



SYNCHRONISING & TOTALISING PANEL

for 2, 3, 4 or several gensets

This type of electric control panel is studied for the control and management of a power plant comprising 2, 3, or 4 gensets working in synchro-parallel.

In case of emergency power plant, it's possible to include into the same cabinet even the control and the power section of the transfer switch between the Mains and the Gensets.

The synchro/parallel control panel includes the main **engine and alternator protections** and all the functions for the **synchronization** and **load sharing** for paralleling operations among several gensets. In addition, including the **Mains protections** and **AVR regulation**, this type of control panel can be used even for synchro/parallel application with the mains.

General info

The standard composition of the control panel comprises:

- One microprocessor based genset controller made by SICES (one for each genset) including internal synchronizer, load management and load sharing, power modulations and reactive power modulation functions.
- Power circuit (on demand) fit in a separated area from ancillary circuits, comprising (for each genset) one automatic, fixed and motorized, 4 poles circuit breaker for the alternator protection against max current properly sized based on the power of genset. For small powers (up to 170kVA) it's typically used one automatic and manual handled circuit breaker combined with a contactor for the genset connection on the parallel bus bars. In addition, 3 current transformers (for each genset) are provided.

As option it's possible to require the synchro/parallel control panel without power circuit in case of the latter is placed in a separated and external power switchboard.

- Series of fuses, relays and terminal boards
- Steel sheet carpentry with painting treatment using high resistance epoxy powder, colour RA7035. External protection degree IP40; internal protection degree IP20.
- Rules-compliant hazardous labelling and symbols.
- The parallel and speed control system is referred to engines with electronic speed governor or those engines with CANBUS J1939 interface

THE COMMON SECTION IS EQUIPPED WITH:

- N.1 Engine stop push button
- N.1 Selector switch: MAINS – AUTO – 0 – GENSET (only for emergency plant)
- N.1 Selector switch for: IMMEDIATE LOAD SUPPLY / END OF PARALLEL (only for emergency plant)
- N.1 Activation Plant selector switch: LOCAL – 0 – DISTANCE (only for production plant)

Operation sequence

Emergency power plant

The plant is activated by setting the proper selector switches in Automatic mode.

In case of mains failure detection or by receiving an external signal, the Gen Sets start (Voltage relay threshold is adjustable for amplitude and hysteresis).

Gen Sets are activated with 3 or more attempts each followed by break.

When the first Gen Set reaches the rated conditions, the relevant circuit breaker is closed and **synchronizing operations** are activated for the second or several Gen Sets.

Once synchronizing conditions are reached, the Gen Set is paralleled, closing its motorized circuit breaker and the load is switched under the gensets which supply the **load sharing** the latter.

If the proper circuit is selected (**load management**), after an adjustable delay, the control panel checks the real electric power required from the load and if a minimum number of Gen Sets is enough to supply the load, the Gen Set selected as slave is stopped. If the load increases, the system activates the Gen Set in stand-by once again operating in parallel with the master Gen Set.

At the Mains restoring, after a settable delay to verify Mains conditions, Gen Sets/Mains transfer switch return to normal conditions. The Gen Sets are disconnected from the loads and after a proper time delay for engines cool down are stopped.

All previous parallel start and change-over operations can also be carried out manually through proper controls.

Production power plant

When required at the same price the Control Panel can be modified to use it only for production plant.

In this case the plant activation will be obtained not by a mains sensing relay but by a proper selector with possibility of local or remote starting.

Priority management of gensets

There are different management systems which define conditions and priorities for ON/OFF of Gensets according to the load.

1. **Manual Management**
2. **Rotation scheme based on fixed time**
3. **Rotation scheme based on time intervals**
4. **Automatic Master genset selection based on the rated power of available gensets (NEWS)**
5. **Automatic Master genset selection in order to have the minimum number of running gensets (NEWS)**

These priorities may even be excluded by the operator keeping all the Gen Sets ON independently from the load.

1. MANUAL MANAGEMENT

With this mode the operator can set the Master Gen Set which will be always ON, when required.

Based on the request of load, the other Gen Sets start or stop depending on the load measured on mains and, also, depending on the default priorities given by the operator himself.

2. ROTATION SCHEME BASED ON A FIXED TIME

The Master genset is automatically selected by the genset controller based on a fixed timing per day. Thus the master genset periodically changes.

3. ROTATION SCHEME BASED ON TIME INTERVALS

The Master genset is changed after the previously set elapsed time.

4. AUTOMATIC MASTER GENSET SELECTION BASED ON THE RATED POWER OF AVAILABLE GENSETS (NEWS)

Based on the request of load, the automatic logic defines which gensets have to be ON, analysing the rated power of them with the requested load.

Example: there is power plant composed by 4 synchro/parallel gensets of the following powers: 100, 700, 300 and 500kW.

The load is 300kW.

With the “function based on power available”, the automatic logic maintains at work the 100kW and 300kW gensets only due to the total power of working gensets is 400kW a bit more than the load power request.

5. AUTOMATIC MASTER GENSET SELECTION IN ORDER TO HAVE THE MINIMUM NUMBER OF RUNNING GENSETS (NEWS)

Based on the request of load, the automatic logic selects which gensets maintain at work, evaluating their power, with the purpose to have the minor number of gensets on.

Considering the previous example, with the “function based on Number”, only the 500kW genset is maintained ON because able to supply the load.

Operation sequence in case of Mains Synchro/Parallel

The activation command, by operator or remote control, provides the following actions:

- Gen set activation
- Control of synchronization between the Genset and the Mains
- Closure of the genset circuit breaker (GCB) after checking the reached conditions
- Ramp power until a settable value

In case of a problem on the line, the control panel controls the opening of the Mains Circuit Breaker (MCB)

- When the Mains value are into the usual limits, the control panel starts again the synchro operation between gen set and Mains, closing the MCB once again and supply the power.

The deactivation command, provides the following actions:

- The gradual reduction of the supplied power until zero
- Opening in GCB
- Genset running without load for a settable time for coolant operation of the engine until stop

If the emergency mode is selected, the genset is in stand-by, ready to automatically start to run in case mains failure.

When the mains returns, the control panel manages the back-synchronization avoiding the second voltage drop.

Special and customized solutions are available even for CHP power plants.

Fast paralleling system with DST4602^{Evolution}



*Innovative and automatic sequence already built-in DST4602^{Evolution} genset controller that allows to achieve a **fast synchronization and paralleling of many gensets comprising in an emergency power station in a maximum time of 9 - 15 sec.** (based on the alternator and engine features).*

*The advanced system called “**Fast Paralleling**” is an effective solution for those sensitive realities where any mains failure, even for a few seconds, could cause huge problems for the security of people and data and create damages for the production processes (banks, hospitals, data centers, etc...). Using the Fast Paralleling system, gensets are switched on, synchronized and ready to supply the loads in a few seconds from the mains failure signal.*

Standard composition

Besides the gensets controllers (one for each genset9 and the power circuit (if required), based on the type of the genset, a series of additional circuits are available as option:

- Feeders for electric radiators, electric fans, electric pumps, prelube pumps, ant—condensate space heater, ...
- Electronic devices for additional analogues I/O like temperature measures with setting thresholds from PT100, Thermocouples, and Voltage / Current signals 0..05V - 0...10V e 0...10mA - 0...20mA
- A supervisor software called SicesSupervisor is available for a local or a remote supervision of the plant. This system allows to be informed in case of alarm or shutdown of the gensets.
- Based on the needs, different modes are available in order to monitor the status of gensets:
- RS485 Modbus (for a max. connection of 800mt)
- Analogue modem
- GSM/GPRS modem
- Ethernet interface with gateway converter TCP/IP

Measures

Generator voltage:

L1-N, L2-N, L3-N, L1-L2, L2-L3, L3-L1
Lx-N max. voltage < 300Vac cat. IV
High voltage pulse = 6kV 1.2/50 us
Max. measurable voltage = 25.000V (by external TV)

Generator Currents:

L1, L2, L3, N (*)
True RMS measurement
Nominal max. current: 5Aac and 1Aac (based on the selected controller)
(Overload measurable current : 4 x 5Aac (sinusoidal)
Internal current transformer
Max. nominal current = 6000A (by external TA)
(*) Neutral generator current as alternative to differential protection or to be used for measure mains power with DST4602 *Evolution*.

Mains/Bus Voltage:

L1-N, L2-N, L3-N, L1-L2, L2-L3, L3-L1 True RMS measure.
Lx-N max. voltage < 300Vac cat. IV
High voltage pulse = 6kV 1.2/50 us
Max. measurable voltage = 25.000V (by external TV)

Generator and Mains Frequency meter:

Resolution = 0.1 Hz
Accuracy = ± 50ppm, ±35ppm/°C (typical)

Battery Voltmeter:

Resolution = 0.1V

Oil Pressure Sensor:

Settable curve based on sensors available

Oil Temperature Sensor:

Settable curve based on sensors available

Water Temperature Sensor:

Settable curve based on sensors available

Fuel Level Sensor:

Settable curve based on sensors available
Up to 400 ohm

Engine Revolution Counter:

By pick-up. Programmable teeth number
Same input can be used by W signal

Derived Values

- Active power
- Reactive power
- Apparent power
- Power factor: total and phase by phase
- Active and reactive energy counter
- Hour counter for maintenance/rental
- Start Counter

Engine Protections

- Max. power
- Overspeed (12)
- Incomplete sequence (48)
- Belt-break
- Engine temperature warning and alarm
- Oil pressure warning and alarm
- Water level warning and alarm
- Fuel level

Generator Protections

- Underfrequency (81U)
- Overfrequency (81O)
- Undervoltage (27)
- Overvoltage (59)
- Power direction (32)
- Loss of excitation (Reverse reactive 32RQ)
- Time dependent overcurrent (51) IDMT
- Instantaneous overcurrent (50)
- Synchro-check (25)
- Phase sequence (47) and Current and Voltage unbalance (46)
- Ground Fault Protection (51N or 51GN) as alternative to neutral measure (64)
- Negative sequence I2
- Phase overcurrent with voltage restraint/control (51V)

Mains Protections

For Mains parallel applications, there are the following protections:

- Rate of Change of Frequency (81R ROCOF)
- Vector shift
- Undervoltage (27)
- Overvoltage (59)
- Underfrequency (81U)
- Overfrequency (81O)
- 27T - Low voltage protection time-dependent (FNN-VDE Q-U-protection)
- 27Q - Low Voltage Protection with Directional reactive (FNN-VDE Q-U-protection)

Dynamic Mains Support

Automatic adjustment of the power output based on the mains frequency value. This feature allows to maintain the safety conditions of the genset in case the mains frequency drops under acceptable values for the genset.

General functions

Real time clock calendar:

Hour, minute, second, day, month, year (leap year), day of week.

Rechargeable Lithium battery available as standard.

Gen-set operation can be enabled based on days of the week and time. Test operation can be enabled based on days of the week. Date and time can be remotely adjusted by software.

Engine diagnostic code

Periodical test

Fast and Slow trend history log:

Event history log:

Fuel pump:

Board manages a fuel pump by means an external power relays and by 5 input level signals. Auto and Manual operating mode.

Maintenance warning:

Board issue a warning when the running hours before maintenance are elapsed.

Panel Temperature warning:

Board issue a warning when panel temperature are approaching a specified temperature.

Gen-Set lock function

Gen-Set operation can be remotely disabled. Unlocking requires the supplied password.

Internal Alarm Horn:

Internal Alarm Horn make easier panel assembling.



Communication

- N.1 Serial port RS232 with MODBUS RTU protocol
- N.1 Serial RS485 insulated with MODBUS RTU protocol
- N.1 Ethernet interface MODBUS TCP/IP
- N.1 USB Port for the configuration and FW update

As option:

- Direct GSM and PSTN Modem management
- Automatic call in case of event



Genset controllers



DST4602^{Evolution} - Advanced microprocessor based genset controller which includes synchronizer, load sharing, power modulation and reactive power management. It allows the synchronization of a **max. of 24 gensets**.

Thanks to the great extension capability of binary and analogical I/O, DST4602^{Evolution} is particularly recommended for complex power stations such as Oil&Gas systems.

In addition, DST4602^{Evolution} includes PLC offering an high level management of and customized logics .

The big and powerful **graphic display 7”(125 x 72mm)** allows an user-friendly interface for the user.

In very critical and sensitive plants like Hospitals, Datacentres, Banks, where the total power of multiple gensets is required in very short time, the DST4602^{Evolution} offers a special function called **Fast Paralleling or Dead Synchronisation**.

Considering DST4602^{Evolution} includes the main engine and alternator protections and even the mains protections 81R ROCOF, Vector shift, 27, 59, 81<, 81> , with just one controller it’s possible to cover all the applications.

- ▶ **Easy operation management**
- ▶ **Programmable start and stop**
- ▶ **Event history log with data**
- ▶ **Fast Paralleling Function**



GC600 - Reliable microprocessor based genset controller which includes synchronizer, load sharing and the main engine, alternator and mains protections for a safety control of gensets. It allows the synchronization with a **max of 24 gensets**.

GC600is equipped with a **graphical and coloured display 4,7” (95x54mm)** and allows a user-friendly visualization of the measures and status of the genset displayed on the pages of the menu.

GC600 offers several modes for the **remote communication**: RS485 (Modbus RTU), Ethernet (Modbus TCP/IP). RS232 and USB are available as well for the configuration and the FW update.

As per as every Sices genset controllers, the parameters setting can be done using the free PC toll (BoardPRG) or the front key board of the controller.

- ▶ **User friendly management**
- ▶ **Programmable start and stop**
- ▶ **Event history log with data**
- ▶ **Extended communication serial ports**



GC400 - Compact and competitive microprocessor based genset controller which includes synchronizer, load sharing and the main engine, alternator and mains protections for a safety control of gensets. It allows the synchronization with a **max of 16 gensets**.

GC400is equipped with a **graphical display (70x38mm)** and allows a user-friendly visualization of the measures and status of the genset displayed on the pages of the menu.

GC400, in the LINK version include a powerful GPRS modem already built-in particularly recommended for unattended plants.

- ▶ **User friendly management**
- ▶ **Programmable start and stop**
- ▶ **Event history log with data**
- ▶ **Reliable and competitive solution with a special technology already built in for the remote communication**

S.I.C.E.S. SRL

Società Italiana Costruzioni Elettriche Sumirago

Via Molinello 8B
21040 - Jerago con Orago (VA) ITALY

T +39 0331 212941
F +39 0331 216102

www.sices.eu
sales@sices.eu

SICES BRASIL LTDA

Avenida Portugal, 1174
Condominio Empresarial ONIX
06696-060 / ITAPEVI (SP)

T +55 11 4193 2008

www.sicesbrasil.com.br
contato@sicesbrasil.com.br

