DST4602*Evolution*

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

DESCRIPTION

DST4602*Evolution* is the top-level device among SICES 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.

DST4602*Evolution* 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), DST4602*Evolution* 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.

DST4602*Evolution* is fully equipped with **internal Load Sharin**g, 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.

DST4602*Evolution* can be used together with all Sices genset controllers (**GC600, GC400**). In case of multiple gensets in parallel with the mains where the reverse synchronization is required, DST4602*Evolution* can be interfaced with the Sices mains controllers (**MC200, MC400**), to avoid in this way any further blackouts on the loads.

The controller's configurable parameters make standard and customized tasks easy to manage.

All the parameters can be set directly by the controller's keyboard or, alternatively using the free software tool (**BoardPRG3**), available from SICES' website.

It is also available a free **PLC software editor,** (**SicesPlcEditor**) 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.

DST4602*Evolution* 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.

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.

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.

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 = ±50ppm, ±35ppm/°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.

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 SICES 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.

GENERAL FUNCTIONS

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

DST4602*Evolution*
- 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 **SIMONE** using GPRS/GSM and GPS technology.
- DANCE - Module interface for **SIMONE** using Ethernet technology.
- Supervision software **SicesSupervisor3** and **SIMONE**.

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
DST4602 Evolution controls AVR directly in order to manage the reactive power.

DST4602 Evolution is a multilanguage device.
The display languages available are: English, Italian, French, German, Spanish, Russian, Albanian, Greek, Polish and Brazilian Portuguese.

TECHNICAL DATA

DST4602 Evolution
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).

> 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
> **DST4602**Evolution 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.

FAST PARALLELING SYSTEM
(Dead bus paralleling)

DST4602_Evolution_ 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, Sices 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 **DST4602**_Evolution_ 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.

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.
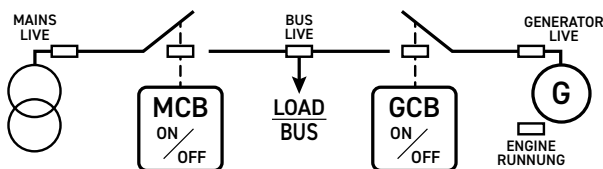

APPLICATION TYPE

Depending on the application, two different single line diagrams on the front panel are available.
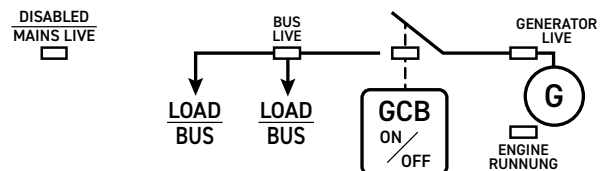
1. Including the GCB (not the MCB)

For those plants where the genset 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 genset working as emergency or in parallel to the mains.

DST4602evo
Datasheet_EN

ADDITIONAL REMOTE DISPLAY

For each local **DST4602***Evolution* it is possible to add one or more remote displays, called **DST4602***Remote*.

This solution is usually recommended in case of remote-control room where the genset monitoring is required.
It is possible to connect up to 4 remote displays to a single **DST4602***Evolution* controller.

|	
Connection between DST4602*Remote* **and DST4602***Evolution*	• 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 **DST4602***Remote* to one local controller.
Graphic display	**DST4602***Remote* 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 **DST4602***Remote*, 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

DST4602 Compact

DST4602 Compact (BACK-UP)

MONITORING SYSTEM

Power generator
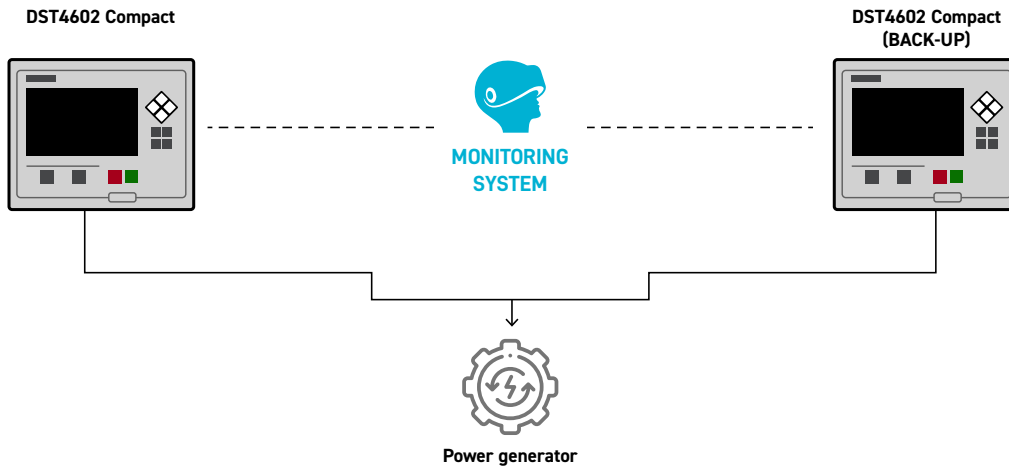
In sensitive contests, it is necessary to ensure a safe control of the genset.

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.

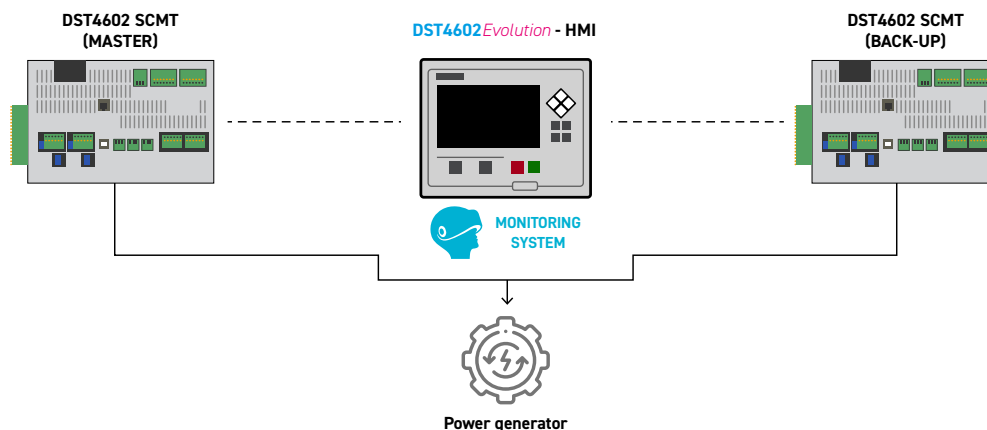In this way, there is no command failures risks between the controllers.

The redundancy available is defined "warm type", taking consideration that 6-7 seconds are required before the "Back-up unit" is activated.
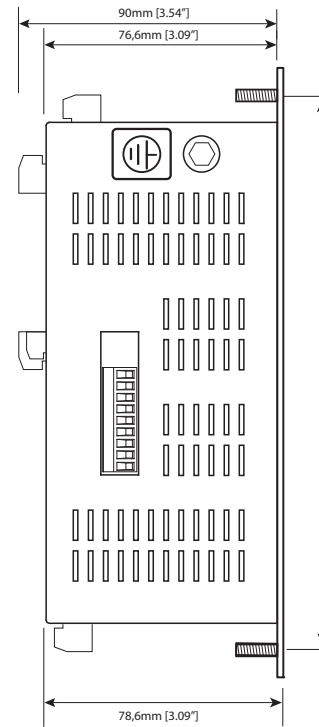
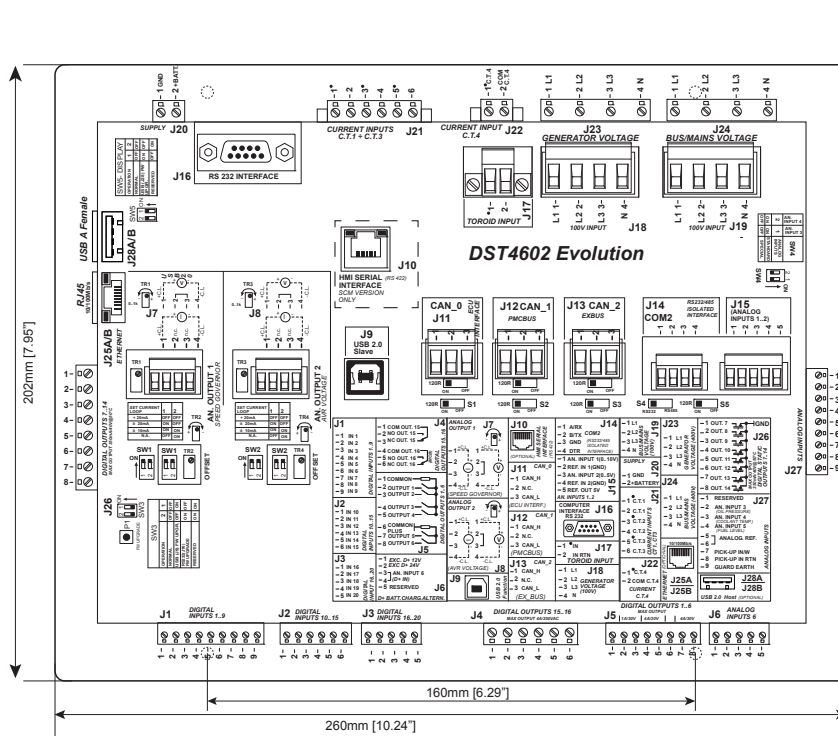It is possible to configure the redundancy of the controllers as follows.

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).

DST4602 SCMT (MASTER)

DST4602_Evolution_ **- HMI**

DST4602 SCMT (BACK-UP)

MONITORING SYSTEM

Power generator

DST4602 Evolution

90mm [3.54"]
76,6mm [3.09"]
202mm [7.95"]
160mm [6.29"]
260mm [10.24"]
78,6mm [3.09"]

SUPPLY J20
J16 RS 232 INTERFACE
USB A Female
J28A/B
RJ45 10/100 J25A/B ETHERNET
CURRENT INPUTS C.T.1 + C.T.3 J21
CURRENT INPUT C.T.4 J22
J17 TOROID INPUT
J23 GENERATOR VOLTAGE
J24 BUS/MAINS VOLTAGE
J18 100V INPUT
J19 100V INPUT
J10 HMI SERIAL INTERFACE (RS 422) SCM VERSION ONLY
CAN_0 J11
J12 CAN_1 PMCBUS
J13 CAN_2 EXBUS
J14 COM2
J15 ANALOG INPUTS 1..2 RS232/485 ISOLATED INTERFACE
J9 USB 2.0 Slave
AN. OUTPUT 1 SPEED GOVERNOR
AN. OUTPUT 2 AVR VOLTAGE
DIGITAL OUTPUTS 7..14
J26 SW5
SW1 SW1 SW2 SW2
DIGITAL INPUTS 1..9 J1
DIGITAL INPUTS 10..15 J2
DIGITAL INPUTS 16..20 J3
DIGITAL OUTPUTS 15..16 MAX OUTPUT 45/230VAC J4
DIGITAL OUTPUTS 1..6 J5
ANALOG INPUTS 6 J6
J27
ANALOG OUT/INPUTS

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