Advel Application Note – AAN2010.1

How to calibrate the parallel DIN power supplies in a running system

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1. Introduction

For powering systems that can not have any interruption of work (DCS or SCADA systems for power plants or refineries, ...) would be perfect to use rack systems, for the excellent maintainability of the system (see **AAN2009 .2**).
However very often happens, mainly for economic reasons, it is decided to use a DIN power supply system in parallel / redundancy.
In this case the customer may have more difficulty in the phase of system maintenance (replacement of faulty power supplies, power calibration, ...).

2. Replacing a DIN power supply

First of all, the DIN power supplies can not be "hot" replaced (for security reasons, according to UNI EN 60950), then such a system must have installed for each power supply input, an adequate circuit breaker (as in Figure 1).

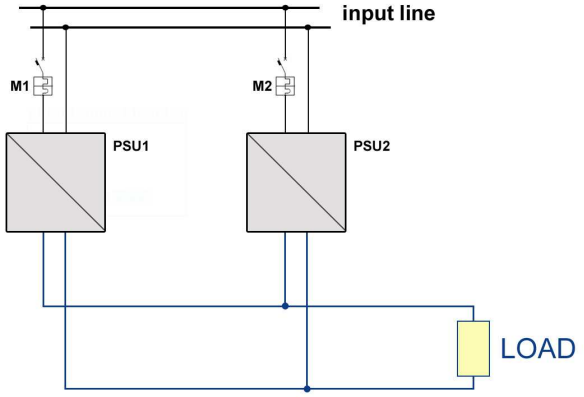

Figure1 *– DIN redundant power supply system, with an input switch for each power supply*

To replace a DIN power supply that is part of a redundant system (N+1 or N+N or ...), since the LOAD must remain on, the first thing to do is opening the input circuit breaker of the power supply to replace.
Referring to Figure 1, for example to replace the power supply **PSU1** it's necessary to open **M1**. At this point the power **PSU1** can be disconnected from the system and can be put in place a new power supply (operation easier if the power supplies have removable terminals, such as Advel DIN power supplies).
Now the switch input **M1** can be restored.
After closing the switch, different situations can happen (depending on the characteristic of the power supply, depending on the V_{out} calibration of the new power supply just inserted in relation to existing power supplies in the redundant system) which is worth analyzing.
Taking the example of two sets of Advel power supplies series:
- power supply SPSxxx**D1** (old series)
- power supply SPSxxx**DZ1** (new series)

3. Calibration problems

The importance of calibration of power supplies in parallel has been widely described (see **AAN2009.1**): it is known that a good calibration of power supplies in parallel/redundancy helps increase the MTBF of the system, since it allows a more equitable distribution of load current between the power supplies in parallel.
Besides the power supply, over time, may have slight variations in calibration, because of the inexorable aging/wear of certain components inside (...), moreover when a power supply is giving current to a load, its output voltage typically tends to slightly lower than the nominal value, depending on the load. That said: how can we be sure that the "new" power supply inserted into the redundant system, which perhaps has been running for years and is working, is well calibrated?

3.1 Advel power supplies DZ1 series

If the system is composed of power supplies of the new Advel series **DZ1** (SPS151/201/251/301 ... 1001DZ1), the above problem does not exist, as these are equipped of passive and active current sharing device inside (the active CS is enabled by interconnecting the power supplies with a special connection, as described extensively in the product manual) that automatically "adjust" the calibration of power supplies in parallel.

3.2 Advel power supplies D1 series

If the power system is composed of parallel power supplies of the old Advel series **D1** (SPS151/201/251/301 ... 601D1), or by any other power supply not provided with active current sharing, the problem of calibration should not be underestimated.
The power supplies of the old Advel series **D1**, if placed in parallel with other power supplies which are not perfectly calibrated, indicates the imbalance (LED ON is OFF, faulty relay open), and therefore a good calibration is required.

4. DIN power supplies calibration procedure, on a running system

Take for example a system consisting of two Advel power supplies **D1** series, one of which (the one on the left in Figure 2) is in fault and has to be replaced with a new one. It's necessary to calibrate the system.

Once opened **M1**, the load is fully powered by the power supply n.2 (the one on the right), whose output voltage depends on the load; for example V_{out2} = 23.87V.

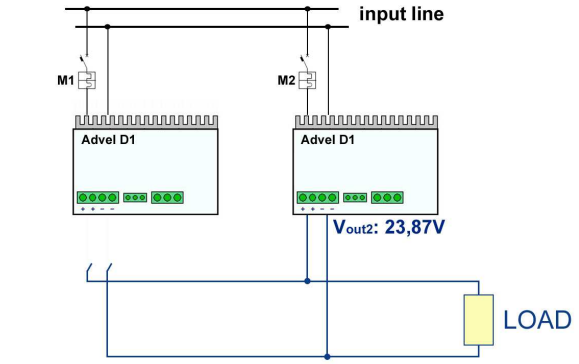

Figure2 *– A system consisting of two Advel power supplies D1 series in parallel, in which we want to replace the one on the left (power supply n.1)*

Once replaced the power supply n.1 with a new one, it woult be wrong to calibrate it at the same voltage read on power supply n.2 terminals, because as said before, power supply n.2 is loaded (that's why the settings should always be made with no load).

The correct procedure is as follows:

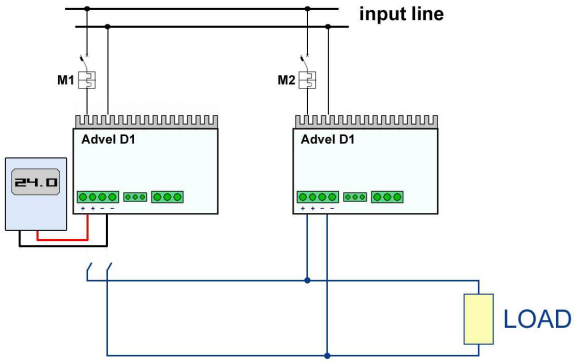

Figure3 *– A system consisting of 2 power supplies Advel D1 series in parallel, the new power supply just replaced (on the left) is calibrated at 24.0V.*

As described in Figure 3, it would be appropriate to calibrate the new power supply, with a precision voltmeter while it is with no load, for example at the nominal value 24.0V.

Then it's possible to connect the new power supply in the system. Now remove the output termilals of the power supply n.2 and the calibrate it at 24.0V, as described in Figure 4.

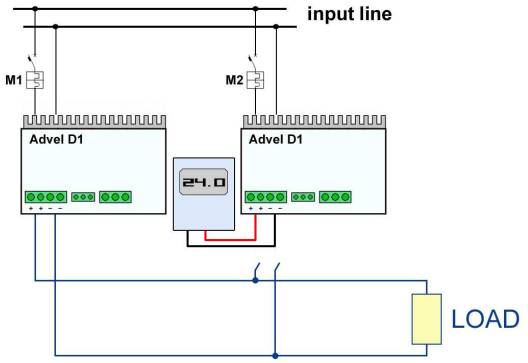

Figure4 *– A system consisting of 2 power supplies Advel D1 series in parallel, the old power supply is calibrated at 24.0V.*

Finally, connect back the power supply n.2 to the parallel system. In this way, the calibration between the two power supplies has been made perfectly: infact the two power supplies have been pre-adjusted at the same voltage, while they were with no load.

5. Conclusions

It has been described the calibration of a system of two power supplies in parallel, keeping the load powered (of course the procedure is extended to a system of ***n*** power supplies).

This procedure is necessary when it's necessary to replace a power supply that is not equipped with an active current sharing device.

Instead, if the power supplies are equipped with active current sharing device (power supplies Advel DZ1 series or Advel racks) it's not required any calibration.

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