

# Advanced synchro parallel genset controller with internal load sharing, synchronizer and PLC functions

## DESCRIPTION

DST4602Evolution is the top-level device among Mecc Alte Load Share Generator Controllers.

It is an highly configurable genset controller for advanced and complex parallel applications, where a huge number of settings are required (functions and parameters) for the genset management, and its auxiliary circuits.

DST4602Evolution allows to connect up to 24 gensets on the same bus, working in island mode and in parallel with the mains.

Thanks to the controller's high configurable level and built-in PLC functions (with PID blocks), DST4602Evolution can be used for CHP power plants equipped with Gas, Diesel, Biofuel and Dual fuel Engine.

The controller also features fully integrated Air-Fuel Ratio (AFR) control, furthering its ability for such applications.

DST4602Evolution is fully equipped with internal Load Sharing, Synchronizer and W and VAR regulation. This controller includes a CAN J1939 interface, supporting a wide range of engines (Volvo Penta, Scania, Perkins, MTU, Deutz, Cummins, John Deere, Caterpillar and others). It can be also used with traditional engines, where measurements and control are performed by the embedded analogue interfaces.

DST4602Evolution can be used together with all Mecc Alte Load Share Generator Controllers (GC600, GC400). In case of multiple gensets in parallel with the mains where the reverse synchronisation is required, DST4602Evolution can be interfaced with the Mecc Alte mains controllers (MC200, MC400), to avoid in this way any further blackouts on the loads.

All the parameters can be set directly by the controller's keyboard or, alternatively using the free software tool (Mecc Alte Smartech BoardPRG4), available from the Mecc Alte website.

A free PLC software editor is also available, (SmartechPlcEditor) to set the PLC logics.

The enhanced and large 7" graphic colour display with TFT technology, is a user-friendly interface, conceived for a quick and easy visualization of measures and alarms coming from the genset.















This controller stores events and periodical data in the internal memory, this information can be read from the front panel display.

DST4602Evolution provides several communications interfaces for local or remote control.

In case of complex applications, like Oil&Gas stations, the inbuilt protections can be expanded by using the external protection relay D-PRO.



## INPUTS - OUTPUTS AND AUXILIARY FUNCTIONS

-  20 Digital inputs
-  16 Digital output
-  5 Analogue inputs
-  2 Analogue outputs
-  AND/OR Logic control
-  Event history log
-  16 Calendars
-  USB port
-  RS232
-  RS485
-  PLC Logic control
-  Ethernet connection
-  Air fuel ratio
-  TIER4 final STAGE V

- N. 20 opto-insulated digital Inputs.
- N. 5 analogue inputs including oil pressure, oil temperature, coolant temperature, fuel level (2 voltage inputs, 3 resistive inputs, all can be used as digital).
- N. 2 insulated analogue outputs for the regulation of frequency and voltage.
- N. 16 digital outputs.

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## Communication:

N.2 MODBUS RTU Serial Ports: RS232 and insulated RS485. N.1 Ethernet Port 10/100Mbps.

N.1 USB FUNCTION for the configuration.

- Internal clock with history log.
- Front protection degree: IP65 with gasket always included for free.

## OPERATION MODE

### Off/Reset

Engine start not allowed; load is forced to be supplied from the Mains.

When the engine is running and the operating mode is turned to 'OFF/RESET', the engine shutdown sequence is activated.

Reset of all alarms.

Parameters change allowed (programming).

### Program

Access to all programmable parameters.

Programming access can be controlled by means of three level passwords.

Some parameters can be changed even if the engine is running.

### Manual

Engine manual START and STOP controls are enabled.

The genset protections are activated.

The starting command is automatically disabled when the engine is running.

MCB and GCB pushbuttons are enabled when generator is in operating range.

Their function depends on the selected application.

Manual synchronization can be easily accomplished by built-in function.

### Automatic

The operating sequence depends on the selected application:

Single Prime Mover, Stand-by, Stand-by and Short Time Parallel, Single Parallel to Mains, Multiple Prime Mover, Multiple Parallel to Mains.

## Test

Automatic start for testing operations with safety protections enabled.

Test can be made unloaded, loaded or in parallel to mains.

Upon mains failure, the load is immediately supplied by the genset.

## PARALLEL APPLICATIONS

Parallel to mains application is allowed by the internal power regulator. Soft loading and unloading is automatically performed. The most common Loss Of Mains protection are embedded.

Multiple prime mover application is allowed by means of CAN interface that allows load sharing.

Synchronization is done through an internal digital synchronizer, avoiding expensive external synchronizers.

## CONTROLS

- Operating mode selection (available in two versions):
  - with selector key,
  - with two dedicated push buttons.
- Engine START and STOP pushbutton.
- GCB and MCB command using push buttons.
- ACK/MODE (acoustic alarm silencing and other aux. functions).
- Four ARROW keys for LCD display selection mode, window selection, parameter change and other.
- EXIT, ENTER and SHIFT keys.
- LCD CONTRAST DECREASE/INCREASE.

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## MAIN FEATURES

- Digital UP/DOWN commands for speed governor and AVR.
- Mains and Genset circuit breaker management.
- True RMS readings on generator and mains voltages and on generator currents, with an additional current measurement for neutral or differential protection.
- Active, reactive and apparent power measurements.
- Frequency and power measurements on mains input.
- 20 fully programmable digital inputs with possibility of additional several inputs.
- 16 fully programmable digital outputs with possibility of additional several outputs.
- Several communication tools (RS232, Insulated RS485, RJ45 Ethernet, USB port).
- Large TFT graphic coloured display 7" 800x480 pixel.
- Real Time Clock, events and data recording.
- Remote control systems.
- KEMA Certification - Guideline BDEW (DE).

## DYNAMIC SUPPORT OF THE GRID

The dynamic support to the grid is available: automatic adjustment of the active power output based on the mains frequency value. This feature allows the genset to support the grid in case of over/under production.

## MEASURES

### Generator voltages

L1-N, L2-N, L3-N, L1-L2, L2-L3, L3-L1.

True RMS measurement.

Lx-N max. voltage < 300Vac cat. IV.

Max. measurable voltage = 50.000V (by external VT)..

### Generator currents

L1, L2, L3, N (\*).

True RMS measurement.

Nominal max. current: 5Aac, 1Aac.

Overload measurable current: 4 x 5Aac (sinusoidal).

Internal current transformers.

Max. nominal current = 6000A (by external CT).

(\*) Neutral generator current measure or, in alternative used for the measure of the power on the mains.

### Mains voltages

L1-N, L2-N, L3-N, L1-L2, L2-L3, L3-L1.

True RMS measurement.

Lx-N max. voltage < 300Vac cat. IV.

Max. measurable voltage = 50.000V (by external VT).

### Generator and mains frequency meter

Resolution = 0.1 Hz. Accuracy =  $\pm 50\text{ppm}$ ,  $\pm 35\text{ppm}/^\circ\text{C}$  (typical).

### Battery voltmeter

Resolution = 0.1V.

### Oil pressure gauge

Configurable curve based on sensors available.

### Coolant or Oil Thermometer

Configurable curve based on sensors available.

### Fuel level

Configurable curve based on sensors available.

### Engine revolution counter

By pick-up.

Programmable teeth number.

Same input can be used by W signal.

### Derived values

Active power: total and phase by phase.

Reactive power: total and phase by phase.

Apparent power: total and phase by phase.

Power factor: total and phase by phase.

Active and reactive energy counter.

Hours counter for maintenance/rental.

Start Counter.

Power and currents peak values are stored with date and time.

Additional engine analogue measures are available in case of engines with CANBUS J1939 interface.

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## PROTECTIONS

### AMF Mains protections

- Undervoltage (27)
- Overvoltage (59)
- Underfrequency (81U)
- Overfrequency (81O)
- Voltage unbalance (47)
- Phase sequence (47)

### Loss Of Mains (LOM) protections

- Rate of Change of Frequency (81R ROCOF)
- Vector shift
- Undervoltage (27)
- Overvoltage (59)
- Underfrequency (81U)
- Overfrequency (81O)

### Generator protections

- Max power. Underfrequency (81U).
- Overfrequency (81O).
- Undervoltage (27).
- Overvoltage (59).
- Power direction (32).
- Loss of excitation (Reverse reactive 40).
- Time dependent overcurrent (51) IDMT.
- Instantaneous overcurrent (50).
- Phase overcurrent with voltage restraint/control (50V/51V).
- Synchro-check (25).
- Phase sequence (47).
- Current and Voltage unbalance (46/47).
- Ground Fault Protection (64) as alternative to neutral protection (50N).
- Negative sequence (I2).

Possibility to extend the protections of the controller using Mecc Alte Protection Relay D-PRO.

### Engine protections

- Overspeed (12).
- Incomplete sequence (48).
- Belt-break.
- Coolant and lube oil temperature warning and alarm.
- Lube oil pressure warning and alarm.
- Max. power.
- Fuel level.
- Emergency stop.

### Real time clock calendar

- Hour, minute, second, day, month, year (leap year), day of week.
- Rechargeable Lithium battery available as standard.
- Genset 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.

### Periodical data recording

- Up to 860 record based on the configuration.

### On event data recording

- Up to 860 record based on the configuration.

### Fuel pump

- The controller manages a fuel pump by means an external power relays and by 5 input level signals, or by the analogue measurement.
- Auto or manual operating modes.

### Maintenance warning

- The controller can issue a warning when the running hours for maintenance are elapsed. Three timers are available for this task.

### Controller temperature warning

- The controller can issue a warning when controller temperature is approaching a specified temperature.

### Internal alarm horn

- Internal alarm horn make easier panel assembling.

## COMMUNICATIONS

### DST4602Evolution

- N..1 Serial port RS232 with MODBUS RTU protocol.
- N..1 Serial port RS232 or insulated RS485 with MODBUS RTU protocol.
- N..1 USB port for firmware upgrade.
- N..1 USB port with MODBUS RTU protocol.
- N..1 Ethernet port with Modbus TCP protocol
- Direct GSM and PSTN modem management.
- Automatic call or SMS in case of event.

### As option

- Modem GSM.
- REWIND - Module interface for SMARTCLOUD using GPRS/GSM and GPS technology.
- DANCE - Module interface for SMARTCLOUD using Ethernet technology.
- Supervision software Mecc Alte SS3 and SMARTCLOUD.

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## LOAD MANAGEMENT

In case of plants with several gensets connected in parallel on the same bus, it is possible to set different automatic logics for start/stop gensets, based on the load request.

### In detail

- Manual setting of the master genset by means of selector switch on the control panel.
- Automatic rotation of the Master genset after a fixed time per day.
- Automatic rotation of the Master genset after an elapsed time.
- Automatic selection of working gensets having a matching power with the request on load (\*).
- Running hours equalizations.

(\*) Functions available for a max of 5 gensets.

### Active power modulation

Power regulation is allowed through internal power regulator.

For electronic engines, a CAN line is available for speed regulation.

For traditional engines is available a proper analogue interface.

### Reactive power regulation

DST4602Evolution controls AVR directly in order to manage the reactive power.

DST4602Evolution is a multilanguage device.

The display languages available are: English, Italian, French, German, Spanish, Russian, Albanian, Greek, Polish and Brazilian Portuguese.

## TECHNICAL DATA

- Supply voltage: 8...33 Vdc.
- Power consumption: less than 7W (+5W for display lamp) typically.
- Rated Genset frequency: 50 or 60 Hz.
- Digital Input: opto-insulated.
- Static outputs: 500mA @ 25°C, 360mA @ 50 °C, 20 Apk.
- Relay outputs: 10A nominal.
- Auxiliary relays outputs: 1/2,5/4A 30V.
- Weight: 1,6kg.
- Overall dimension: 260 (W) x 202 (H) x 86 (D) mm.
- Panel cut-out: 240 (W) x 172 (H) mm.
- Panel mounting: by means of stud-bolt.
- Protection Grade: IP54 (front panel, by means of additional keylock protective cap and gasket).
- EMC: compliant with EN61326-1.
- Safety: built in compliance with EN61010-1.

### Display Features

- DST4602Evolution 800x480 Pixel TFT, 7" Colour display.
- Overall dimension: 155(L) x 93(H) mm.
- Operating temperature: -20 °C to 60 °C.
- Stock temperature: -30 °C to 80 °C.

DST4602Evolution is equipped with a dual processor for improved response.

One processor is aimed for the measures and operation sequences. The other one is aimed for the human interface(display).

## FAST PARALLELING SYSTEM (Dead bus paralleling)

DST4602Evolution has a built-in innovative and automatic start sequence, that allows to achieve a fast paralleling of several gensets in a maximum time of 9 - 15 sec. (it depends on the alternators and engines features).

The advanced system so called "Fast Paralleling" or "Dead Bus Paralleling", is an effective solution for those sensitive stations where any mains failure, even for a few seconds, could cause huge problems to people and data security, by creating damages during the production processes (banks, hospitals, data centres, etc...).

Using the Fast Paralleling feature, gensets are switched on, synchronized and ready to supply the loads in a few seconds from the mains failure signal.

### How it works

In case of a mains failure, Mecc Alte genset control panel gets a signal from the existing ATS (it may be ATS115, MC200 or MC400) to start the gensets.

The implemented logic in DST4602Evolution controls the gensets status, checking which of them are ready and available to start taking the load.

The gensets start working together with the relevant circuit breakers (GCB) already closed. By means of a safety and proper control of speed ramp and excitation range, gensets are simultaneously brought to the rated conditions.

All gensets are, therefore, ready and in parallel in 9-15 seconds max. (it depends on the engines and alternator types). The load is supplied by all gensets running in parallel.

If some gensets won't start at first attempt, the control logic opens the relevant circuit breaker.

The other gensets carry on with the fast-starting operations. The genset that has reached the rated conditions with delay, can be inserted afterwards, making the usual synchronization operations.

# Advanced synchro parallel gset controller with internal load sharing, synchronizer and PLC functions

## FURTHER PRODUCT CONFIGURATIONS

### Split version

This controller can be provided in two separate devices (Display + Control unit), for particular use and assembly purposes.

In addition, it's possible to choose between the version with Key selector switch or with Push buttons for the operating mode selection.

Below, the user interface with display unit, to be mounted on the control panel's door, and the control unit to be mounted inside the panel.

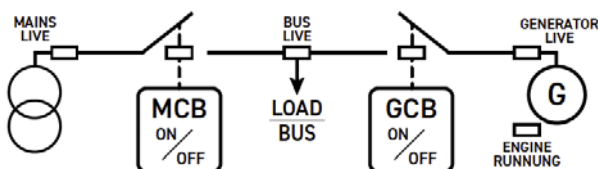


## APPLICATION TYPE

Depending on the application, two different single line diagrams on the front panel are available.

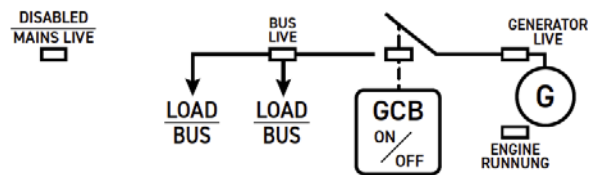
### 1. Including the GCB (not the MCB)

For those plants where the gset controller do not manage directly the MCB (Mains Circuit Breaker)



### 2. Including MCB + GCB

For those plants where is necessary to directly control the MCB (Mains Circuit Breaker): single gset working as emergency or in parallel to the mains.



## ADDITIONAL REMOTE DISPLAY

For each local DST4602Evolution it is possible to add one or more remote displays, called DST4602Remote.

This solution is usually recommended in case of remote-control room where the gset monitoring is required.

It is possible to connect up to 4 remote displays to a single DST4602Evolution controller.



### Connection between DST4602Remote and DST4602Evolution

- Via RS485 Modbus RTU (max 800mt).
- Via ethernet TCP/IP (max. distance 100mt without any hub). If via ethernet, it is possible to connect several DST4602Remote to one local controller.



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## Graphic display

DST4602Remote is equipped with a powerful 7" colour graphic display  
TFT - 800x480 pixel.

## Key selector controls

- Command disabled: no operation is allowed.
- Command enabled: all operations are allowed.
- Remote reset: reset of alarms/warnings.

## Push buttons

REMOTE START: starting is enabled if the operating mode of the local controller is in AUTO.

REMOTE STOP: used to remotely stop the genset.

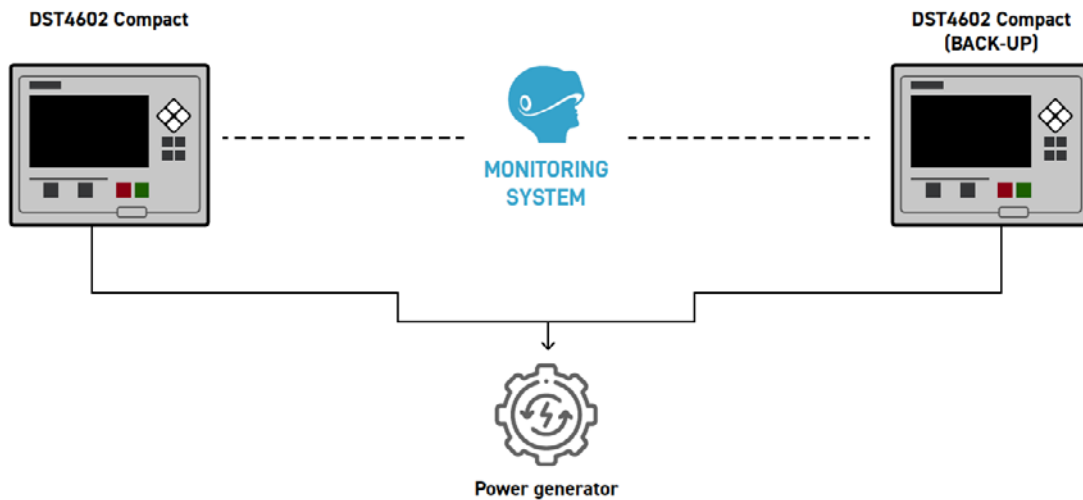
- If the genset has been started by the DST4602Remote, the "REMOTE STOP" stops the genset with the cooling operations.
- If the genset has been started by the local DST4602, the "REMOTE STOP" stops the genset immediately without any cooling operations.

GCB: for manual opening/closure of the Genset Circuit Breaker.

## Security

System safety can be increased with a dedicated password, on both local and remote controller.

## REDUNDANT CONTROLLER FUNCTION



In sensitive contexts, it is necessary to ensure a safe control of the genset.

Basically, a reliable control is achieved using a "Master unit" which is able to control the genset, combined to a "Back-up unit".

The "Master unit" is equipped with a self-diagnostic system (watch dog), able to detect any failure of the controller.

After an elapsed and settable time, the "Back-up unit" automatically switches on, taking responsibility of controlling the genset.

When the "Master unit" is ON, the "Back-up unit" is OFF and vice-versa.

In this way, there is no command failures risks between the controllers.

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The redundancy available is defined “warm type”, taking consideration that 6-7 seconds are required before the “Back-up unit” is activated.

It is possible to configure the redundancy of the controllers as follows.

For each genset:

- A. 2 x DST4602 compact,
- B. 2 x DST4602 SCM + N.1 DST4602 HMI (display).

With the case b) there is one common display (DST4602 HMI) and the backup is done on DST4602 SCM (the internal box).

