Drive System Application

applications & TOOLS

Working with different drive data sets DDS / command data sets CDS

SIEMENS

Application description
for SINAMICS G120/G120D and MICROMASTER 430/440

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Preposition

Aim of the application

This application was generated in order to provide users with an overview of the drive and command data sets for the MICROMASTER 430/440 frequency inverters and the CU240 Control Units of SINAMICS G120 and G120D.

Examples on how to use drive and command data sets are shown in this application.

Scope

The following core issues are discussed in this application:

- Drive data sets
- Command data sets
- Examples

Exclusion

This application does not include any description of the following

- STARTER commissioning tool
- Basic commissioning of the frequency inverter
- Commissioning higher-level controls

It is assumed that readers have basic knowledge about these subjects.

Reference to the Automation and Drives Service & Support

This article is from the Internet Application Portal of the Automation and Drives Service & Support. You can go directly to the download page of this document using this link.

http://support.automation.siemens.com/WW/view/en/22077669

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Application description

Here, you can obtain an overview of the drive and command data sets for the MICROMASTER 430/440 frequency inverters and the CU240 Control Units of SINAMICS G120 and G120D frequency inverters.

1 Description

For many applications, it is advantageous to be able to change properties of the drive – for example, the setpoint channel operator control, closed-loop structure, functionalities, etc. This change can come about as a result of external events as well as also events inside the drive converter. The MICROMASTER 430/440 and the Control Units CU240 of the SINAMICS G120 and G120D drive converter series offers the possibility to be able to parameterize a wide range of applications. This is achieved using three different drive data sets (DDS) and independently of this, three different command data sets (CDS).

Note:

Please carefully note that for MICROMASTER 4 (MM4) frequency inverters, the numbering of the digital and analogue inputs and outputs and also of the drive data sets and command data sets starts with 1 and for SINAMICS G frequency inverters, the numbering starts with 0.

In this application note the numbering for MM4 is used.

2 Drive Data Sets

2.1 Description

The drive data set (DDS) contains various setting parameters which are of significance for the open-loop and closed-loop control of a drive.

The drive data sets include

- the data of the motor and the encoder
- the closed-loop control setting
- the setting values of the setpoint channel (fixed frequencies, motorized potentiometer, PID controller, ramp-function generator, frequency bands)
- drive functions (restart-on-the-fly, kinetic buffering, closed-loop Vdc control, braking, positioning)
- the settings of monitoring functions
- normalization of the drive system

A list of all of the parameters is provided in the parameter lists of MICROMASTER 430/440 and SINAMICS G120/G120D.

2.2 Selection

Drive data sets are selected using bit 4 (DDS bit 0) and bit 5 (DDS bit 1) in control word STW 2 (monitoring parameter r0055). To select the command source for the changeover, parameter P0820 is used for DDS bit 0 and parameter P0821 for DDS bit 1. An example showing how drive data sets can be changed-over is shown in Fig. 2-1.

All of the existing command sources are possible as sources, for example

- binary inputs
- control words of the interfaces
- internal status words

For test purposes it also possible to enter a fixed value into P0820 and P0821.

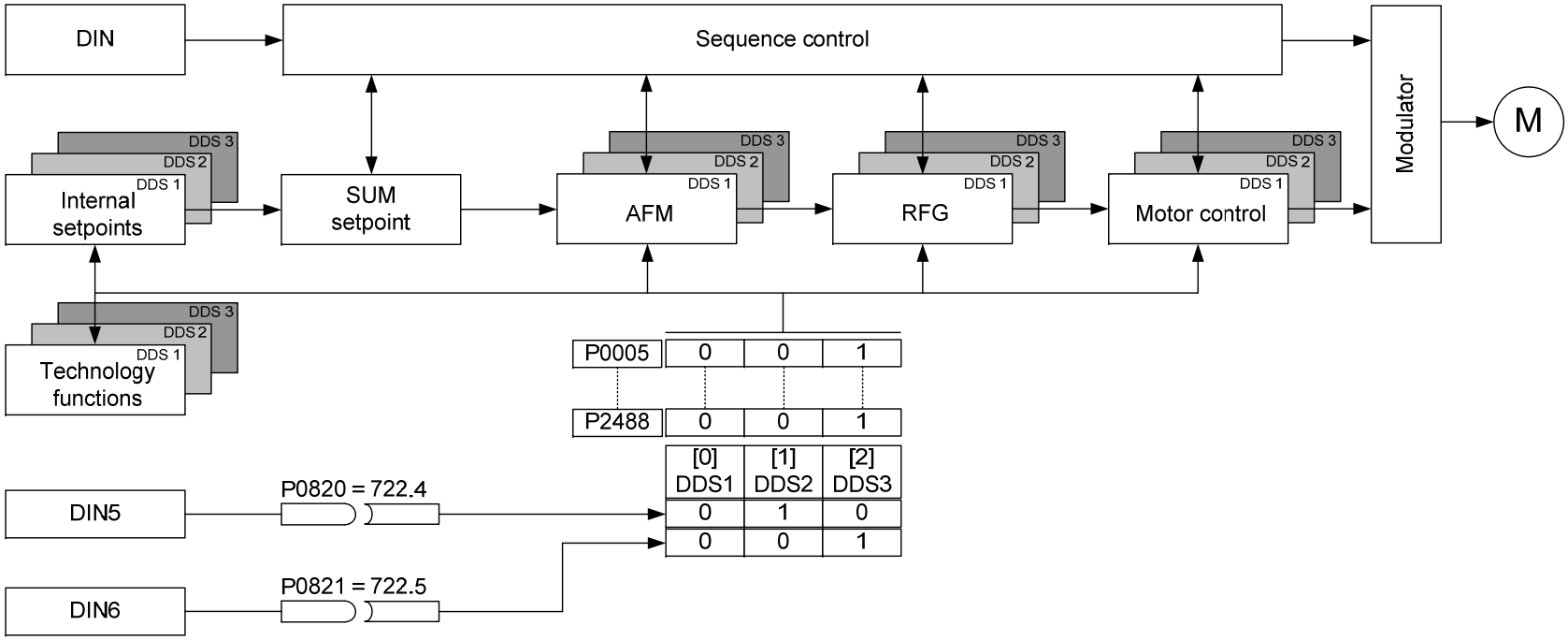

Figure 2-1 Selecting and changing-over the drive data sets DDS

2.3 Changing-over between drive data sets

With just a few exceptions, drive data sets can only be changed-over in the ready state. This is necessary so that during operation it isn't possible to accidentally change over closed-loop control structures. The changeover time is approx. 50 ms. The actual drive data set is displayed in monitoring parameter r0051[1].

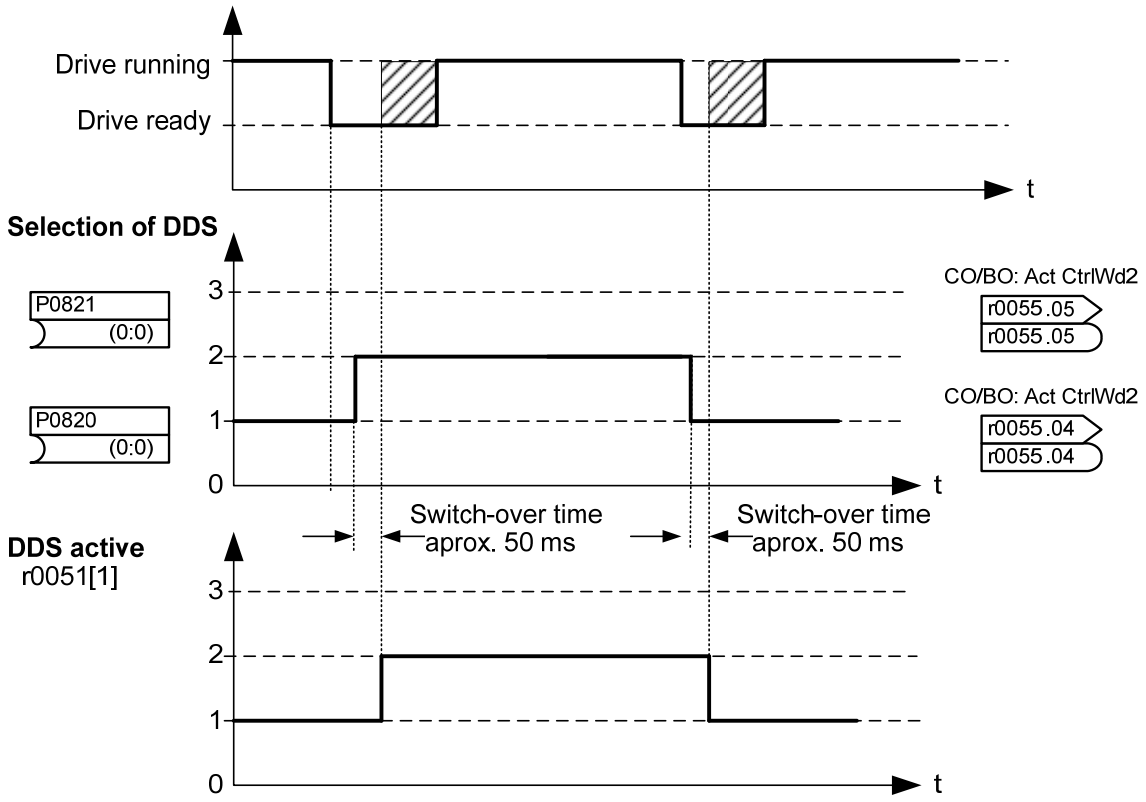

Figure 2-2 Changeover sequence, drive data sets

A ramp-function generator is the exception. Its ramps and rounding-off times can be changed-over in operation, the OFF3 function, where the down ramp can be changed-over, as well as the gain Kp of the speed controller for Vector control (with and without encoder) which, for example, can be changed-over in operation as a function of the speed.

2.4 Commissioning

When commissioning the various drive data sets it must be observed that the required data set is also selected. In addition, for the start-up parameters, the appropriate indices must be selected.

With the STARTER start-up program, the various drive data sets can be activated.

Proceed as follows:

- Open the **"Configuration"** screen by double clicking on the button with the same name in the project tree (1)
- Under the **"Configuration"** tab, activate the checkbox **"Display all drive data sets"** (2)
- The **"Drive data sets"** tab is then displayed (refer to Fig. 2-4)

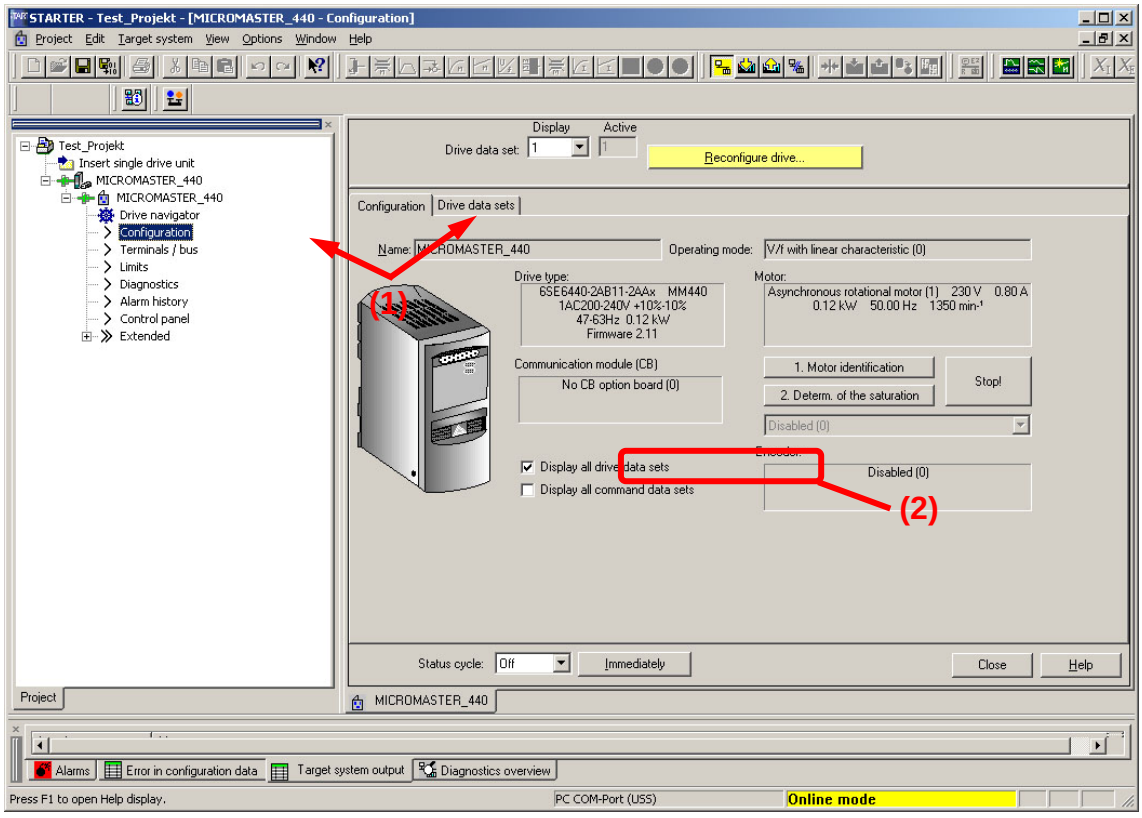

Figure 2-3 Selecting a drive data set using the STARTER start-up program

- Change to the **"Drive data sets"** tab (1)
- Select the drive data set that you wish to display or process/edit; in addition, it is also displayed as to which drive data set is active (2)
- Under **"Drive data set selection"** define how the drive data sets are selected in the frequency inverter (3):
  - **Bit 0**: selection of the parameter that supplies the signal for Bit 0 of the drive data set selection;
  - **Bit 1**: selection of the parameter that supplies the signal for Bit 1 of the drive data set selection.

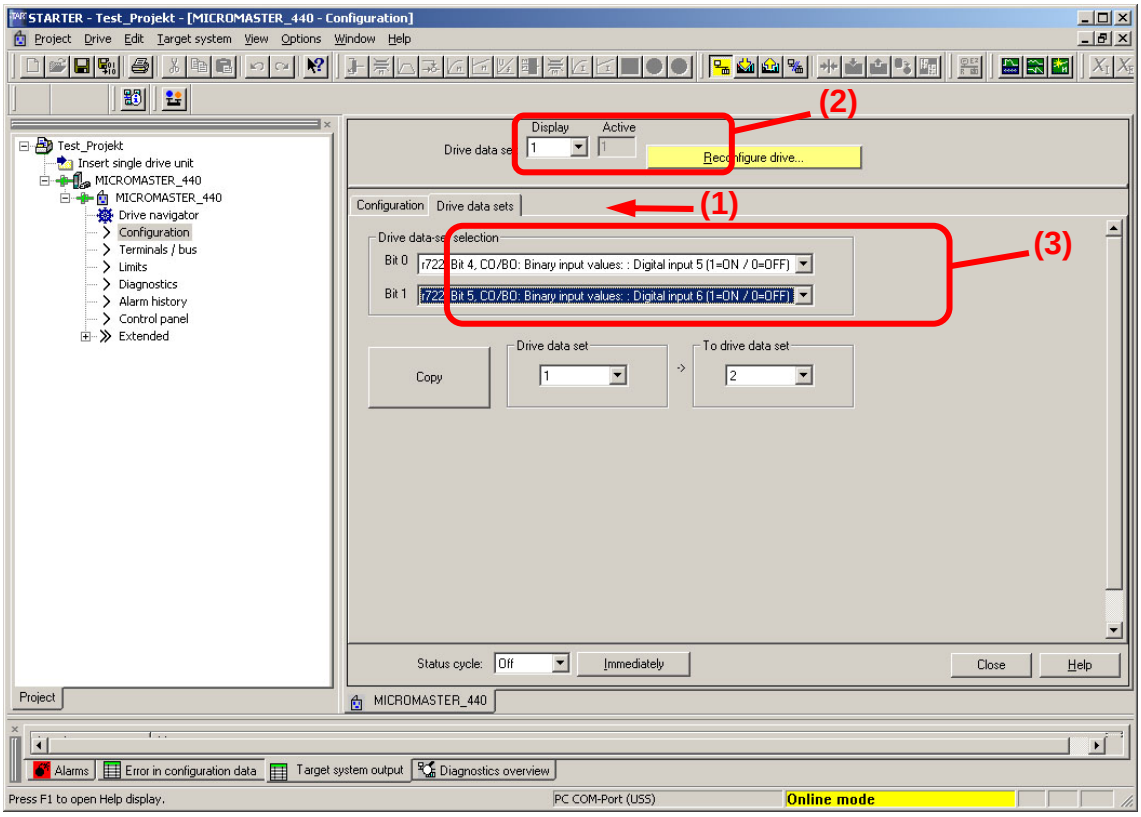

Figure 2-4 Selecting a drive data set using the STARTER start-up program

2.5 Copying data sets

If drive data sets only differ in a few details, it is possible to generate the new data set by copying the original data set. When using the BOP, this can be realized using parameter P0819:

1. P0819[0] = number of the drive data set which is to be copied (source)
2. P0819[1] = number of the drive data set into which data is to be copied (target)
3. P0819[2] = 1 ⇒ copying is started

P0819[0] = 0 1. DDS
P0819[1] = 2 3. DDS
P0819[2] = 1 Start copy

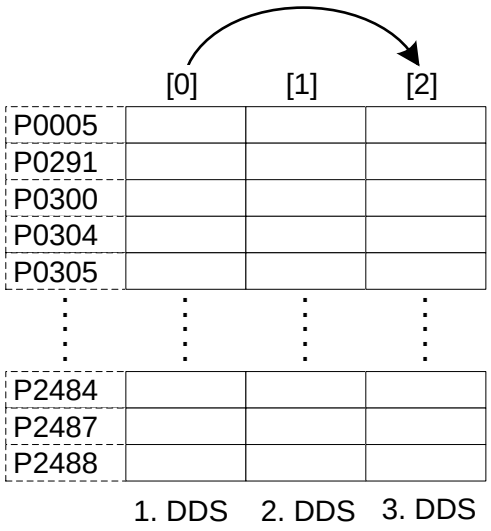

Figure 2-5 Example of copying drive data sets using BOP

Parameter P0819[1] is again set to zero after copying has been completed.

For the STARTER start-up program, copying can be carried-out in a user-friendly way using the mask **“Configuration > Drive data sets”** (1). The data set to be copied can be selected (2) as well as also the data set into which data is to be copied (3). Copying is started using the **“Copy”** button (4).

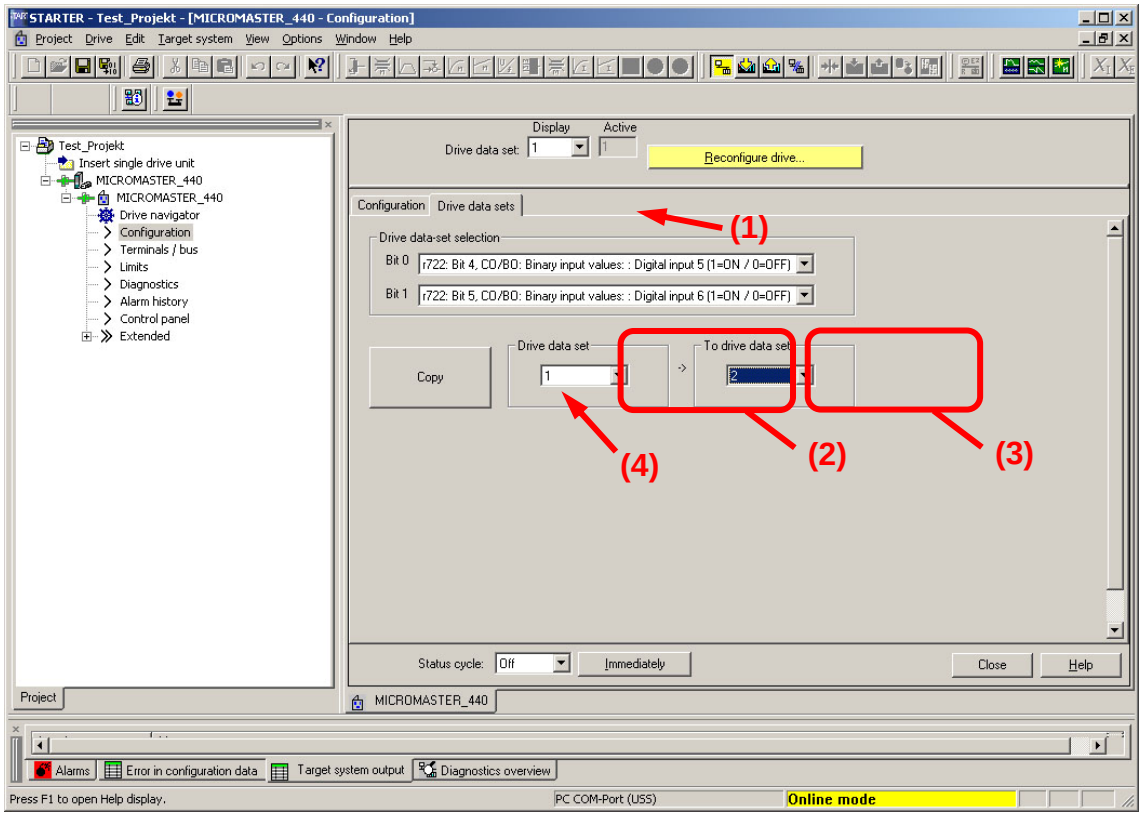

Figure 2-6 Copying drive data sets using the STARTER start-up program

3 Command Data Set

3.1 Description

The command data sets are assigned to those parameters (connector and binector inputs) which are used to control the drive and enter the setpoint. BICO technology is used to interconnect the signal sources for the control commands and setpoints. In addition to individually interconnecting the connectors / binectors, using the following parameters

- P0700 : Select, command source
- P0719 : Select, command/setpoint source
- P1000 : Select, frequency setpoints

it is possible to call-up specified parameter assignments which automatically influence the lower-level BICO interconnection.

3.2 Selection

Command data sets are controlled using bit 15 (CDS bit 0) in control word STW 1 (monitoring parameter r0054) and bit 15 (CDS bit 1) in control word STW 2 (monitoring parameter r0055) of the drive inverter. To select the command source for the changeover, parameter P0810 is used for the CDS bit 0 and parameter P0811 for CDS bit 1. The changeover of the control authority from terminal strip to BOP and the changeover of the setpoint input from the analog input to motorized potentiometer via binary input 4 are shown in the following diagram.

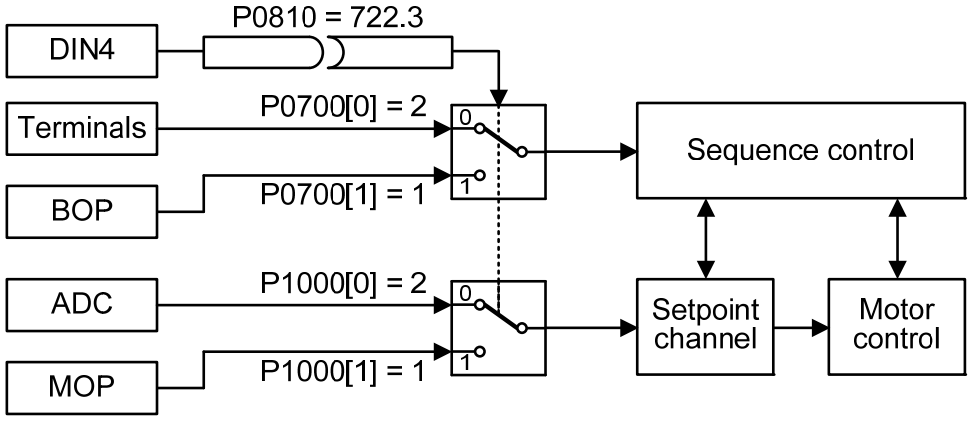

Figure 3-1 Example to select and change-over the command data sets – CDS

All of the existing command sources are principally possible as sources, for example

- binary inputs
- control words of the interfaces
- internal status words

For test purposes, it is also possible to enter a fixed value in P0810 and P0811. By entering the ADC status word r0751 (index 0 and 1) it is possible, for example, to change-over the command data sets as a function of the wire breakage monitoring of the two ADC channels. However, it must be ensured that in all of the command data sets used, it has been parameterized so that a changeover can be made - e.g. using binary inputs. Otherwise it can occur that it is no longer possible to change back to the original data set.

3.3 Toggling between command data sets

Contrary to drive data sets, command data sets can also be toggled between in operation. The changeover time is approx. 4 ms. The currently active command data set is displayed in monitoring parameter r0050.

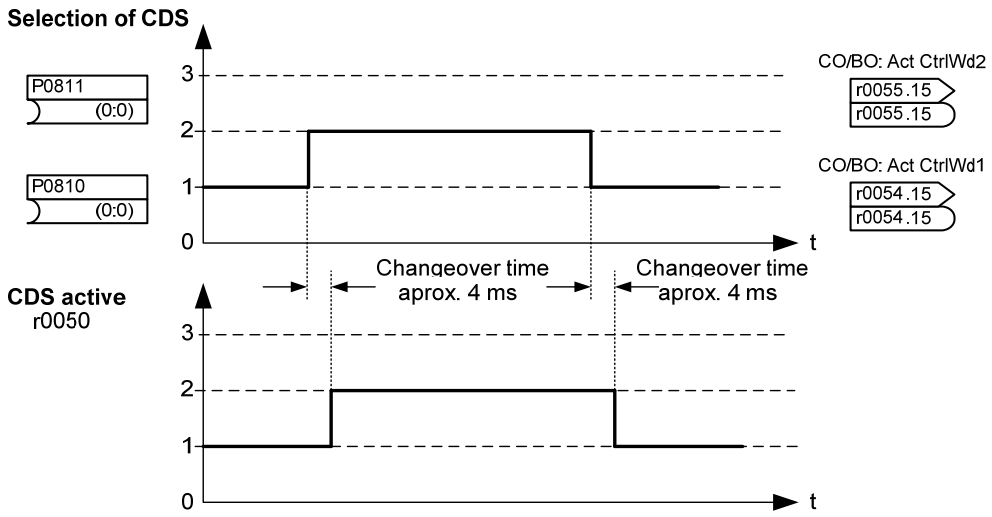

Figure 3-2 Changeover sequence, command data sets CDS

3.4 Commissioning

It is extremely simple to parameterize a basic setting for the selection of the command source (P0700) and the setpoint source (P1000) using parameters P0700 and P1000. P0719 is a combination of both parameters - with which the command source as well as the setpoint source can be selected.

The various command data sets can be activated using the STARTER start-up program.

Proceed as follows:

- Open the **"Configuration"** screen by double clicking on the button with the same name in the project tree (1)
- Under the **"Configuration"** tab, activate the checkbox **"Display all command data sets"** (2)
- The **"Command data sets"** tab is then displayed (refer to Fig. 3-4)

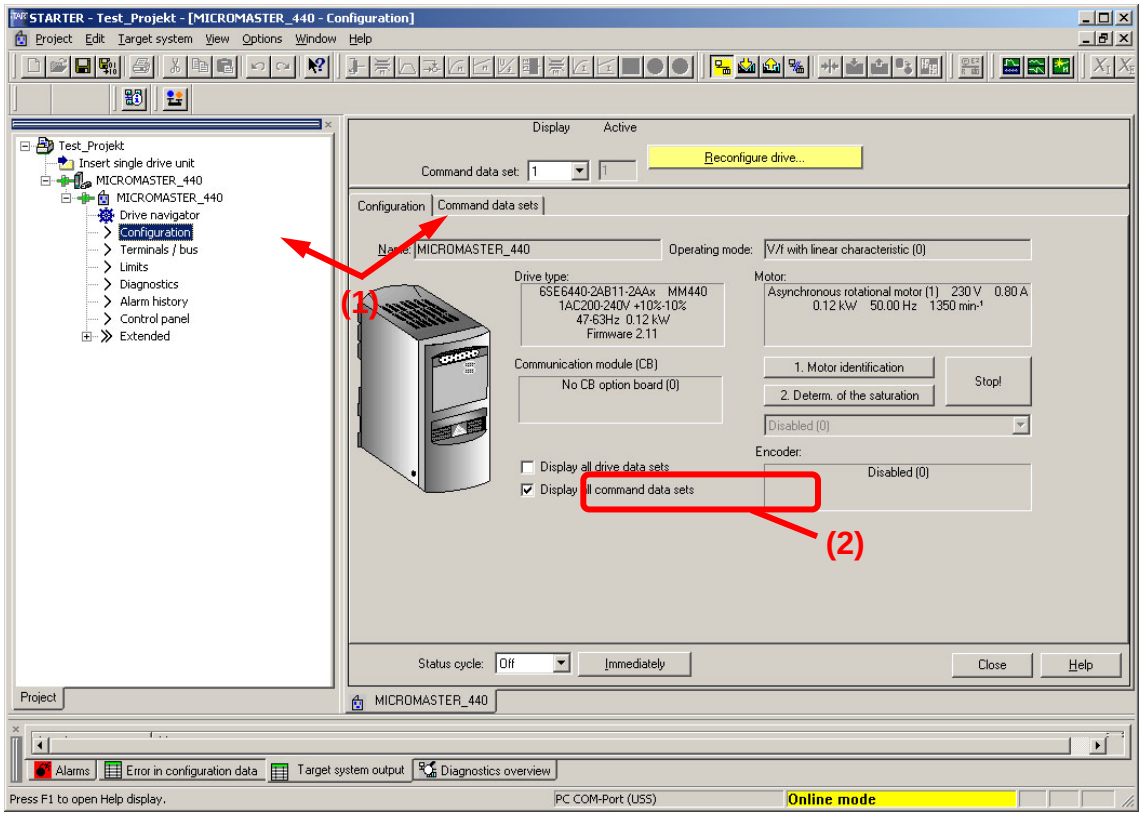

Figure 3-3 Selecting the command data set using the STARTER start-up program

- Change to the **"Command data sets"** tab (1)
- Select the command data set that you wish to display or process/edit; in addition, it is also displayed as to which command data set is active (2)
- Under **"Command data set selection"** define how the command data sets are selected in the frequency inverter (3):
  - **Bit 0**: selection of the parameter that supplies the signal for Bit 0 of the command data set selection;
  - **Bit 1**: selection of the parameter that supplies the signal for Bit 1 of the command data set selection.

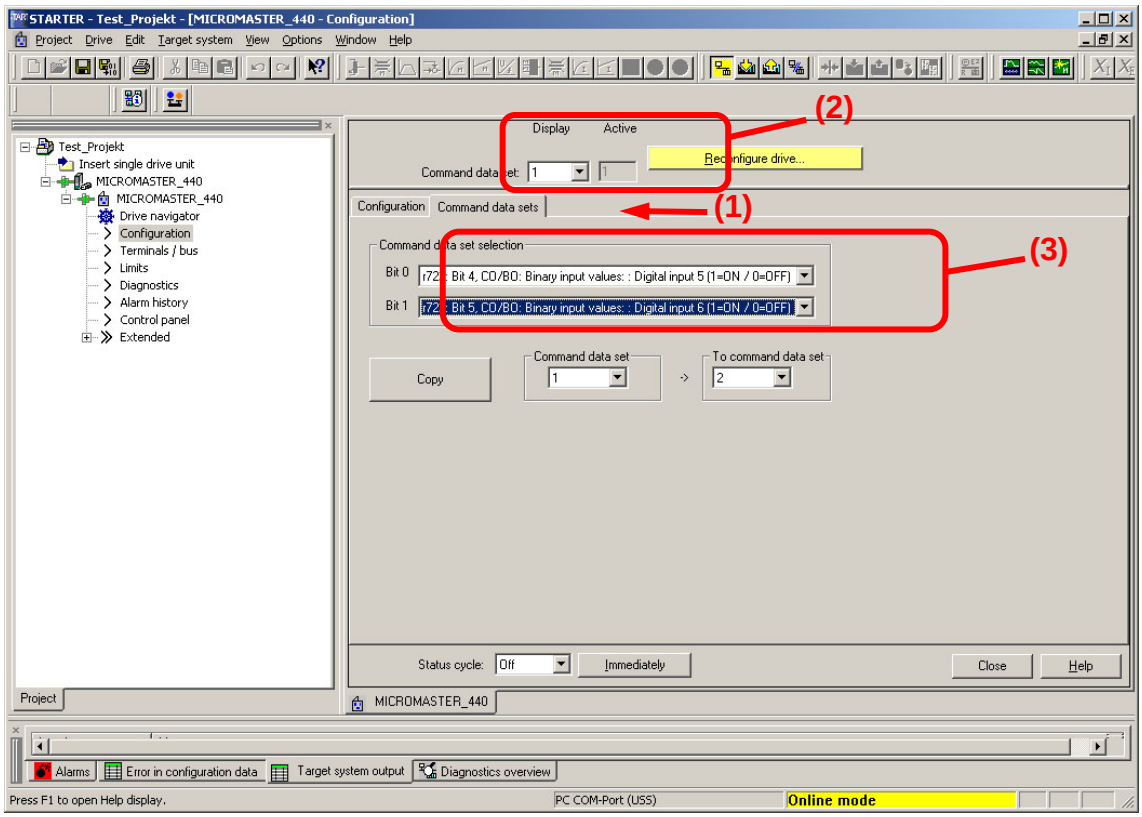

Figure 3-4 Selecting the command data set using the STARTER start-up program

3.5 Copying data sets

If command data sets only differ as far as a few details are concerned, then a new data set can be generated by copying the original data set. When using the BOP, this can be realized using parameter P0809:

- P0809[0] = number of the command data set which is to be copied (source)
- P0809[1] = number of the command data set into which data is to be copied (target)
- P0809[2] = 1 ⇒ copying is started

P0809[0] = 0 1. CDS
P0809[1] = 2 3. CDS
P0809[2] = 1 Start copy

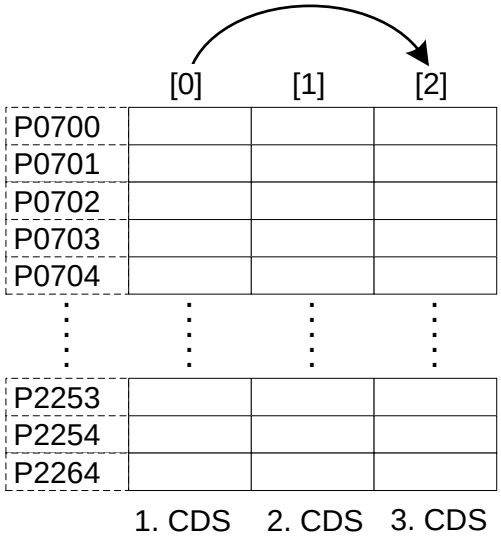

Figure 3-5 Example of copying command data sets using BOP

Parameter P0819[1] is again set to zero after copying has been completed.

Working with different drive data sets DDS / command data sets CDS 22077669

For the STARTER start-up program, copying can be carried-out in a user-friendly way using the mask **“Configuration > Drive data sets”** (1). The data set to be copied can be selected (2) as well as also the data set into which data is to be copied (3). Copying is started using the **“Copy”** button (4).

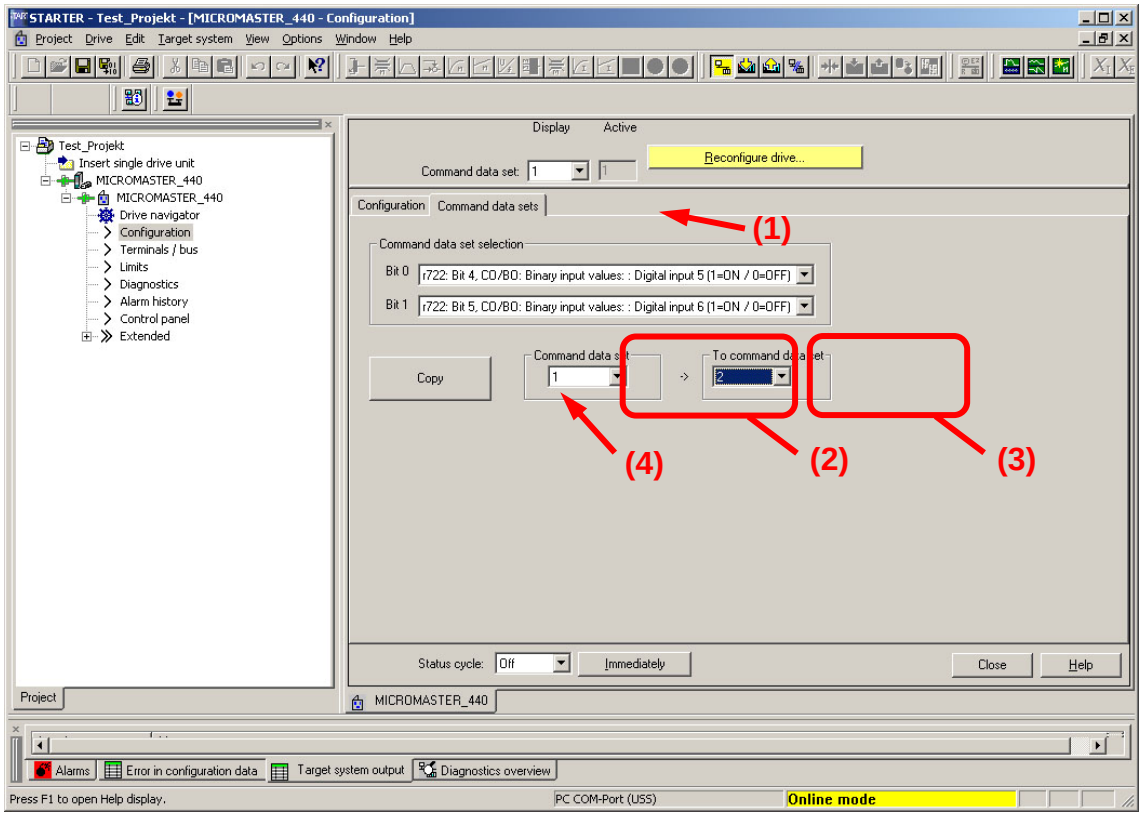

Figure 3-6 Copying command data sets using the STARTER start-up program

4 Examples

All of the examples described below – with the exception of example 4 – are applicable for MICROMASTER 430, MICROMASTER 440, CU240 of SINAMICS G120 and SINAMICS G120D.

Example 4 is only applicable for MICROMASTER 430, MICROMASTER 440 and CU240 of SINAMICS G120.

4.1 Example 1: Connecting several different motors to a drive inverter

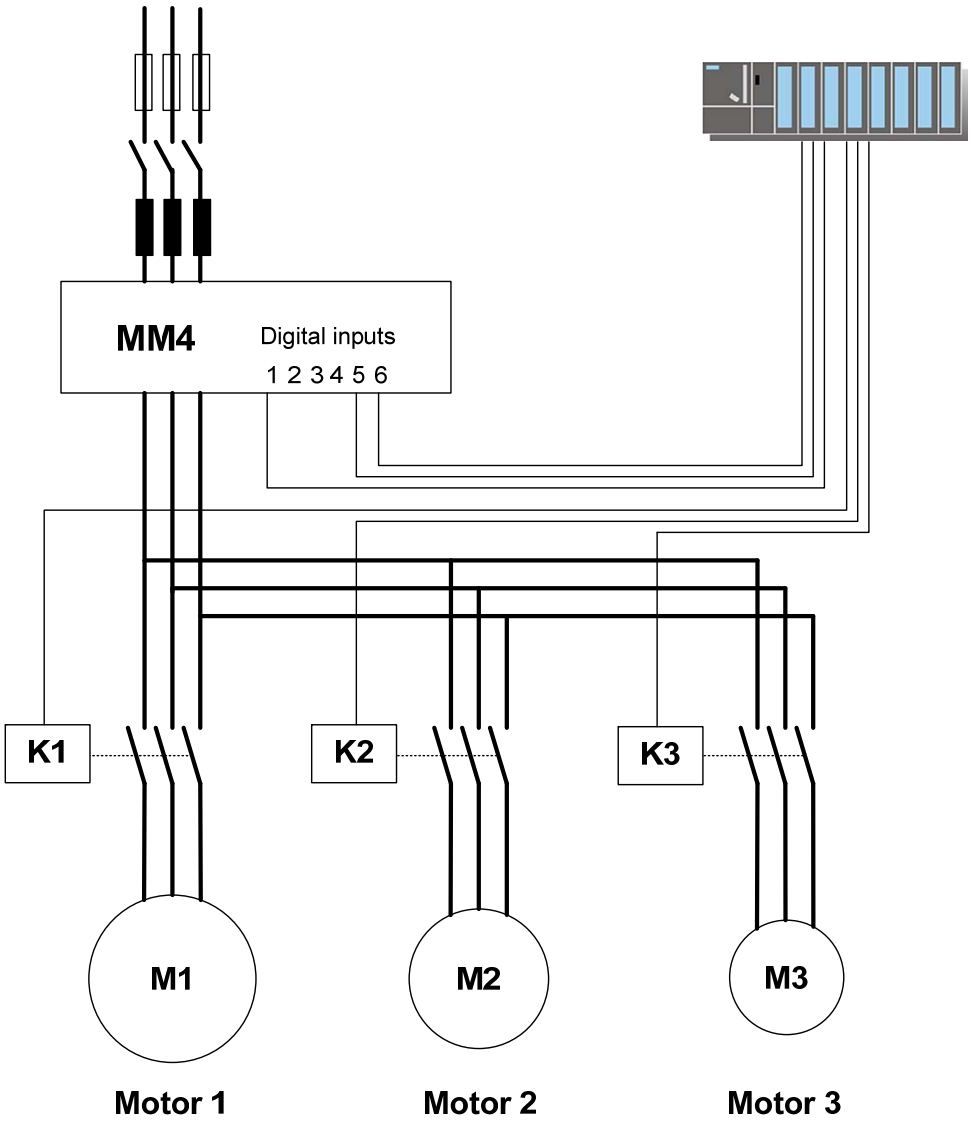

Figure 4-1 connecting three different motors to a drive inverter

4.1.1 Design

The various motors must be connected to the drive inverter through contactors. A higher-level control controls both the contactors and also selects the associated drive data sets. If the motor is changed, then initially, the drive inverter is powered-down and then the motor contactor is opened. The next drive data set is selected and the associated contactor is controlled. The system must wait 50 ms for the data set to be changed-over. The drive inverter can then be powered-up again.

4.1.2 Control

Digital inputs are used to enter the control signals. DIN 1 is used to power-up/power-down the drive inverter and DIN 5 and DIN 6 are used to select the drive data sets. If there is no signal at DIN 5 and DIN 6, then drive data set 1 is automatically selected. A high signal at DIN 5 selects drive data set 2 and a high signal at DIN 6, drive data set 3.

The following setting parameters are obtained if it is assumed that in addition to the drive data set changeover, there is no command data set changeover:

Table 4-1 Parameterization of the frequency converter

Parameter No.	Designation	Parameter value	Note / comments
P0700[0]	Selection of command source, CDS 1	2	2: Terminals
P0840[0]	BI: ON/OFF1, CDS 1	r0722.0	ON/OFF1 via DIN 1
P0705[0]	Digital input 5 (DI5) , CDS 1	99	99: Enable BICO parameterization
P0706[0]	Digital input 6 (DI6) , CDS 1	99	99: Enable BICO parameterization
P0820	BI: DDS bit 0	r0722.4	DDS bit 0 = DIN 5
P0821	BI: DDS bit 1	r0722.5	DDS bit 1 = DIN 6

To start, drive 1 is commissioned. It must be ensured that

4.1.3 Commissioning

To start, drive 1 is commissioned. It must be ensured that neither DDS 1 nor DDS 2 is selected from the PLC. The drive can then be commissioned according to the information provided in Operating Instructions. There are 2 possibilities of commissioning drive 2 and 3:

1. Select the drive data set and commission (start-up) the drive according to the Operating Instructions (e. g. MM440, chapter 3.5; G120, chapter 5; G120D, chapter 4)
2. Copy the 1st drive data set into the 2nd drive data set using parameter P0819

In the 1st case it must be ensured that for the commissioning steps, the appropriate index is always selected (1 or 2). The 2nd method offers the advantage that for the drive only the different motor parameters have to be re-determined if the remaining parameters (set points, closed-loop control, etc.) remain the same.

4.2 Example 2: Changing-over the speed controller gain

For a wide range of technological applications it has been seen to be necessary to adapt the gain and the integral action time of the speed controller to the changing control loop. Up to three different gain factors and integral action times can be parameterized using the drive data sets. Contrary to most parameters of the drive data sets, gain Kp and integral action time t_N can be changed-over (toggled) while the drive is operational. A changeover can either be externally initiated via previously parameterized digital inputs; when using the frequency threshold value f_1 (P2155) it is possible to toggle between two drive data sets, also as a function of the drive speed.

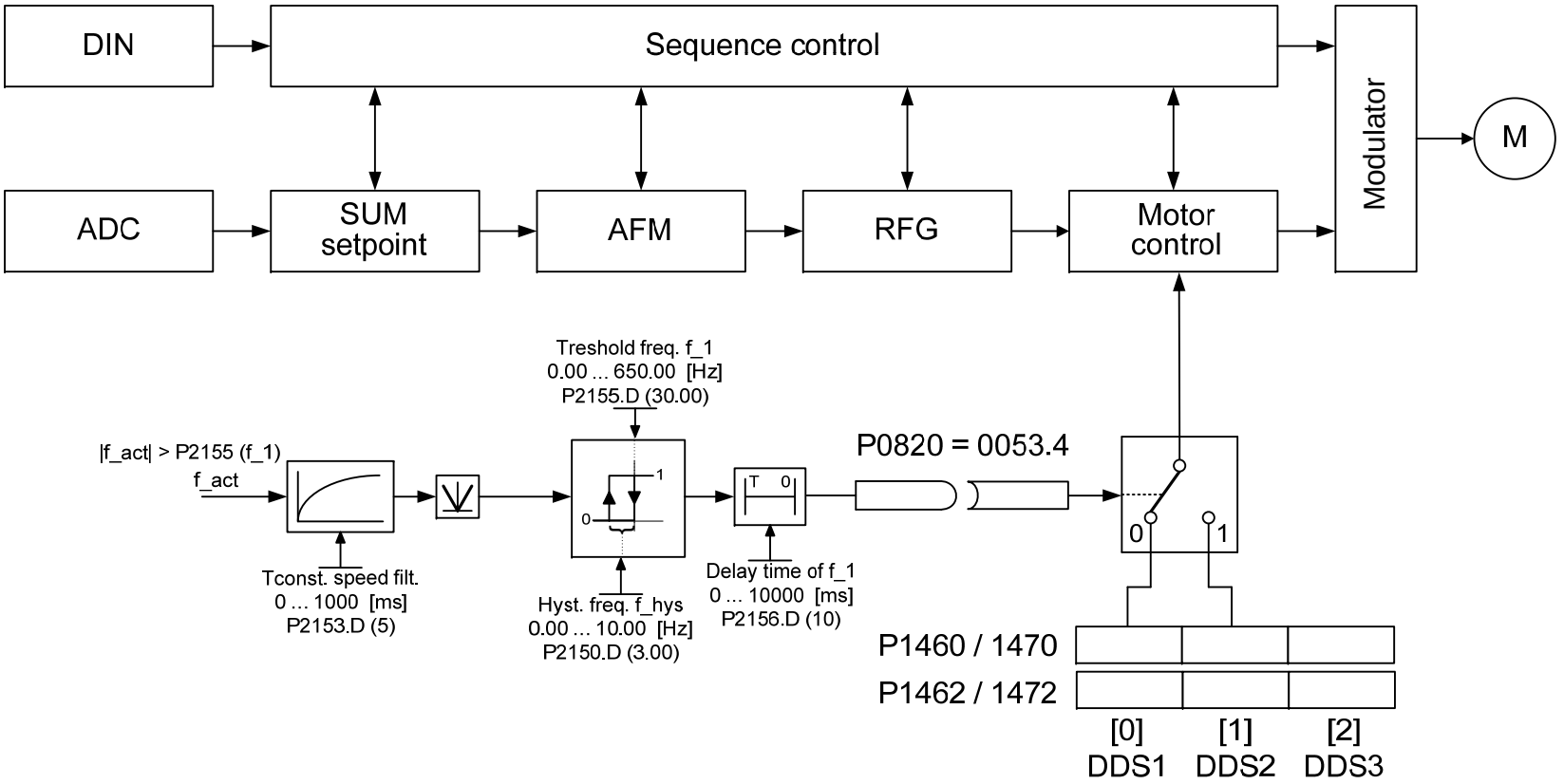

Figure 4-2 Changing-over the gain / integral action time of the speed controller

4.3 Example 3: Changing-over the ramp-function generator

The ramp-function generator parameters - such as ramp-up and ramp-down times, initial and final rounding-off, OFF3 ramp-down time - can also be changed with the drive inverter operational using drive data sets. The changeover using digital input DIN 4 is shown in the following example.

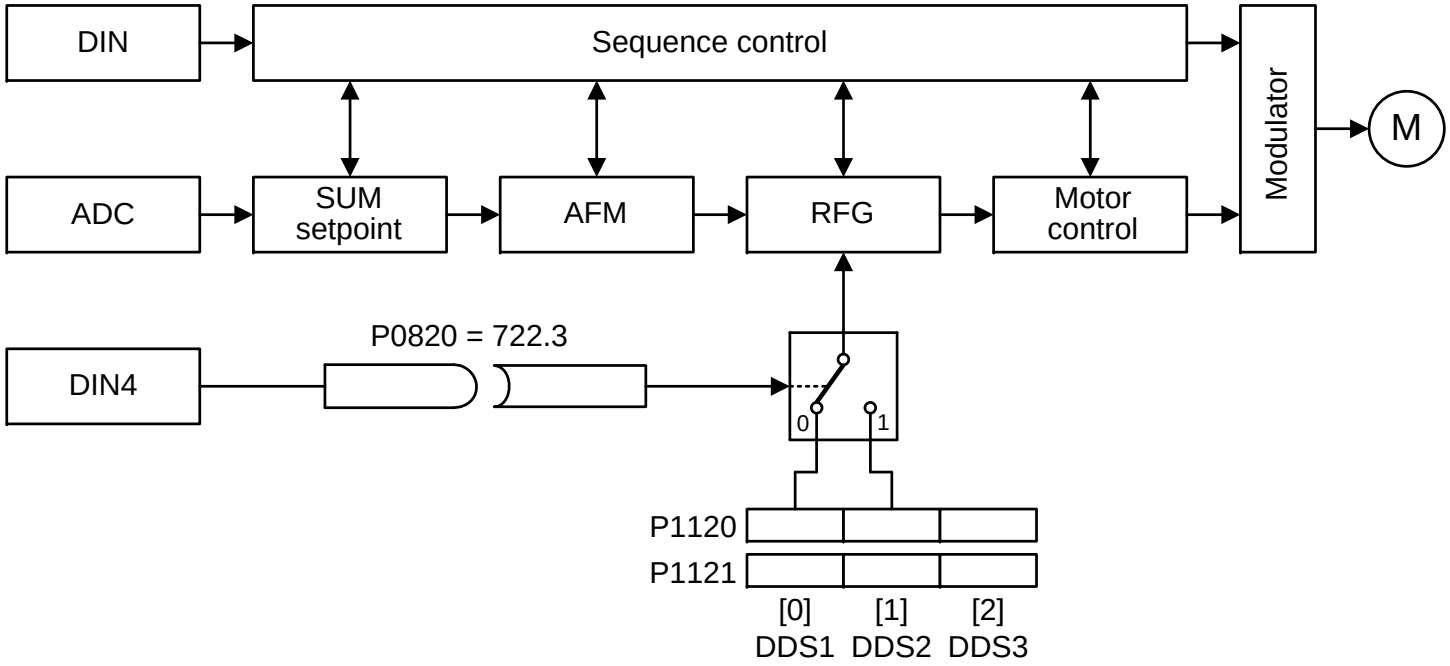

Figure 4-3 Changing-over the ramp-up/ramp-down time of the ramp-function generator

4.4 Example 4: Changing-over between local / remote

Note:

Example 4 is only applicable for MM430, MM440 and CU240 of G120.

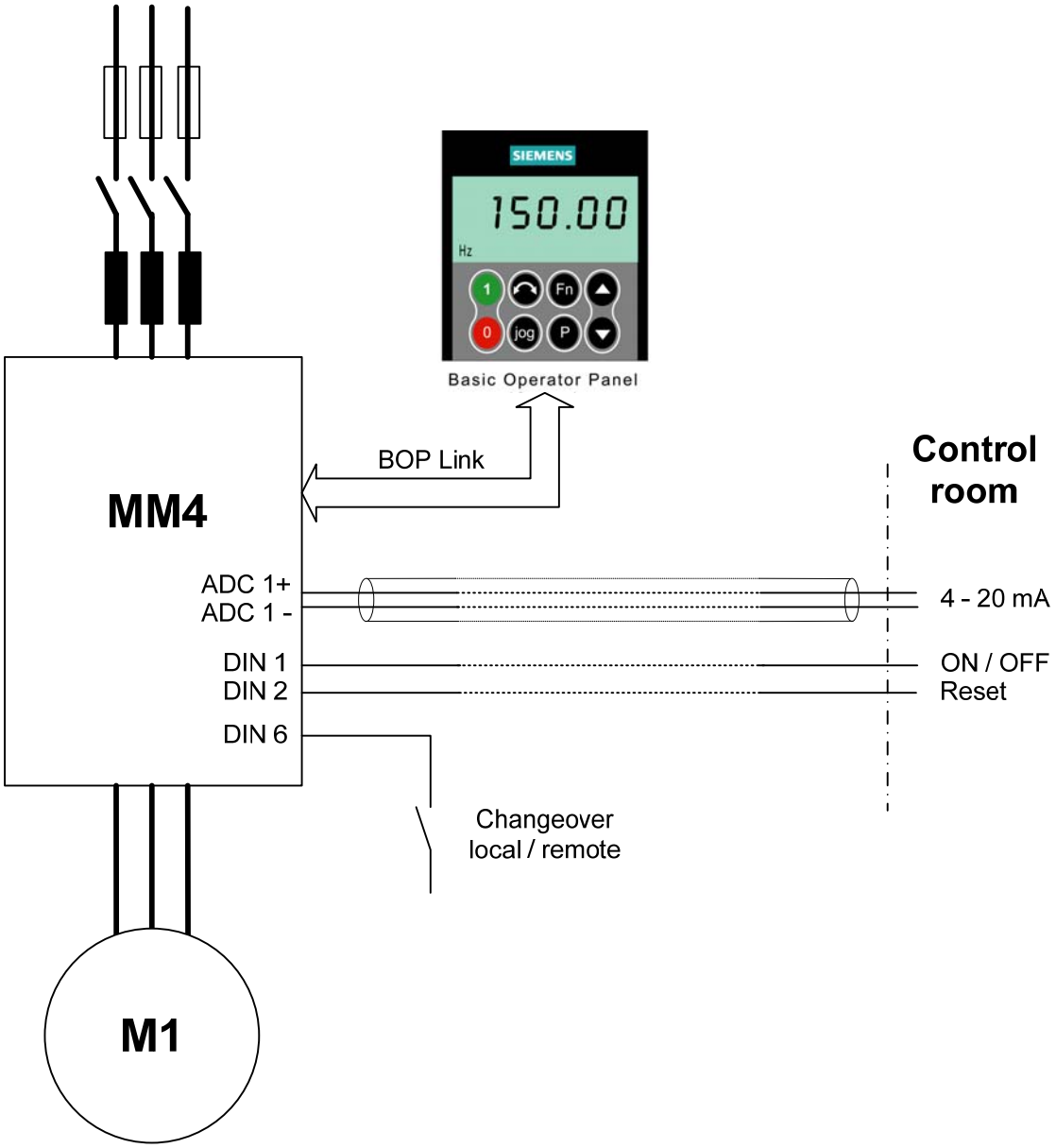

Figure 4-4 Changing-over between local / remote control

A drive, e.g. for a pump or a conveyor belt, which is located some distance away from the switchgear room, is normally powered-up and powered-down from the main control room via binary inputs; the setpoint is 4 – 20 mA. When faults occur, or also when maintenance is required, the pump is locally operated from the operator device.

Using a key-actuated switch, the drive can be changed-over from remote control to local control. The following settings are parameterized:

Local operator control (CDS 0):

- Setpoint via the BOP (motorized potentiometer with raise / lower key)
- On / Off via the BOP

Remote control (CDS 1):

- 4 – 20 mA setpoint
- On / Off / fault acknowledgement via digital inputs

The basic setting of the two command data sets is extremely simply realized using parameters P0700 and P1000.

Binary input DIN 6 is used to changeover (toggle) between the two operating modes. The parameterization is as follows:

Table 4-2 Changeover local / remote

Parameter No.	Designation	Parameter value	Note / comments
Selection of command source:			
P0700[0]	Selection of command source, CDS 1	1	1: BOP
P0700[1]	Selection of command source, CDS 2	2	2: Terminals
Selection of frequency setpoint:			
P1000[0]	Selection of frequency setpoint, CDS 1	1	1: MOP setpoint
P1000[1]	Selection of frequency setpoint, CDS 2	2	2: Analog setpoint
Selection CDS 1 / 2:			
P0706[0]	Digital input 6 (DI6), CDS 1	99	99: Enable BICO parameterization
P0706[1]	Digital input 6 (DI6), CDS 2	99	99: Enable BICO parameterization
P0810	BI: CDS Bit0 (Local / remote)	r0722.5	Local / remote = DIN 6

Setting of the 4 – 20 mA setpoint channel:

Table 4-3 Setting of the 4 – 20 mA setpoint channel

Parameter No.	Designation	Parameter value	Note / comments
ADC 1:			
P0756[0]	Type of ADC	3	3: Unipolar current input with monitoring (0 to 20 mA)
P0757[0]	Value x1 of ADC scaling [V / mA]	4	x1 = 4 [V /mA]
P0758[0]	Value y1 of ADC scaling	0	y1 = 0 [%]
P0759[0]	Value x2 of ADC scaling [V / mA]	20	x1 = 20 [V /mA]
P0760[0]	Value y2 of ADC scaling	100	y1 = 100 [%]
P0761[0]	Width of ADC deadband [V / mA]	4	Width of ADC deadband = 4 [V / mA]

Note:

It is important that the analog input ADC 1 is also brought into the correct setting using the DIP switch on the terminal board (ON = 0–20 mA).

Wire breakage monitoring

It is extremely simple to implement a wire breakage monitoring of the 4 – 20 mA setpoint by evaluating the ADC status word r0751[0]. The analog inputs can be parameterized for voltage input or current input with a monitoring function. If the setpoint falls below 50% of the value of the ADC deadband zone, parameterized using P0761, as a result of a damaged cable, then the appropriate bit of the ADC status word r0751 is set. In order that a fault is not output, fault message 80 must be suppressed using parameters 2100 and 2101. Only different drive responses can be initiated by the status bit, e.g.

- changing-over to a fixed setpoint (parameterization of CDS 2 !!!)
- freezing the last setpoint
- output of a fault message

For the particular example, freezing the setpoint and the output of a fault message were selected. The ramp-function generator output and therefore the drive inverter frequency setpoint can be frozen at the last actual setpoint using parameter P1141. The control is realized via r0751.0, however, the signal must be negated once (NOT 1). A fault message can be simultaneously generated using r0751(0). In order that the On/Off

command is still active via DIN 1, the setpoint is no longer frozen when an On command is withdrawn.

This wire breakage monitoring is only active in data set CDS 1 - remote operator control; when changing-over to local operator control, it is no longer effective.

Freezing the frequency setpoint:

Table 4-4 Freezing the frequency setpoint

Parameter No.	Designation	Parameter value	Note / comments
Digital input 1:			
P0701[0]	Function of digital input 1, CDS 1	99	99: Enable BICO parameterization
P0701[1]	Function of digital input 1, CDS 2	99	99: Enable BICO parameterization
Digital output 3:			
P0733[0]	BI: Function of digital output 3	0	no function
P0733[1]	BI: Function of digital output 3	r0751.0	Signal lost on ADC 1
Delay for loss of signal action:			
P0762[0]	Delay for loss of signal action, ADC 1	0	0 ms
Local / remote control:			
P0840[0]	BI: ON/OFF1, CDS 1	r0019.0	ON/OFF1 via BOP
P0840[1]	BI: ON/OFF1, CDS 2	r0722.0	ON/OFF1 via DIN 1
P1141[0]	BI: RFG start, CDS 1	1	enabled
P1141[1]	BI: RFG start, CDS 2	r2829.0	Output of the NOT 1
P2100[0]	Alarm number selection	80	80: ADC input signal lost
P2101[0]	Stop reaction value	0	0: No reaction, no display
FFBs:			
P2800	Enable FFBs	1	1: Enabled
P2801[0]	Activate FFBs	3	Activate AND1 (Level 3)
P2801[9]	Activate FFBs	3	Activate NOT1 (Level 3)
P2810[0]	BI: AND 1	r0722.0	1st input of the AND1 = DIN 1
P2810[1]	BI: AND 1	r0751.0	2nd input of the AND1 = Signal lost on ADC 1
P2828	BI: NOT 1	r2811	Input of the NOT1 = Output of the AND1

4.5 Example 5: Changeover manual / automatic

A drive operates in an automation group and is normally powered-up and powered-down via PROFIBUS; the setpoint is also entered via the bus. When faults occur or also when service is required, the drive is to be locally controlled from a switch box.

Using a key-actuated switch the drive can be changed-over from automatic to manual operation. The following settings are parameterized:

Manual operation (CDS 0)

- Setpoint via the motorized potentiometer using the higher / lower key
- On / Off via a pushbutton

Automatic operation (CDS 1)

- Setpoint via PROFIBUS
- On / Off / fault acknowledgement via PROFIBUS

The basic setting of the two command data sets is extremely simply realized using parameters P0700 and P1000.

Binary input DIN 6 is used to changeover (toggle) between the two operating modes.

Parameterization as follows:

Table 4-5 Changeover manual / automatic

Parameter No.	Designation	Parameter value	Note / comments
Selection of command source:			
P0700[0]	Selection of command source, CDS 1	2	2: Terminals
P0700[1]	Selection of command source, CDS 2	6	6: Profibus
Selection of frequency setpoint:			
P1000[0]	Selection of frequency setpoint, CDS 1	1	1: MOP setpoint
P1000[1]	Selection of frequency setpoint, CDS 2	6	2: Profibus setpoint
Selection CDS 1 / 2:			
P0706[0]	Digital input 6 (DI6), CDS 1	99	99: Enable BICO parameterization
P0706[1]	Digital input 6 (DI6), CDS 2	99	99: Enable BICO parameterization
P0810	BI: CDS Bit0 (Local / remote)	r0722.5	Manual / automatic = DIN 6

5 Executing scripts in STARTER

For fast parameter changes, you can use the attached script files.

Note:

Before you execute a script on the drive, please set your drive inverter to the factory settings (P0010 = 30, P0970 = 1) and carry-out a quick commissioning (P0010 = 1) of the drive.

The procedure in detail:

1. Save the attached script file in a folder on your computer hard drive.

2. Set-up a script folder for the drive in your STARTER project by clicking with the righthand mouse key on the drive; then click on **“Expert”** (lefthand mouse key) and on **“Insert script folder”**.

   A new folder appears **“SCRIPTS”** at the lower end of the tree.

3. Import the script from your folder into STARTER as described below:
   - Using the righthand mouse key click on the tab **"SCRIPTS"**;
   - Click on **"ASCII import..."** and open the required script file;
   - Assign a name to the opened file and acknowledge with **“OK”**.

4. Go **Online** with the drive.

5. Execute the script by clicking with the righthand mouse key on the script and clicking **“Accept and execute”**;

or open the script by double clicking on it and then pressing the button  **“Accept and execute”**.

Also refer to the application Entry ID: 22078810 "STARTER: Generating application macros" (Chapter 1.5 „Save Expert List and User-defined Lists as Script”, section “Series commissioning of a number of drives using scripts“).

Appendix and references

6 References

6.1 Internet link data

This list is in no way complete and only reflects a selection of suitable references.

Table 6-1

	Subject area	Title
\1\	Manuals	MICROMASTER 4
\2\	Manuals	SINAMICS G120
\3\	Manuals	SINAMICS G120D
\4\	FAQ	How do I use different parameter sets with the MM440/MM430?
\5\	Application	STARTER: Generating application macros

6.2 History

Table 6-2 History

Version	Datum	Change
V1.0	June 2003	First edition
V2.0	December 2008	Second edition; extended by G120
V2.1	July 2009	Word file reformated