Drive System Application

applications & TOOLS

MICROMASTER 4 & SINAMICS G120
Application Description

SIEMENS

Profibus monitoring and “LOCAL / REMOTE” changeover

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Introduction

Objective of the application

This application was generated in order to provide users with a user-friendly way of implementing a PROFIBUS monitoring function. The application monitors the system for Profibus failure.

Using a MICROMASTER 440 or a SINAMICS G120 drive equipped with CU24S DP and a PLC - in this case an S7 300 – this applications shows how a Profibus communications error (failure) can be identified.

Core contents of this application

The following core points are discussed in this application:

- Parameterizing MICROMASTER 4 / SINAMICS G120
- Programming the PLC
-

Limit of the scope

This application does not provide any description of the SIMATIC STEP 7 engineering tool.

Table of Contents

1 Description

If there is a Profibus communications error (failure) or if the system is specifically powered-down (SIMATIC S7 and Profibus communications), then the drive inverter should be changed over to other command and setpoint sources. This then guarantees uninterrupted operation (e.g. for emergency operation).

In order to solve this task, the possibilities of the 3 command data sets (CDS) of MICROMASTER 4 (430 & 440) / SINAMICS G120 will be used.

3 different drive control types can be implemented with these command data sets (CDS).

Command data set 1 [CDS-1]

The drive inverter is controlled via Profibus.

It receives its setpoints and on/off commands via the BUS (P0700[0] = 6, P1000[0] = 6).

Command data set 2 [CDS-2]

When Profibus communications fail or if the system is shutdown in a controlled fashion, then the drive inverter should operate with a local setpoint. In this case, with a fixed frequency, P0700[1] = 2, P1000[1] = 3.

Command data set 1 [CDS-3]

The drive inverter should be controlled from a control station or “local” operation. This means that it receives its setpoints as analog value. However, the various states should still be signaled back via Profibus (P0700[2] = 2, P1000[2] = 2).

2 Interconnections in the drive

The basic philosophy for monitoring communications is based on the fact that in addition to the 2 words that are transferred (control word 1 and the main setpoint) an additional word is sent to the drive. This word contains a comparison value (PZD 3). This value is processed in the MICROMASTER / SINAMICS and a bit that can be evaluated is generated as a result of the appropriate interconnection, shown in Fig. 2.1.

Komparator 1 & Timer 1

The word that is received is compared with “0“ in comparator 1 (P2885). If the word that has been received is greater, then the bit is set; if it is lower, then the bit is inactive. This bit is switched to timer 1 (P2849), which operates as switch-in delay element (0). When the bit is activated, timer 1 starts; if it is inactive, it is stopped and reset.

The PLC sends a value of “200” for 30 seconds via Profibus (any value can be selected, in this particular example, 30 s was selected). This value is greater than “0”. This means that the bit is active and the timer (e.g. 35 seconds) counts down. After the 30 s has expired, the PLC sends a value of “-200” for one second. This resets the output bit of the comparator so that the timer is stopped and the bit is again set for the following 30 seconds.

CDS 1 & CDS 2

If the Profibus connection develops an error condition (e.g. fails), or the PLC goes to STOP, the value of “-200” is not sent, the comparator bit is not reset and after 35 seconds, the output bit of timer 1 becomes active. This bit can now be used in order to execute the appropriate actions (i.e. responses) when Profibus fails. The bit (the output of timer 1 P2852) is used as the command source to toggle (changeover) between the two first command data sets BDS1 [CDS1] and BDS 2 [CDS 2] (P0810 = remote / local control). This means that when the output bit of timer 1 is activated a changeover is made from remote to local operation. The drive inverter now receives a fixed frequency as the setpoint and it receives the commands from the terminal strip.

CDS 3

Digital input 6 is used for the changeover to the third data set (P0706 = 99, P0811 = 722.5). The drive inverter setpoints are now received as analog value.

Note

After PROFIBUS fails Alarm A0703 is issued "No valid setpoints are received from Profibus". This alarm cannot be acknowledged; however this is not relevant for operation via the terminal strip. This alarm is no longer output after changing over from PROFIBUS to the terminal strip.

Timer 2

Timer 1 is activated with timer 2. Timer 2 operates as switch-in delay function and is set to 1.5 s. This means that if no signal is received from comparator 1 within 1.5 s, timer 2 is activated. After 35 s expires, the output of timer 1 is set, i.e. Profibus failure is detected.

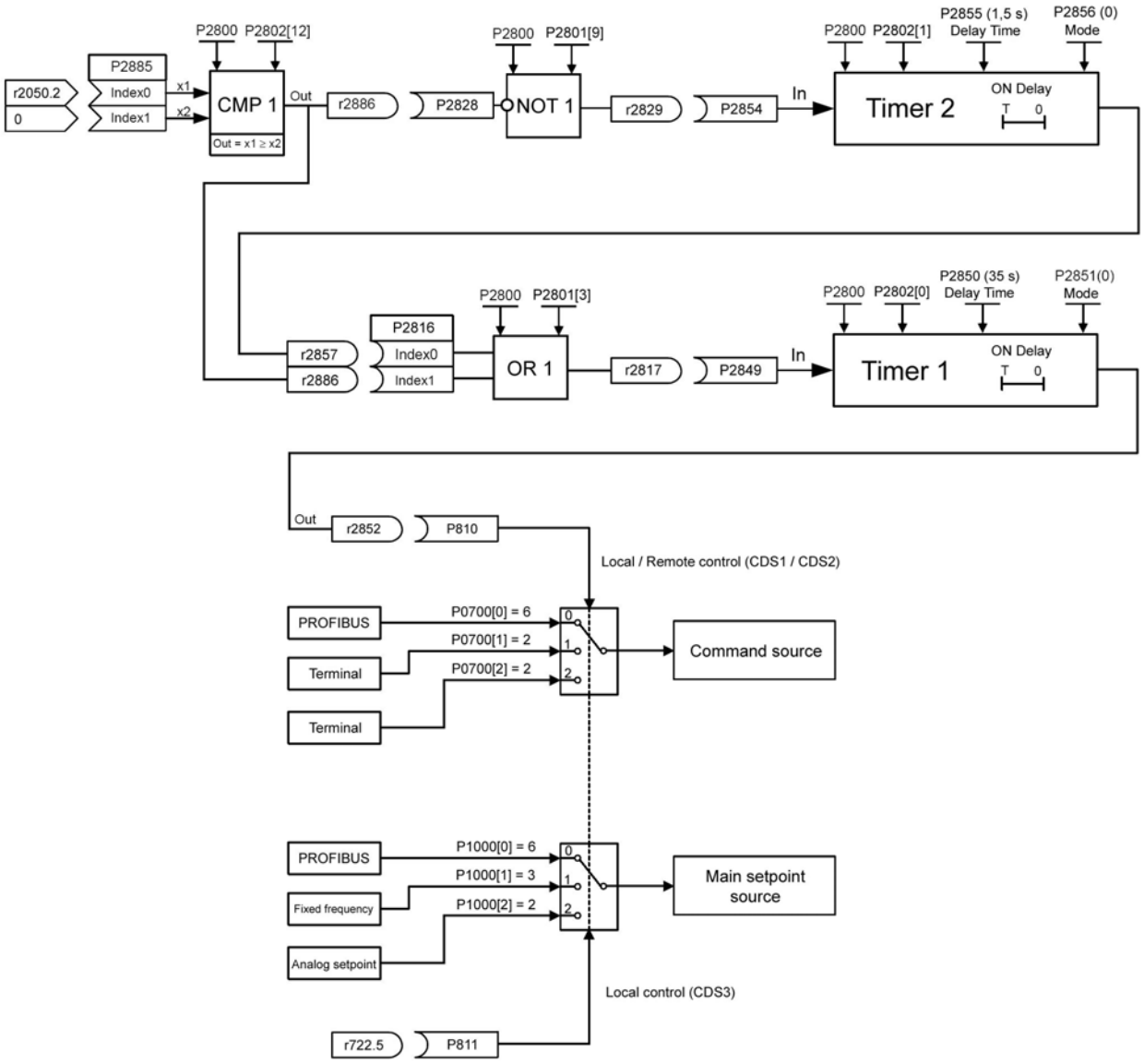
If PROFIBUS is now to be re-activated (e.g. CPU in RUN), then the system must wait 35s until timer 1 is reset (using ON, OFF and powering-up the CPU, this 35 s could be bypassed).

Note:

If timer 2 is not configured then this can mean that Profibus failure is not detected.

Reason: If Profibus fails precisely at the instant at which value "-200" is sent and if timer 2 has not been configured (timer 2 is used to start timer 1) comparator 1 cannot be activated and in turn timer 1 cannot be activated >Profibus failure is not detected<.

Figure 2-1



The programming can be manually carried-out using the operator panel (BOP/AOP), or using the STARTER / DriveMonitor commissioning tool.

The necessary changes are as follows:

Command source

P0700[0] = 6	// Selects PROFIBUS as command source [CDS 1]
P0700[1] = 2	// Selects terminals as the command source [CDS 2]
P0700[2] = 2	// Selects terminals as the command source [CDS 3]

setpoint source

P1000[0] = 6	// Selects PROFIBUS as setpoint source [1st CDS]
P1000[1] = 3	// Selects a fixed frequency as setpoint source [2nd CDS]
P1000[2] = 2	// Selects an analog setpoint as setpoint source [3rd CDS]

Selecting a fixed frequency:

P0704[1] = 0 or 99	// Only required for SINAMICS G120 with CU240S (this setting allows parameter P1020[1] to be enabled for fixed frequencies).
P1020[1] = 1	
P1001[0] = fixed frequency [Hz]	

Free blocks

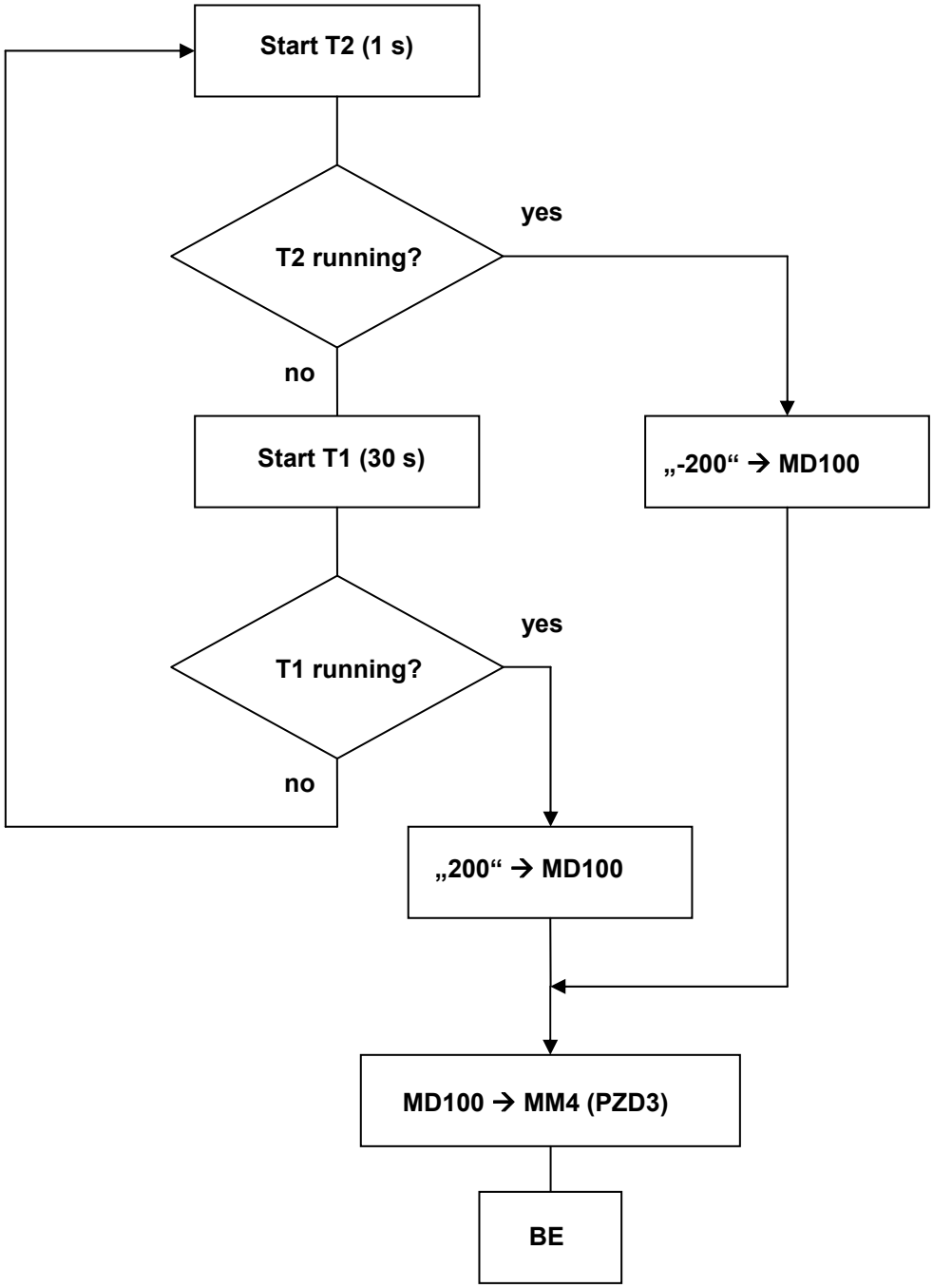
P2800 = 1	// Free blocks are enabled
P2801[3] = 1	// Activates OR 1
P2801[9] = 1	// Activates NOT 1
P2802[0] = 1	// Activates timer 1
P2802[1] = 1	// Activates timer 2
P2802[12] = 1	// Activates comparator 1
P2885[0] = 2050.2	// Sets word 3 (PZD3), received from the CB, as the first input of comparator 1
P2885[1] = 0	// Sets 0 as the second input of comparator 1
P2828 = r2886	// Sets the output of comparator 1 as the input for NOT 1
P2854 = r2829	// Sets the output of NOT 1 as the input for Timer 2

P2855 = 1.5	// Sets the delay of timer 2 to 1.5 s
P2856 = 0	// Selects the mode of timer 2 (0 switch-on delay)
P2816[0] = r2857	// Sets the output of timer 2 as the first input for OR1
P2816[1] = r2886	// Sets the output of comparator 1 as the second input for OR1
P2849 = r2817	// Sets the output of OR 1 as the input for timer 1
P2850 = 35.0	// Sets the delay of timer 1 to 35 s
P2851 = 0	// Selects the mode of timer 1 (0 switch-on delay)
P0810 = 2852.0	// Selects the output of timer 1 as the command source to toggle between the two first command data sets CDS 1 and CDS 2 (remote/local control)
P0706[0] = 99	// Selects BICO parameterization as the function of digital input 6
P0811 = 722.5	// Digital input 6 as the command source to change over to the third command data set - CDS 3 (local control)
P2040 = 0	// Disable the PROFIBUS monitoring function

3 Flowchart for S7

The following program flowchart clearly shows the programmed Profibus monitoring in the PLC.

Figure 3-1



This program flowchart is implemented in the attached S7 project. The control word 1 and the main setpoint are sent to the drive in the OB1. Function FC 15 is called – shown in the flowchart above.

3.1 Contents of OB1

Network 1:

```
L    1150
T    PQW  264        // Sends control word 1 to the drive
                     (047E hex = 1150 dec)

L    1151
T    PQW  264        // Sends control word 1 to the drive
                     (047F hex = 1150 dec, edge of Bit 0: 0 → 1)

L    4096            // Main setpoint (4096 dec = 1000 hex → 25% of the
                     maximal frequency (P2000, default 50Hz), 16384 dec =
                     4000 hex → 100% of the maximal frequency)

T    PQW  266        // Sends the main setpoint to the drive

CALL FC   15         // Calls FC 15
```

3.2 Contents of FC15

Network 1:

```
L    MD   100
T    PQW  268        // Sends PZD 3 to the drive
```

Network 2:

```
AN   Q    6.1        //Starts timer 2 (1 s) if the output bit of timer 1 is inactive.
L    S5T#1S
SE   T    2
```

Network 3:

```
A    T    2          // Output bit of timer 2
=    Q    6.0
```

Network 4:

```
AN   Q    6.0        // Starts timer 1 (30 s) if the output bit of timer 2 is
                     inactive.

L    S5T#30S
SE   T    1
```

3.2.1 Network 5:

```
A    T    1          // Output bit of timer 1
=    Q    6.1
```

Network 6:

```
AN   Q    6.0
JC   n001

L    -200
T    MD   100        // Sends a value of "-200" via Profibus
BE

n001: L    200
T    MD   100        // Sends a value of "200" via Profibus
BE
```