

Introduction

The interface module D-CAN2 of the DELTA controller family allows to automatically detect a modified configuration of connected NANO expansion modules and FESTO CP-modules.

Automatic detection is for example useful when some expansion modules are located on a part of the machine that is to be changed during operation (tool change).

See fig. 1 for an exemplary configuration where automatic detection can be used:

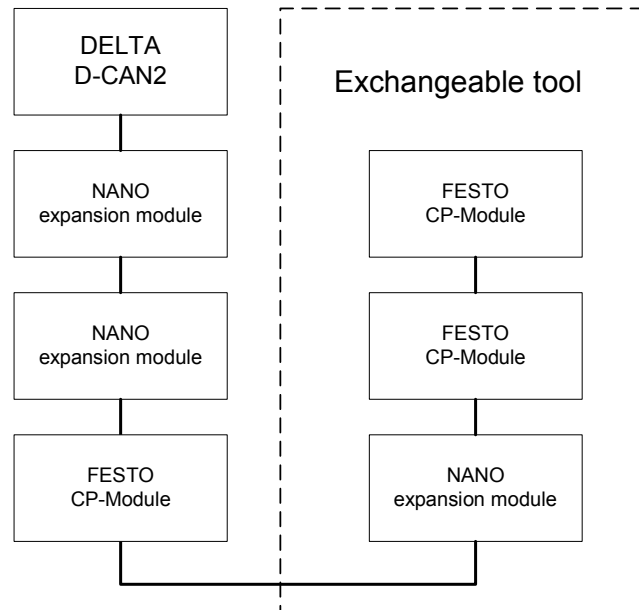


Figure 1

In this case, the application program must detect the tool change, initialize the new expansion modules and arrange them in a predefined order to ensure that the inputs and outputs on the expansion modules are addressed correctly.

The number of the tool being used can be inferred from the number and types of the connected NANO and FESTO CP modules.

Problem

Modifying the module configuration entails a different sorting of the individual inputs and outputs of the connected modules. The reason is that FESTO CP-modules are detected in ascending order of their test number (PN).

NANO expansion modules, however, are detected by the order of their position in the CAN-bus.

Remedy

The PROCESS-PLC allows to detect and sort FESTO CP-modules automatically by their test number, or to have them sorted in an order specified by the application program.

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In this Application Note, the assignment of FESTO CP-modules is specified by the application program.

System Requirements

A D-CAN2 module for the DELTA is required with operating version V1.11 or higher.

Notes on Plugging and Unplugging Voltage-Carrying Modules

Please note that NANO expansion modules are not designed to be removed from or connected to the CAN-bus while the controller is supplied with voltage.

The supply voltage of the N-PS1 modules must be turned off to avoid that the controller modules are damaged. If this is not possible, the point of disconnection must be designed in such a way that the GND connections of the CAN-line are contacted first/isolated last.

The original lines of the FESTO PC-modules are designed in a way that it is possible to plug and unplug the modules while carrying voltage.

Initializing and Detecting the New Configuration

What is special about automatic configuration detection is that it is based on the following two steps:

1. First, the CAN-bus with automatic sorting by test numbers is activated by issuing command 1 to the D-CAN2 module. The tool can then be inferred from the number of I/O modules, FESTO CP-modules, and the test number found.
2. Next, the test numbers of the CP-modules are specified as desired and command 1 is issued a second time to D-CAN2. This activates the CAN-bus in the desired module assignment.

Realization with respect to Programming

In the following programming examples, the data of the individual tools are stored in user registers in the form of tables. Table 1 shows the register assignment.

Structure of Tool Tables	
Register	Comment
100	Pointer to the current tool table
200	Number of modules for tool 1
201	Number of CP-modules for tool 1
202	Test number of first CP-module for tool 1
203	Type of first CP-module for tool 1
204	I/O configuration of first CP-module for tool 1
205	Test number of second CP-module for tool 1
...	...
300	Number of modules for tool 2
301	Number of CP-modules for tool 2
302	Test number of first CP-module for tool 2
303	Type of first CP-module for tool 2
304	I/O-configuration of first CP-module for tool 2
305	Test number of second CP-module for tool 2
...	...

Table 1

Automatic Detection of the New Tool by means of the Number of Plugged Modules

First, register 1xy113 must be set to zero. This causes the D-CAN2 module to initialize the CAN-bus with automatic sorting by test numbers. All connected NANO expansion modules and FESTO CP-modules are found. The number of found modules is stored in registers 1xy110 and 1xy113.

Example 1

```
REGISTER_LOAD[100 with 0]           ;Pointer does not point to any tool
REGISTER_LOAD[1xy113 with 0]        ;Test numbers are sorted automatically
REGISTER_LOAD[1xy101 with 1]        ;Initialize bus system
WHEN
  BIT_CLEAR[1xy100 Bit 13]
THEN
  ;
  ;
IF
  REG 1xy110                         ;Check whether initialization
  =                                 ;has found tool 1
  REG 200                             ;Number of NANO and CP-modules
  REG 1xy113
  =
  REG 201                             ;Number of CP-modules
THEN
  REGISTER_LOAD[100 with 201]        ;Pointer points to data for tool 1
  ;
  ;
IF
  REG 1xy110                         ;Check whether initialization
  =                                 ;has found tool 2
  REG 300                             ;Number of NANO and CP-modules
  REG 1xy113
  =
  REG 301                             ;Number of CP-modules
THEN
  REGISTER_LOAD[100 with 301]        ;Pointer points to data for tool 2
  ;
  ;
IF
  REGZERO [100]                     ;No tool was detected
THEN
  ;no tool detected
THEN
  ;further program flow
```

Initializing the New Tool

After the first initialization according to example 1, it was possible to identify the tool by means of the number of plugged modules. Register 100 now points to the associated data table of the tool. The data from this table are written prior to the next command 1 to the D-CAN2 module.

Example 2

```
REGISTER_LOAD[1xy113 with RR(100)] ;Set number of CP-modules
REGISTER_LOAD[1xy114 with 1] ;Pointer to first CP-module
LABEL sLoop
REGINC 100 ;Point to test number
REGISTER_LOAD[1xy115 with R(100)] ;Enter test number
REGINC 100 ;Point to type
REGISTER_LOAD[1xy116 with R(100)] ;Enter type
REGINC 100 ;Point to I/O-configuration
REGISTER_LOAD[1xy117 with R(100)] ;Enter I/O-configuration
IF
  REG 1xy113 ;Last module not reached yet
  #
  REG 1xy114
THEN
  REGINC 1xy114 ;Pointer to next CP-module
  GOTO sLoop
THEN
  ;all modules entered
  REGISTER_LOAD[1xy101 with 1] ;Initialize bus system
WHEN
  BIT_CLEAR[1xy100 Bit 13] ;Wait until ready
THEN
  ;further program flow
```

Detecting Unplugged Modules

During operation, the D-CAN2 permanently checks whether all connected expansion modules are still responding. If one or several modules do not respond anymore, the D-CAN2 generates a timeout error and sets bit 0 („I/O-Module-Timeout“) in status register 1xy100.

If a tool is changed during operation, a timeout error also occurs as soon as the tool is removed from the machine.

The application program is able to react on this timeout error and to handle the tool change according to the requirements of the machine.

Example 3

```
WHEN
  BIT_SET[1xy100 Bit 0] ;wait until timeout is recognized
THEN
  ;tool going to be changed
```