, so that the Controller "sees" a real windmill.

The program is fully configurable to accommodate for the hardware blocks in place as well as the user interface (HMI) definition. In this document the configuration used is prepared for a **BONUS 1300 windmill**.

Setting starting conditions

As shown in the photograph before, the system is host in a 19" rack and has two mains switches: one for the general power (located right most) to all instruments and subsystems, and another specifically for the instruments and the controllers(Instruments). The PC is switched off only with the general switch.

Additionally the GPTR (grid emulator) has its one security switch, located in the back of it. The PC also has its only switch located in its front panel.

So for starting the SIM1300, follow the next steps:

1. Switch on the General Switch.

For that, uncover the control panel (using the supplied key) and press the "Start" button.

2. Login.

The operating system (Windows XP) will present the form for user identification. Use the supply userid and password.

3. Connect the instruments and controllers.

Check that the *Instruments switch* is already connected: switch it on otherwise.



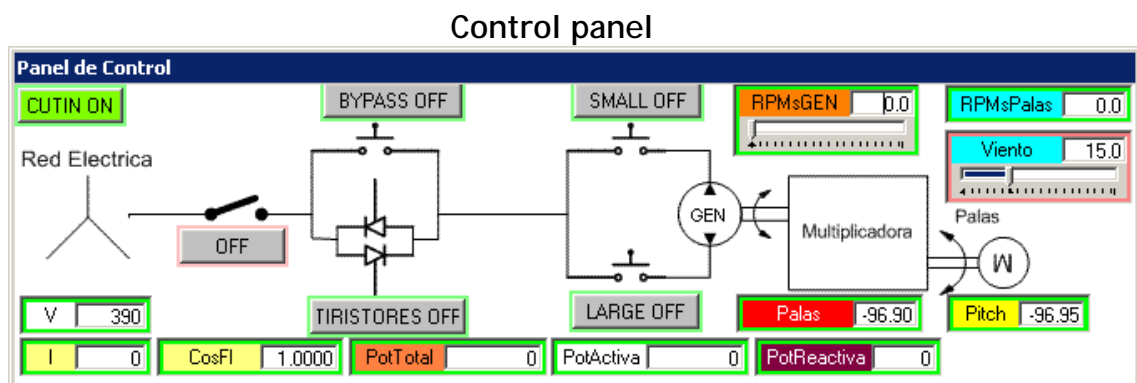
4. Start the Terminal emulator

1. The "Desktop" will show a programs group named "ACM". Inside it you will find a set of icons.
Look for an icon named "TerminalKK" and execute it. It will present a terminal emulator similar to the portable Terminal for the Windmill (4 lines , 40 characters per line).
2. Check that this terminal shows the typical message shown in a real portable terminal connected to the windmill. Otherwise reset the Controllers.

5. Execute the Simulation program

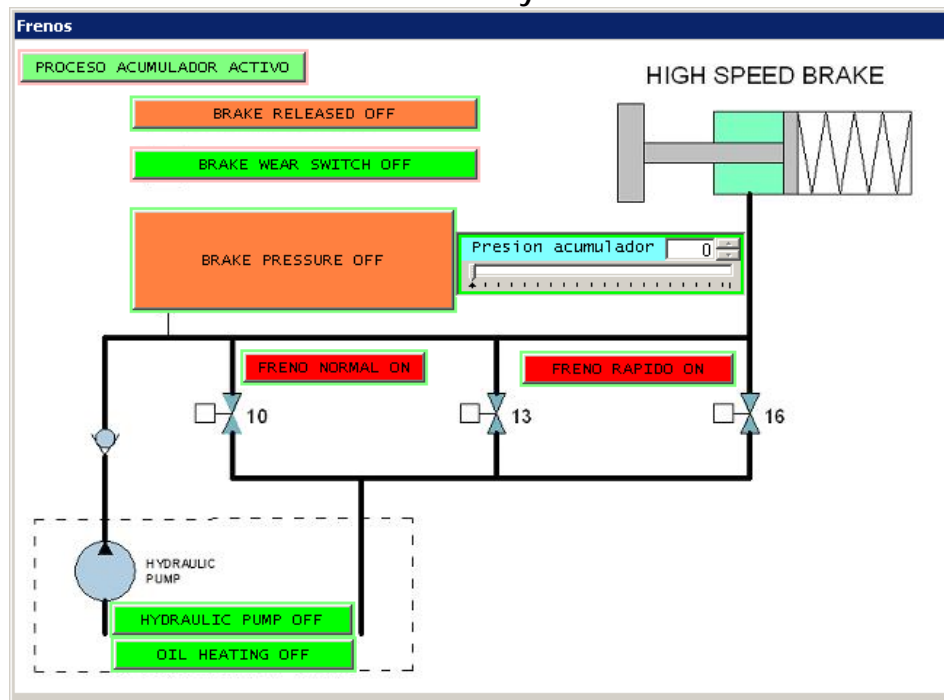
1. Look for an icon named "Simulador 1300" and execute it. This is the main program.
2. You will be presented with a form that contains a menu where you can select the option for specifying a "configuration" file. Select the configuration file that the administrator gave to you. This configuration file is adapted to the set of forms (sinoptics), emulation algorithms and physical instruments in this installation.
3. You will be presented with a list of previously saved "sessions" in the form of a list. Sessions allow the user to save a set of values that will be used as starting setting for the new session. Choose the session that best suits your purpose.

At that moment, the program will present you the set of forms (synoptic like), located in the screen places and with the variable's values, according to the session file selected. For example, you may be looking at the "Control Panel" (showing the electric connections and their status), the "Brake subsystem synoptic" and the Wind and Nacelle Orientation ("Viento y Orientacion"), as can be seen in the next figures.

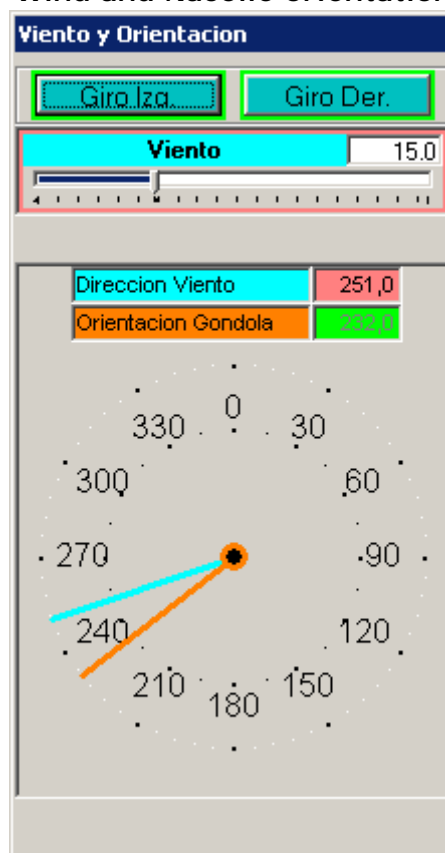




Brake subsystem



Wind and Nacelle orientation

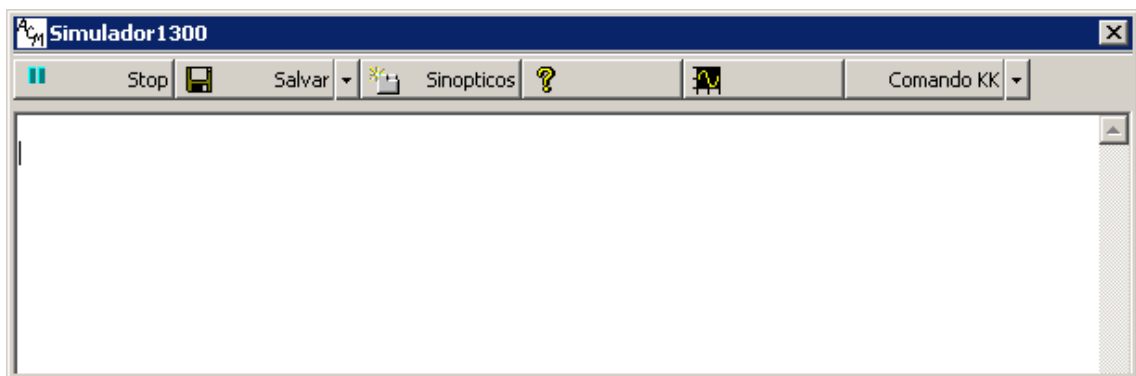




6. Start the simulation

1. So far what happened is that all the outputs from the Controllers are reflected in the "connected" graphic widget in the synoptics, and that all the signals input to the Controllers are set to the values specified in the session file.

You can now "start" execution: look to the form named "Simulador1300" and press the left most menu button (showing "*Ejecutar*"). Immediately this button will change to "Stop" (a multipurpose button) and all the simulation will actually start.



2. Next, you should turn on the Grid.

The GPTR (Generador Programable de Trifásica) is the instrument, located in the bottom of the 19" rack, that actually creates a triphase grid. By default, when switched on, this equipment generates 0 V in each phase, for security reasons. So you must "connect" it to the Simulator (similar operation to connecting the Mains switch in a real windmill).

This can be checked in various ways:

- a. Through the measurements done by the controllers, that can be seen through the Terminal Emulator (menu 15, submenu 3);
or
- b. Going to the "Control Panel" to see that the widget (digital) below the switch connecting to the grid is showing "OFF". In this Control Panel you can see also the actually value of the average voltage in the (analog) widget mark "V": should be 0.
or
- c. Checking in the "GPTR Control Panel"

In this synoptic you can see voltage that will be actually applied to measuring inputs of the controllers, as well as the remaining



electrical variables (the simulated grid).

To connect the grid to the simulator, simply press the digital widget marked OFF in the "Control Panel": automatically the GPTR will generate the voltages indicated in its "GPTR Control Panel", and this widget will change to "ON"

In this stage, the Simulator should be applying a set of values to the Controllers coming from the selected former session. Values such as wind, orientation, etc.

Controlador Generador Programable de Trifasica

Control Manual

<input checked="" type="checkbox"/> Conjuntos	Actual	<input type="checkbox"/> Conjuntos	Actual						
V1	390	I1	0	CosFi1	1.000	AngFi1	0	Pot Total	0
V2	390	I2	0	CosFi2	1.000	AngFi2	0	Pot Eficaz	0
V3	390	I3	0	CosFi3	1.000	AngFi3	0	Pot Reactiva	0

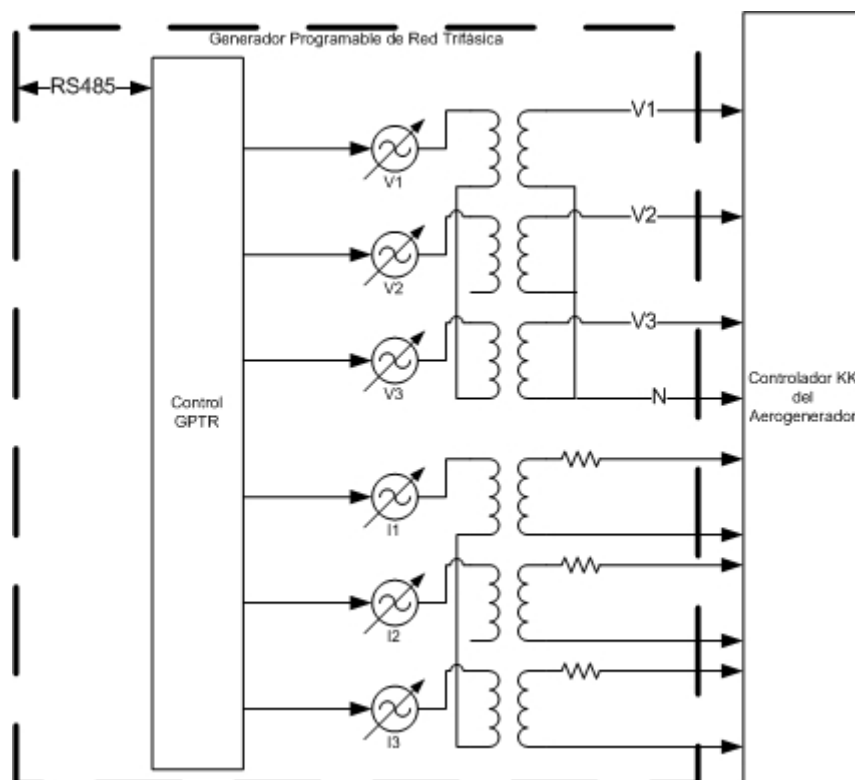
☐ Cal auto ☐ Cal auto

Fase V1: 0 0000 Frecuencia: 50.0

Fase V2: 0 0120

TRIFASICA CONECTADA

Next figure shows the block diagram of the grid subsystem generator.





Playing with the system

You can now play with the system in many ways. Examples are:

1. Checking the capability of self orientation of the windmill

Change the value of the wind speed using the “Viento y Orientacion” synoptic so that it is higher than the minimum value set up in the parameters as “minimum wind”. You can change it with the slider or directly keying the desire value (the entry is error insensitive).

Change them the angle of the wind, using the blue needle in the same synoptic (place the mouse on top of it, press left button and drag), so that this angle is very different from the indicated nacelle orientation.

Wait to see how the Controller take into consideration the preset time to command the yaw motors: the status of these signals are indicated by the two (digital) widgets mark “Giro derecha”, “Giro izquierda”.

Check that the value of the nacelle orientation changes accordingly to the status of these signals and the values of the parameters “VeloGiroDerecha” y “VeloGiroIzquierda”. You can check the actual values for these two parameters as well as change them in the form “Parametros”. Those parameters take into consideration the possibility (probably faulty) that the two yaw motors behave different or badly (i.e. setting one of these parameters to 0, will prevent the nacelle to yaw in that direction, causing - hopefully- a fault).



Parametros

Nuevo parametro

Digitales

	Nombre		Descripcion
ControlGPTR	UsaCosFi	<input type="checkbox"/>	Indica si se envia el valor insta...
General	ControlGeneralI	<input type="checkbox"/>	Parametro general que sirve pa...
General	ON	<input checked="" type="checkbox"/>	
General	OFF	<input type="checkbox"/>	
Orientacion	SignoOrientacino	<input checked="" type="checkbox"/>	DirViento - Orientaicon o al rev...
CalculoBYPASS	CombinacionProhibida	<input type="checkbox"/>	

Analogicos

				Descripcion
ControlGPTR	TiempoEsperaComando	5000	ms	
General	RelacionMultiplicadora	77.73		
General	Velocidad subida palas	2.5	grados/seg	Velocidad co...
Frenos	LimiteInferiorPresostatoFrenos	12	psi	
Frenos	LimiteSuperiorPresostatoFrenos	15	psi	
Frenos	PerdidasPorFugasFrenos	0	psi	
Frenos	PeriodoAcumuladorFrenos	500	milisegundos	
Frenos	PresionMinimaLiberarFrenos	8.5	psi	
Frenos	PresionMaxManometro	20	psi	
Frenos	VelocidadVaciadoFrenoFuerte	10	psi/seg	
Frenos	VelocidadVaciadoFrenoSuave	7	psi/seg	
Frenos	VeloSubidaPresionBomba	1.5	psi/seg	
Generador	CoefDisipacion	2	grados/se...	Descenso d...
Gondola	VeloGiroDerecha	1	grados/se...	grados por s...

NOTE:

There are many ways to *force* operational faults. The simplest one is to remember that many of the *widgets* in the synoptics has **dual purpose**:

- a) as an *indicator* (showing the value of a variable of the system) and
- b) as a tool to change the value of that same variable (**indicator and control**).

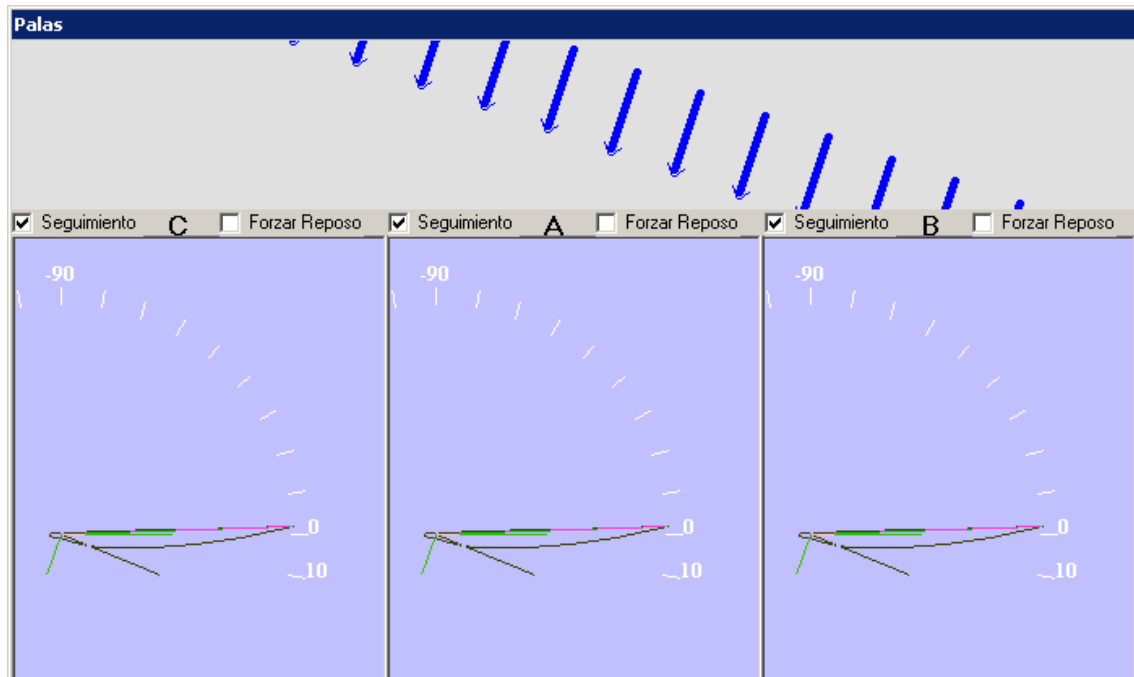
Sometimes this dual behavior is forbidden by the internal settings; in any case you can see in which mode a given widget is, checking the color of the little border around it: if green then the mode is in "indicator" mode (the user can not modify it manually), if red, is in "control" mode. If not forbidden by the internal settings of the synoptic, you can change the behavior of any widget pressing "F6" on it: you will be prompted to provide a password to enter this "setting" mode. That can be done in any moment, even while the execution of a emulation.

In order to fully understand the influence of each widget, you have to know how the internal variables are connected among each other and with the



widgets. Go to the "SIM1300 User's manual" for a complete description of this matter.

An interesting way of looking the values of the wind speed and the difference between the wind direction and the nacelle orientation is to look at the upper part of the "Blades" synoptic.



The *higher the wind speed*, the *bigger the density of the arrows*. The direction is the difference between the wind direction and the nacelle orientation (*disorientation* degree of the nacelle).

In this synoptic are represented (different for each blade) the actual angle of the blade and the incoming wind, the rotational speed wind and the resulting effective wind and the attack edge (lower part of the synoptic).

2. Start production

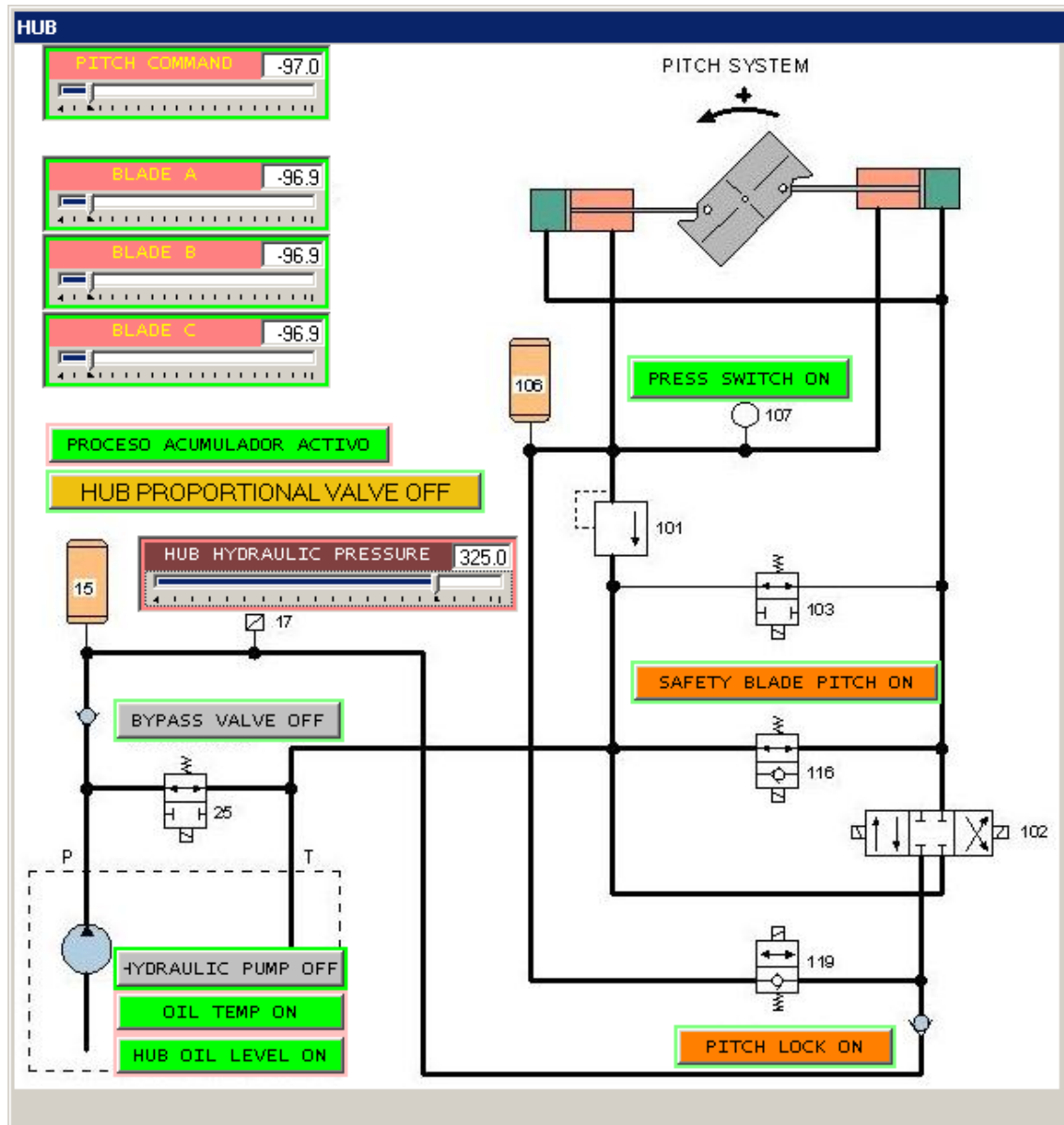
Assuming that there are no errors pending in the Controllers (that implies that the grid is connected) and the wind speed is above the minimum limit, you can use the "Start" command in Terminal Emulator, to order the Controller to initiate a operation of connection to the grid and start generating power.

To achieve that, go the Terminal Emulator, set it at menu 2 and check all the pending errors. Whenever they are no pending errors, you can issue the Start command with pressing "A" followed by "1" (immediate start) at the Terminal Emulator.

You can check the behavior of the simulated windmill looking, first, to the "Brake subsystem" synoptic. There, you will see that the Controller orders the brake pump to start, that produces an steady growth of the pressure, till a value is achieved, at which moment, brake is released.



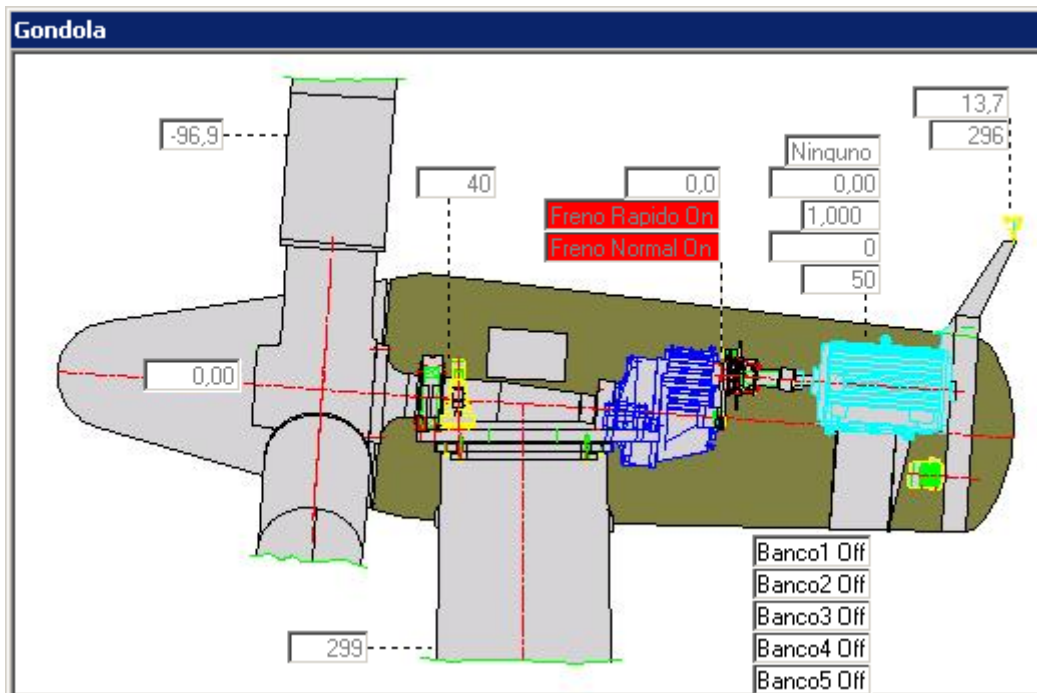
You might have a look also to the behavior of the “Pitch subsystem” and the “Blade synoptic”.



In this synoptic is presented the status of all the variables related to the *Hub subsystem*. You can see the value of the Pitch angle “forced” by the Controller, as well as the “actual” angle of the each of the three blades. These three values are simulated by SIM1300 using independent linear control algorithms (one for each blade) and presented in the indicated widgets.

Another part of the synoptic shows the behavior of the hub oil pump, also implemented with its own process algorithm.

Of course, angle position of each of the blades is also presented in other synoptics, like the “Blade” synoptic, or the general view of the windmill (“Gondola” synoptic).



The behavior of every algorithm is controlled by a number of parameters. The value of these parameters can always be changed through the "Parametros" form. For a full description of each of them please check the "SIM1300 User's manual".

A typical behavior of the Controller, with adequate values for the parameters, and after the "Start" command issued in the Terminal Emulator, follows this pattern:

1. Look to the "Viento and Orientacion" synoptic, and see that the Controller activates the signals for "Giro Izq" or "Giro der", forcing the orientation of the nacelle. You can check (in the TE ,menu 3) that this situation correspond to the characters "<", ">" or "-" indicated in the 4th line of the TE.
2. Look also to the "Brake subsystem" synoptic and you will see that after some time, the Controller set the pump on and that the (simulated) pressure grows to arrive to a value, feeded back to the Controller, indicating that the brakes are set free (widget "Brake pressure" change color).
3. Look now for the "Pitch" value issue by the Controller. You can find it in a number of synoptics: the "Control Panel", the "Pitch subsystem" and the "Gondola view". Typically these value will change in the range of 2, depending on the wind speed. This is the value the Controller uses to "speed up" the blade speed in order to arrive, in a controlled manner, to the cut-in point.



4. If you look now to the angle of the blades (in the "Pitch subsystem" or "Blade subsystem") you will see that they attempt to arrive (they follow) the pitch value.
5. As a result of the (simulated) wind on the (simulated) blades and due to the fact that the (simulated) brakes are not acting, the blades start moving. The Controller uses the Pitch value to control the profile of the speed growing process. This will be more evident, if you look carefully, when the blade speed corresponds to around 600 rpms of the generator speed.

Note that you can always change the value of the wind and/or its direction using the "Viento" synoptic, to see how those changes influence the behavior of the Controller.

6. Assuming that the wind is high enough (say, 13 m/s) you can watch that the Controller does activate the "Large" widget ("Control Panel") when the generator speeds reach around 1000 rpms. That event indicates that it plan to use the Large generator for the connection to the grid.
7. If conditions continue stable you will see that the generator rpms RPMsGEN ("Control Panel" up right) will continue to climb, always controlled by the Pitch value, till the reach and specific value (around 1490 rpms). At that moment starts the operation that will end up (if succesful) with the connection of the generator to the grid (*cut-in*).

At that value of rpms, the Controller activates the conduction of the thyristor block. You will see that looking to the "TIRISTORES" widget in the "Control Panel", that will change color to green. This typically last for around 4 seconds and, in reality, this conduction is not uniform.

8. When the RPMsGEN exceed the synchronous speed (1500 rpms for the Large connection of the generator), the Controller activates the BYPASS switch, short circuiting the Thyristors block and making a direct connection between the generator and the grid.

Immediately after, the GPTR generates current values for each current measuring circuit of the grid, effectively "simulating" a drain (production) of power to the grid. This situation is presented in the "Control Panel" with changes in the "I", "cosFi", "PotTot", "PotAct" and "PotReact" widgets.

The windmill is in production state.



3. Changes while in production

While the Controller + Simulator maintain a “Production” state, you can play with all the external variables (wind speed, wind direction, grid voltage) as well as with internal variables and see the induced changes in the whole set.

For example, you can change the temperature of the generator using the corresponding slider widget in the “Temperaturas” synoptic, to check how long takes the Controller to react connecting the corresponding fan, or any other reaction, in the “Miscelaneos” synoptic.

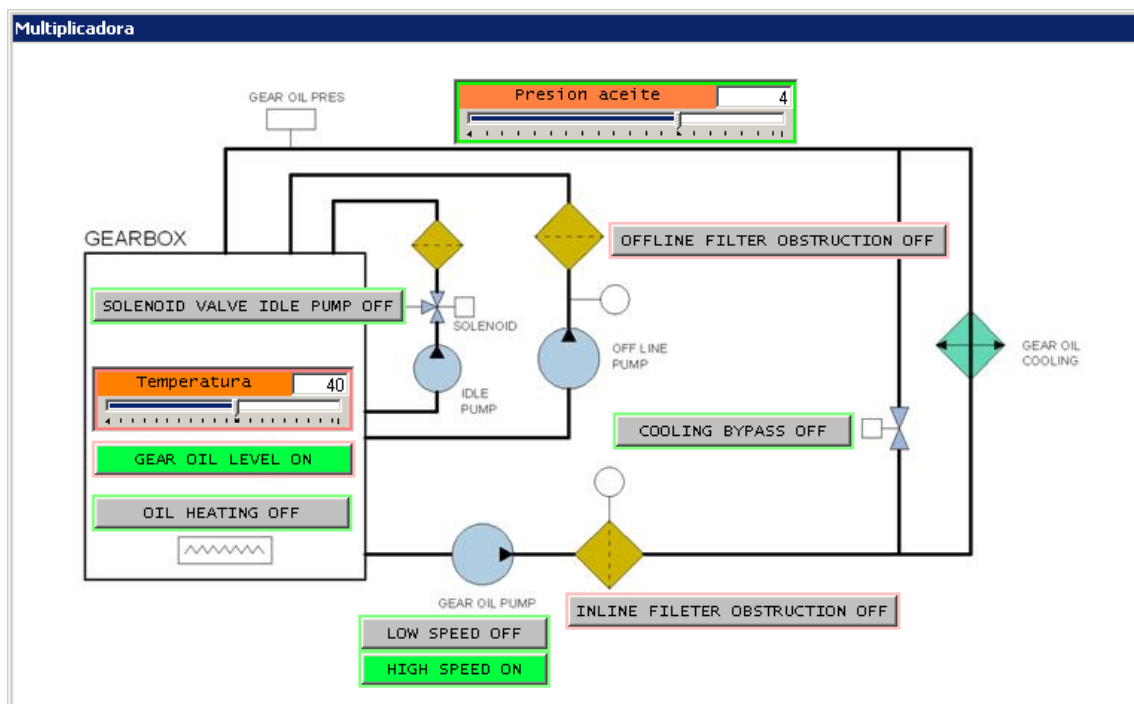
Temperaturas	
AMBIENT	15
GEAR BEARING HSS-ROT	40
GEAR BEARING HSS-GEN	40
GEAR BEARING IMS-ROT	20
GEAR BEARING IMS_GEN	20
GENERATOR	50
Q103	40
GENERATOR BEARING-NDE	40
A4 INSIDE GENBOX	30
A4 INSIDE PFCBOX	30
A4 OUTSIDE	30
A2 INSIDE	30
A8.1 INSIDE	30
A8.1 CAPACITORS	30

Miscelaneos		
EMERGENCY STOP CIRCUIT OFF	HEATING OFF	GENERATOR HEATING OFF
CPU EMERGENCY STOP OFF	HEATING FAN OFF	GENERATOR BLOWER1 OFF
GRID FAULT OFF	AUX CCJENSEN OFFLINE OFF	GENERATOR BLOWER2 OFF
DISPARO TIRISTORES OFF	UPS SHUTDOWN OFF	
HOUR COUNTER OFF	A2 HEATING OFF	A2 HEATING FAN OFF

You can also exercise the reaction to some security transgression, using the signal monitor and/or controlled in the “Seguridad y Auxiliares” synoptic.



Or generate problems in the Gearbox subsystem ("Multiplicadora" synoptic). You can create a fault increasing the value of the temperature in the gearbox, or keeping the oil pressure low, or forcing a filter problem.



You can also generate complex-to-create-in-reality problems such as *setting one blade as non controllable*, to understand the behavior of the Controller and its timing. You can do that in a number of ways:

- Setting the blade angle as non controllable ("Pitch subsystem", widget "Blade X" to manual control, pressing "F6")

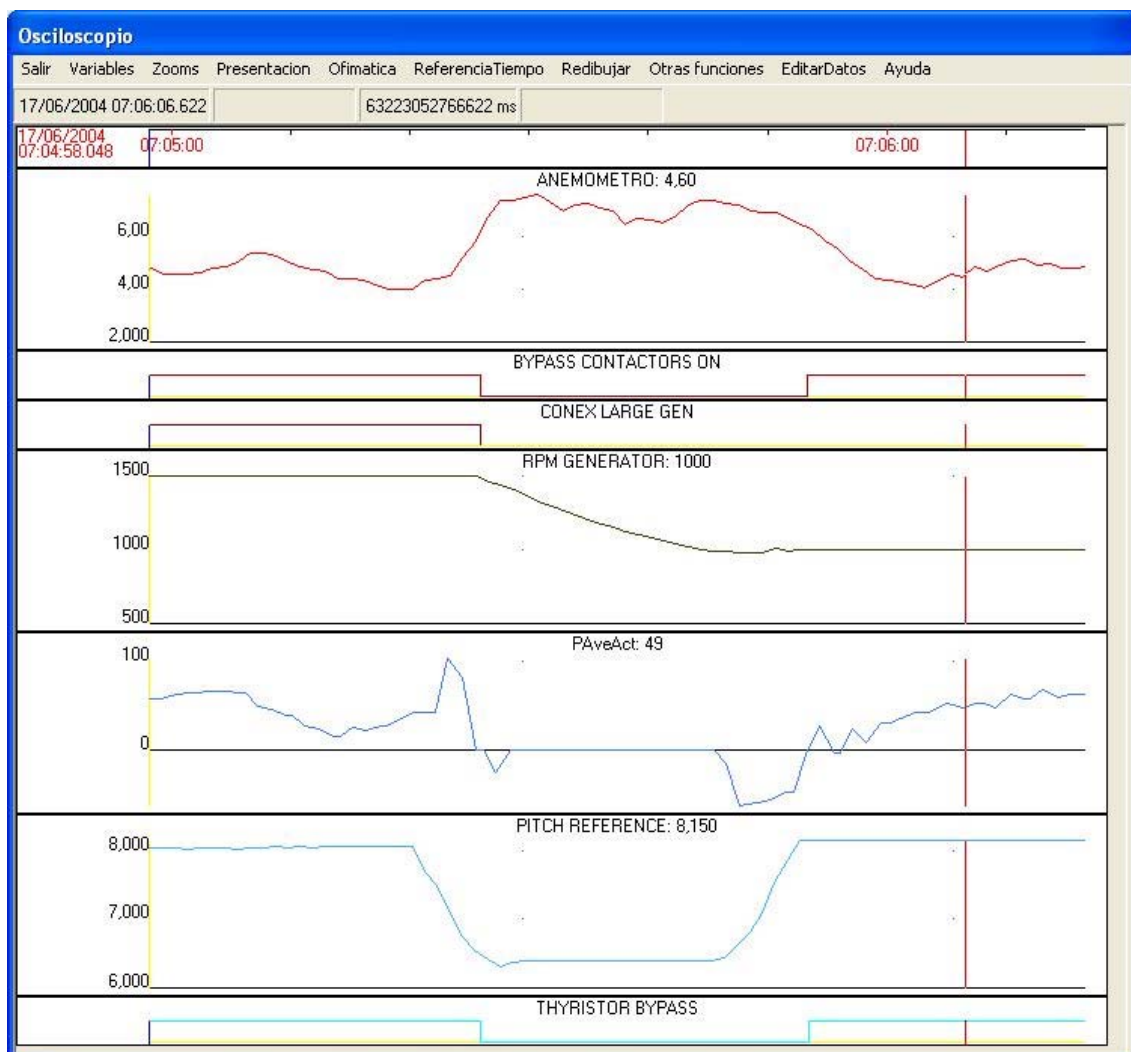


- Setting the “Seguimiento” checkbox of blade X to non checked, in “Blades synoptic” (follow up algorithm not active)
- Setting the “Forzar reposo” checkbox of blade X to check , in “Blades synoptic” (force fixed position).

An interesting experiment is to see how is the transition from “Large” generator connection to “Small” generator connection and vice versa. These changes occurs in “normal” behavior, due to changes in the wind speed.

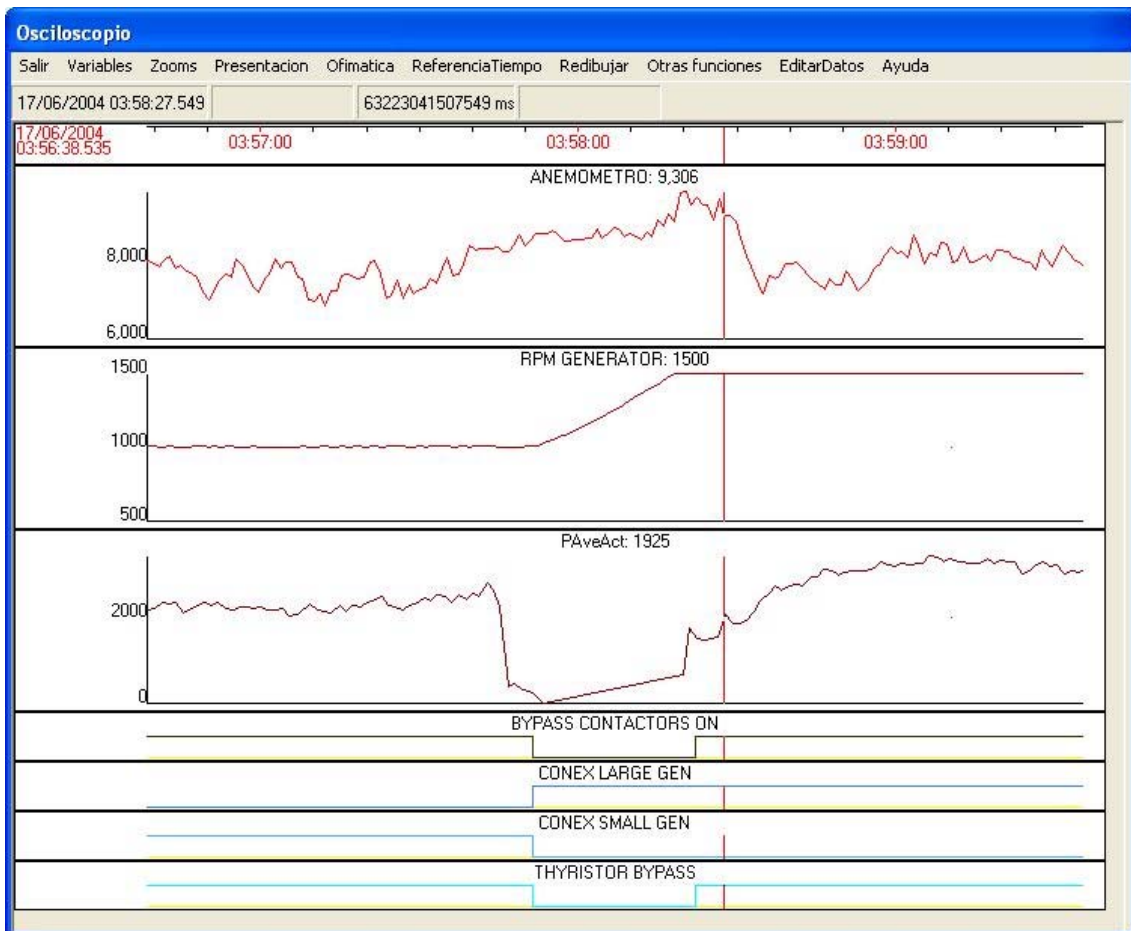
You can check that the transitions are similar to the cases shown in the following figures.

1500 to 1000 transition





1000 to 1500 transition



These figures come from **actual field data**, taken in a real windmill.

Of course you can also test the reaction of the Controller to extreme wind speeds, just changing the wind speed above the preset level for that and keeping it for a long enough period of time.



Synoptics

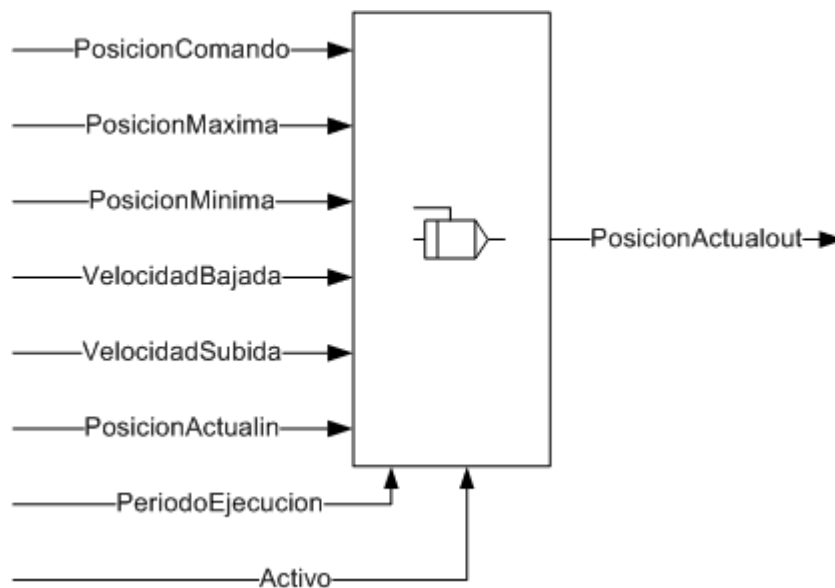
Every synoptic presented so far, is considered also a building block, with signals coming in and out of widgets, with no functional difference from a hardware block.

Algorithms

The behavior associated with some signals comes from the execution, in real time, of a number of instances of several algorithms. Those algorithms admit input signals as well as parameters and produced one or more output signals.

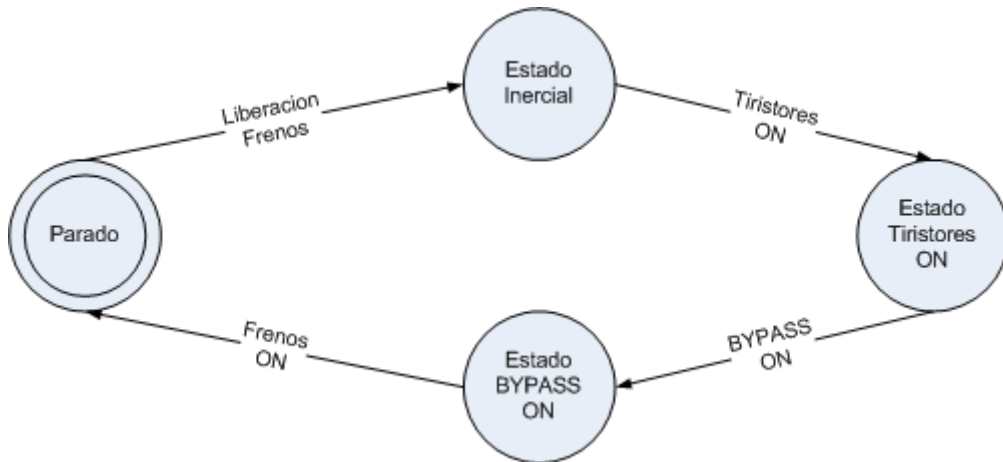
Algorithms are also treated as blocks. In this configuration for the BONUS 1300 we use a number of algorithms: linear following (blades), circular integration (nacelle yawing), thermal inertia, state-machine for the windmill, table driven (generator curves) and complex ones, such the computing of available power related to with speed and blade angle.

Linear Control

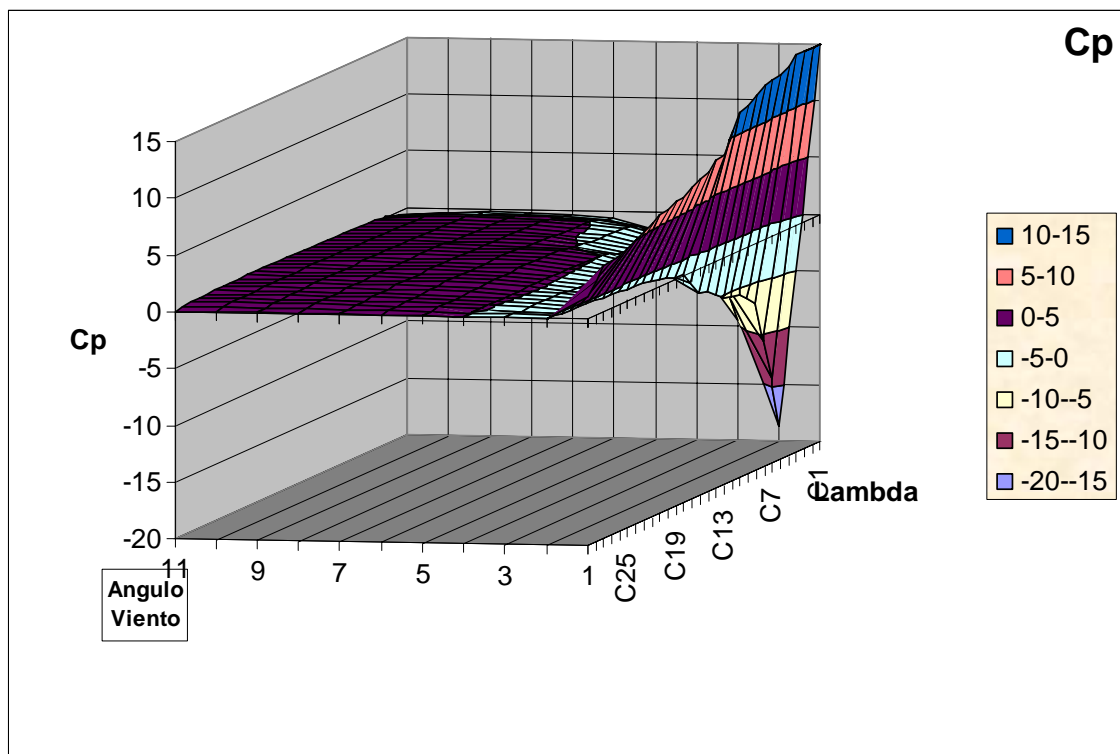




State Machine



Available power from wind speed, wind angle, blade angle.



The design of this Simulator allows the replacement of any of these algorithms by others, with no need to replace other parts, such as the synoptic that shows/control its signals. That freedom of design is achieved with the concept of "Connectivity" among the blocks, through their signals.



Connectivity

The behavior of the Simulator, as a whole, depends not only of its block components (hardware, synoptics or algorithms) but also of the way they are interconnected

These connections can be seen (and changed during executing of a simulation!) through the following form.

Edicion de Conexiones internas y bornas de conexion con el exterior

Conexiones internas | Bornas de entrada | Bornas de salida | Señales de Salida | Señales de Entrada

Salida	Entrada
AcumuladorFrenos.ContactodelPresostato	Frenos.Din.7
AcumuladorFrenos.FinCarrera	Frenos.Din.1
AcumuladorFrenos.PresionAcumulador	Frenos.Ain.0
AcumuladorHUB.FinCarrera	HUB.Din.5
AcumuladorHUB.PresionAcumulador	HUB.Ain.0
CalcAcumActivo.AcumActivo	CalcAcumActivo.dActivoGeneral
CalcEntVaciaAcum.VaciadorActivo	AcumuladorFrenos.EstadoVaciador
CalcGEN_CONTACT_FB.GEN_CONTACT_FB	CPUBX1-L1.GEN_CONTACTOR_FEEDBACK
CalcPresionGearOil.VeloVaciado	Multiplicadora.Ain.0
CalculoBYPASS.PosicionOFF	CPUBX1-L1.BYPASS_CONTACTORS_OFF
CalculoBYPASS.PosicionON	CPUBX1-L1.BYPASS_CONTACTORS_ON
CalculoCp.CosFiCalculado	GPTR-L5.CosFiConjunta
CalculoCp.I	GPTR-L5.IinConjunta
CalculoCp.I	Panel de Control.Ain.4
CalculoCp.RPMGen	Panel de Control.Ain.0
CalculoCp.TiristoresOut	Panel de Control.Din.2
CalculoRPMsPalas.RPMsPalas	CalcVCU_FB.RPMsPalas
CalculoRPMsPalas.RPMsPalas	Palas.RPMPalas
CalculoRPMsPalas.RPMsPalas	Panel de Control.Ain.1
CalcVeloBajadaPresAcum.VeloVaciado	AcumuladorFrenos.VelocidadBajadaPresion
CPUBX1-L1.A2_FANE202	Miscelaneos.Din.12
CPUBX1-L1.A2_HEATING_ELEMENT_E201	Miscelaneos.Din.13
CPUBX1-L1.AUX_RELAY_CC_JENSEN_OFF_LINE_FILTER	Miscelaneos.Din.7

Añadir conexion | Analógicas | Digitales | Salidas | Entradas

The left most tab in this form shows the connections among the different blocks (both hardware blocks, synoptics and algorithms). Black rows correspond to digital signals, red ones to analogic signals. Each output signal (left: "Salida" - output -) can be connected to 0, one or more input signals (right: "Entrada" - input -).

The tab branded "Señales de Salida" (Output signals) show all the signals going out of the simulator hardware (to the Controllers). The column "Conectada" (connected) shows the actual "virtual" connection status of the signal: if not checked, the changes of that signal are not transmitted



to the Controllers. This is another way to force faulty conditions to check the reaction of the Controller.

Edición de Conexiones internas y bornas de conexión con el exterior		
<div> Conexiones internas Bornas de entrada Bornas de salida Señales de Salida Señales de Entrada </div>		
Nombre	Conectada	Descripción
AcumuladorFrenos.ContactodelPresostato	<input checked="" type="checkbox"/>	
AcumuladorFrenos.FinCarrera	<input checked="" type="checkbox"/>	
AcumuladorFrenos.PresionAcumulador	<input checked="" type="checkbox"/>	
AcumuladorHUB.ContactodelPresostato	<input type="checkbox"/>	
AcumuladorHUB.FinCarrera	<input checked="" type="checkbox"/>	
AcumuladorHUB.PresionAcumulador	<input checked="" type="checkbox"/>	
CalAnguloVeleta.Veleta	<input type="checkbox"/>	
CalcAcumActivo.AcumActivo	<input checked="" type="checkbox"/>	
CalcAcumHUBActivo.Activo	<input type="checkbox"/>	
CalcEntVaciaAcum.VaciadorActivo	<input checked="" type="checkbox"/>	
CalcForzarOrentacion.Posicion	<input type="checkbox"/>	
CalcGEN_CONTACT_FB.GEN_CONTACT_FB	<input checked="" type="checkbox"/>	
CalcGiroGondola.Activo	<input type="checkbox"/>	
CalcHCU_FB.HCU_FB	<input type="checkbox"/>	
CalcPresionGearOil.VeloVaciado	<input checked="" type="checkbox"/>	
CalcSeguimientoPalasActivo.Activo	<input type="checkbox"/>	
CalculoBYPASS.PosicionOFF	<input checked="" type="checkbox"/>	
CalculoBYPASS.PosicionON	<input checked="" type="checkbox"/>	
CalculoCp.CosFiCalculado	<input checked="" type="checkbox"/>	
CalculoCp.EstadoAerogenerador	<input type="checkbox"/>	
CalculoCp.I	<input checked="" type="checkbox"/>	
CalculoCp.PotTotal	<input type="checkbox"/>	
CalculoCp.RPMGen	<input checked="" type="checkbox"/>	

Temperaturas.Aout.5
Panel de Control.AForzar.1



The last tab (“Señales de Entrada”) (Input signal) shows the list of signals coming in the Simulator hardware, and theirs “virtual” connection status.

Edición de Conexiones internas y bornas de conexión con el exterior		
Conexiones internas	Bornas de entrada	Bornas de salida
Señales de Salida		
Señales de Entrada		
Nombre	Conectada	Descripción
AcumuladorFrenos.Activo	<input checked="" type="checkbox"/>	
AcumuladorFrenos.EstadoBomba	<input checked="" type="checkbox"/>	
AcumuladorFrenos.EstadoVaciador	<input checked="" type="checkbox"/>	
AcumuladorFrenos.PerdidasPresion	<input checked="" type="checkbox"/>	
AcumuladorFrenos.PeriodoProceso	<input type="checkbox"/>	
AcumuladorFrenos.PresionAcumuladorIN	<input checked="" type="checkbox"/>	
AcumuladorFrenos.PresionLiberacionFreno	<input checked="" type="checkbox"/>	
AcumuladorFrenos.PresostatoLimiteInferior	<input checked="" type="checkbox"/>	
AcumuladorFrenos.PresostatoLimiteSuperior	<input checked="" type="checkbox"/>	
AcumuladorFrenos.VelocidadBajadaPresion	<input checked="" type="checkbox"/>	
AcumuladorFrenos.VelocidadSubidaPresionPorBomba	<input checked="" type="checkbox"/>	
AcumuladorHUB.Activo	<input checked="" type="checkbox"/>	
AcumuladorHUB.EstadoBomba	<input checked="" type="checkbox"/>	
AcumuladorHUB.EstadoVaciador	<input checked="" type="checkbox"/>	
AcumuladorHUB.PerdidasPresion	<input checked="" type="checkbox"/>	
AcumuladorHUB.PeriodoProceso	<input type="checkbox"/>	
AcumuladorHUB.PresionAcumuladorIN	<input type="checkbox"/>	
AcumuladorHUB.PresionLiberacionFreno	<input checked="" type="checkbox"/>	
AcumuladorHUB.PresostatoLimiteInferior	<input checked="" type="checkbox"/>	
AcumuladorHUB.PresostatoLimiteSuperior	<input checked="" type="checkbox"/>	
AcumuladorHUB.VelocidadBajadaPresion	<input checked="" type="checkbox"/>	
AcumuladorHUB.VelocidadSubidaPresionPorBomba	<input checked="" type="checkbox"/>	
CalAnguloVelela.DireccionViento	<input checked="" type="checkbox"/>	
Temperaturas.Aout.5		
Panel de Control.AForzar.1		