

ET 200 SP Diagnostic Interrupts When Using Valve Terminals

FESTO

When using valve terminals, the following diagnostic interrupts may occur due to the detection of short circuits and cross circuits by Siemens ET 200 SP fail-safe output modules:

1. Diagnostic message “Output short-circuited to L+” (fault code 261D)
2. Diagnostic message “Output short-circuited to ground” (fault code 262D)

These diagnostic interrupts may make operation impossible. In combination with valve terminals (dynamic load), this can be explained by the different output characteristics of the ET200 SP as compared with the ET200 S.

Note

- The following information is based on the manual for ET 200 SP digital output module F-DQ 4x24VDC/2A PM HF [1].

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Error description

A short circuit (cross circuit) is detected by means of the dark test within a period of time after switching the valve terminal on, which cannot be precisely specified.

The following information concerning diagnostic message “output short circuited to L+/ground” is included in the user manual for ET 200SP digital output module F-DQ 4x24VDC/2A PM HF (table 6-6, pages 39):

Diagnostic message	Fault code	Meaning	Remedy
Output short-circuited to L+	261 _D	Short circuit to L+ can mean: <ul style="list-style-type: none">• The output cable is short-circuited to L+.• The capacitive load is too high.	<ul style="list-style-type: none">• Correct the process wiring.• Increase the test times (dark, light, switch-on tests).
Output short-circuited to ground	262 _D	Short circuit to ground can mean: <ul style="list-style-type: none">• The output cable is short-circuited to ground.• The output signal is short-circuited to ground.• There is a short circuit between two output channels.• The capacitive load is too high.	<ul style="list-style-type: none">• Correct the process wiring.• Increase the test times (dark, light, switch-on tests).

Explanation

Section of the user manual, “B.1 Connecting capacitive loads”, indicates that loads with capacitances may result in the detection of a short circuit. This is because the capacitances are not adequately discharged during the configured readback time.

The capacitances included in the valve terminals are EMC measures (electromagnetic compatibility) and must be used on account of the harmonised standards for EMC guideline 2014/30/EU, for which reason they cannot be reduced.

If no valves are activated during the dark test, existing capacitance is not discharged quickly enough. Furthermore, different numbers of valves on the valve terminal can be switched during the dark test. This results in a dynamic load for the fail-safe output which can also affect the dark test.

Solution – Step 1: Increase Readback Time Dark Test

According to the recommendation included in the section entitled “Setting readback time dark test” (page 21), a higher value should be selected for maximum dark test readback time. If an excessively large value is selected, the valves of the connected valve terminal are switched off and on. As a rule, this switching off and on is audible as a “clattering” sound. These switching operations result in wear and must be taken into consideration when calculating the MTTFD value, resulting in massive restriction of the T10_D value and thus the service life of the valves as well.

As a first step towards a possible solution, you should try to increase “dark test readback time”. If maximum readback time for the dark test cannot be increased, the “Output short-circuited to L+” fault may occur sporadically again and again.

If the diagnostic message cannot be eliminated by increasing “dark test readback time”, either the wiring or the used modules will have to be changed.

Be sure to observe maximum permissible dark time for the installed valves. This information can be found in the product reliability data sheet for the valves where it’s designated “max. negative test pulse with 1 signal”.

Solution – Step 2: Switch Off of Every Valve Terminal Separately Via a Fail-safe Output

If a fault message occurs directly after activating the fail-safe output, switch-on current may be too high. This might be the case if you switch off several valve terminals at the same time with a single fail-safe output. In this case, you should try to switch off each valve terminal separately via a fail-safe output. This solution may be possible if you can subsequently increase “dark test readback time”. However, we cannot guarantee that this modification will work as a solution for you because of the above described dynamic load change.

Be sure to observe maximum permissible dark time for the installed valves. This information can be found in the product reliability data sheet for the valves where it’s designated “max. negative test pulse with 1 signal”.

Solution – Step 3: Increase Load Current with Resistor

The following procedure is described in appendix “B.1 Connecting capacitive loads”, in the section entitled “Remedy for detection a short circuit”:

1. Determine the load current and capacitance of the load.
2. Locate the operating point in the diagram above (comment: the figure contains characteristic curves for the switching of capacitive loads relative to configured dark and light test times).
3. If the operating point is above the curve, you must increase the load current until the new operating point is below the curve by connecting a resistor in parallel.

This solution may be possible if only individual valves are switched and short connecting cables are used. As a rule, however, it’s not possible to foresee how many valves will be switched on during the dark test. Consequently, this solution is unusable for most applications.

Be sure to observe maximum permissible dark time for the installed valves. This information can be found in the product reliability data sheet for the valves where it’s designated “max. negative test pulse with 1 signal”.

Solution – Step 4: Hardware Change

If you do not succeed in eliminating the diagnostic message with the two previous solution steps, the hardware must be changed. The following options are available to this end:

1. Use of distributed I/O system Siemens ET 200S.
2. Use of fail-safe power module Siemens F-PM-E 24 V DC / 8 A PPM (article no. 6ES7 136-6PA00-0BC0) instead of fail-safe digital output module Siemens F-DQ 4x24 V DC / 2 A PM high feature (article no. 6ES7 136-6DB00-0CA0).
3. **Use of a valve terminal with directly integrated PROFIsafe, i.e. with CPX and PROFIsafe shutoff module CPX-FVDA-P2 (part no. 1971599) from Festo.**

If a valve terminal with PROFIsafe shutoff module CPX-FVDA-P2 is used, we are certain that the required short and cross circuit detection functions perfectly in the application.

Literature

- [1] Manual of ET 200SP Digital output module F-DQ 4x24VDC/2A PM HF (6ES7136-6DB00-0CA0), edition 07/2013, A5E03858037-01
- [2] CPX Terminal Output Module CPX-FVDA-P2, Description (8022607 EN 1209NH [8022613])

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