SIEMENS

MICROMASTER 430

7.5 kW - 250 kW

Operating Instructions (Compact) Issue 10/06

User Documentation

Warnings, Cautions and Notes

The following Warnings, Cautions and Notes are provided for your safety and as a means of preventing damage to the product or components in the machines connected. **Specific Warnings, Cautions and Notes** that apply to particular activities are listed at the beginning of the relevant chapters and are repeated or supplemented at critical points throughout these sections. Please read the information carefully, since it is provided for your personal safety and will also help prolong the service life of your MICROMASTER 430 Inverter and the equipment you connect to it.

WARNING

- This equipment contains dangerous voltages and controls potentially dangerous rotating mechanical parts. Non-compliance with **Warnings** or failure to follow the instructions contained in this manual can result in loss of life, severe personal injury or serious damage to property.
- Only suitable qualified personnel should work on this equipment, and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual. The successful and safe operation of this equipment is dependent upon its proper handling, installation, operation and maintenance.
- The DC link capacitors remain charged for five minutes after power has been removed. It is not permissible to open the equipment until 5 minutes after the power has been removed. The drive unit discharges itself during this time.
- This equipment is capable of providing internal motor overload protection in accordance with UL508C section 42. Refer to P0610 and P0335, i^2t is ON by default. Motor overload protection can also be provided using an external PTC or KTY84.
- This equipment is suitable for use in a circuit capable of delivering not more than 10,000 (Frame Size C) or 42,000 (Frame Sizes D to GX) symmetrical amperes (rms), for a maximum voltage of 460 V when protected by an H, J or K type fuse, a circuit breaker or self-protected combination motor controller (for more details see Operating Instructions Appendix F).
- Use Class 1 60/75 °C copper wire only with the cross-sections as specified in the Operating Instructions.
- The mains input, DC and motor terminals, can carry dangerous voltages even if the inverter is inoperative. Always wait **5 minutes** to allow the unit to discharge after switching off before carrying out any installation work.

NOTE

- Before installing and commissioning, please read these safety instructions and warnings carefully and all the warning labels attached to the equipment.
- Please ensure that all of the warning labels are kept in a condition so that they can be easily read and replace missing or damaged labels.
- Maximum permissible surrounding ambient temperature is 40 °C at 100 % permissible output current

Contents

1 Installation

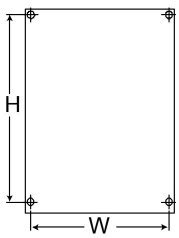
1.1 Clearance distances for mounting

The inverters can be mounted adjacent to each other. When mounting inverters one above the other, the specified environmental conditions must not be exceeded.

Independent of this, these minimum distances must be observed.

- Frame Size C — above and below 100 mm
- Frame Size D, E — above and below 300 mm
- Frame Size F — above and below 350 mm
- Frame Size FX, GX — above 250 mm
below 150 mm
in front 40 mm (FX), 50 mm (GX)

1.2 Mounting dimensions



Frame Size	Drilling Dimensions		Tightening Torque	
	H mm (Inch)	W mm (Inch)	Bolts	Nm (lbf.in)
C	204 (8.03)	174 (6.85)	4 x M5	2,5 (22.12)
D	486 (19.13)	235 (9.25)	4 x M8	3,0 (26.54)
E	616,4 (24.27)	235 (9.25)	4 x M8	
F	810 (31.89)	300 (11.81)	4 x M8	
FX	1375,5 (54.14)	250 (9.84)	6 x M8	13,0 (115.02)
GX	1508,5 (59.38)	250 (9.84)	6 x M8	13,0 (115.02)

Fig. 1-1 Mounting dimensions

2 Electrical Installation

2.1 Technical Specifications

Input voltage range 3 AC 380 V – 480 V, ± 10 % (with built in Class A Filter)

Order No.	**6SE6430-**	**2AD27-5CA0**	**2AD31-1CA0**	**2AD31-5CA0**	**2AD31-8DA0**	**2AD32-2DA0**	**2AD33-0DA0**
Frame Size		C			D		
Output Rating (VT)	**[kW]**	7,5	11,0	15,0	18,5	22,0	30,0
	[hp]	10,0	15,0	20,0	25,0	30,0	40,0
Output Power	**[kVA]**	10,1	14,0	19,8	24,4	29,0	34,3
VT-Input Current 1)	**[A]**	17,3	23,1	33,8	37,0	43,0	59
VT-Output Current max.	**[A]**	19,0	26,0	32,0	38,0	45,0	62,0
Fuse	**[A]**	20	32	35	50	63	80
ded		3807	3812	3814	3820	3822	3824
For UL specified	3NE	*	*	*	1817-0	1818-0	1820-0
Input Cable, min.	**[mm²]**	2,5	4,0	6,0	10,0	10,0	16,0
	[AWG]	14	12	10	8	8	6
Input Cable, max.	**[mm²]**	10,0	10,0	10,0	35,0	35,0	35,0
	[AWG]	8	8	8	2	2	2
Output Cable, min.	**[mm²]**	2,5	4,0	6,0	10,0	10,0	16,0
	[AWG]	14	12	10	8	8	6
Output Cable, max.	**[mm²]**	10,0	10,0	10,0	35,0	35,0	35,0
	[AWG]	8	8	8	2	2	2
Tightening torques for power terminals	**[Nm]**	2,25			10		
	[lbf.in]	20			89		
Required cooling air flow	**[l/s]**	54,9			2 × 54,9		
Weight	**[kg]**	5,7	5,7	5,7	17,0	17,0	17,0
	[lbs]	12,5	12,5	12,5	37,0	37,0	37,0

Order No.	**6SE6430-**	**2AD33-7EA0**	**2AD34-5EA0**	**2AD35-5FA0**	**2AD37-5FA0**	**2AD38-8FA0**
Frame Size		E		F		
Output Rating (VT)	**[kW]**	37,0	45,0	55,0	75,0	90,0
	[hp]	50,0	60,0	75,0	100,0	120,0
Output Power	**[kVA]**	47,3	57,2	68,6	83,8	110,5
VT-Input Current 1)	**[A]**	72	87	104	139	169
VT-Output Current max.	**[A]**	75,0	90,0	110,0	145,0	178,0
Fuse	**[A]**	100	125	160	160	200
ded		3830	3832	3836	3140	3144
For UL specified	3NE	1021-0	1022-0	1224-0	1225-0	1227-0
Input Cable, min.	**[mm²]**	25,0	25,0	35,0	70,0	70,0
	[AWG]	3	3	2	2/0	2/0
Input Cable, max.	**[mm²]**	35,0	35,0	150,0	150,0	150,0
	[AWG]	2	2	300	300	300
Output Cable, min.	**[mm²]**	25,0	25,0	50,0	70,0	95,0
	[AWG]	3	3	1/0	2/0	4/0
Output Cable, max.	**[mm²]**	35,0	35,0	150,0	150,0	150,0
	[AWG]	2	2	300	300	300
Tightening torques for power terminals	**[Nm]**	10		50		
	[lbf.in]	89		445		
Required cooling air flow	**[l/s]**	2 × 54,9		150		
Weight	**[kg]**	22,0	22,0	75,0	75,0	75,0
	[lbs]	48,0	48,0	165,0	165,0	165,0

1) Secondary conditions: Input current at the rated operating point - applies for the short-circuit voltage of the line supply V_k = 2 % referred to the rated drive inverter power and a rated line supply voltage of 400 V without line commutating reactor.

* UL listed fuses such as Class NON from Bussmann are required for use in America)

Input voltage range 3 AC 380 V – 480 V, ± 10 % (Unfiltered)

Order No.	6SE6430-	2UD27-5CA0	2UD31-1CA0	2UD31-5CA0	2UD31-8DA0	2UD32-2DA0	2UD33-0DA0
Frame Size		C			D		
Output Rating (VT)	[kW]	7,5	11,0	15,0	18,5	22,0	30,0
	[hp]	10,0	15,0	20,0	25,0	30,0	40,0
Output Power	[kVA]	10,1	14,0	19,8	24,4	29,0	34,3
VT-Input Current 1)	[A]	17,3	23,1	33,8	37,0	43,0	59
VT-Output Current max.	[A]	19,0	26,0	32,0	38,0	45,0	62,0
Fuse	[A]	20	32	35	50	63	80
Recommended	3NA	3807	3812	3814	3820	3822	3824
For UL specified	3NE	*	*	*	1817-0	1818-0	1820-0
Input Cable, min.	[mm²]	2,5	4,0	6,0	10,0	10,0	16,0
	[AWG]	14	12	10	8	8	6
Input Cable, max.	[mm²]	10,0	10,0	10,0	35,0	35,0	35,0
	[AWG]	8	8	8	2	2	2
Output Cable, min.	[mm²]	2,5	4,0	6,0	10,0	10,0	16,0
	[AWG]	14	12	10	8	8	6
Output Cable, max.	[mm²]	10,0	10,0	10,0	35,0	35,0	35,0
	[AWG]	8	8	8	2	2	2
Tightening torques for power terminals	[Nm]	2,25			10		
	[lbf.in]	20			89		
Required cooling air flow	[l/s]	54,9			2 × 54,9		
Weight	[kg]	5,5	5,5	5,5	16,0	16,0	16,0
	[lbs]	12,1	12,1	12,1	35,0	35,0	35,0

Order No.	6SE6430-	2UD33-7EA0	2UD34-5EA0	2UD35-5FA0	2UD37-5FA0	2UD38-8FA0
Frame Size		E		F		
Output Rating (VT)	[kW]	37,0	45,0	55,0	75,0	90,0
	[hp]	50,0	60,0	75,0	100,0	120,0
Output Power	[kVA]	47,3	57,2	68,6	83,8	110,5
VT-Input Current 1)	[A]	72	87	104	139	169
VT-Output Current max.	[A]	75,0	90,0	110,0	145,0	178,0
Fuse	[A]	100	125	160	160	200
Recommended	3NA	3830	3832	3836	3140	3144
For UL specified	3NE	1021-0	1022-0	1224-0	1225-0	1227-0
Input Cable, min.	[mm²]	25,0	25,0	35,0	70,0	70,0
	[AWG]	3	3	2	2/0	2/0
Input Cable, max.	[mm²]	35,0	35,0	150,0	150,0	150,0
	[AWG]	2	2	300	300	300
Output Cable, min.	[mm²]	25,0	25,0	35,0	70,0	95,0
	[AWG]	3	3	2	2/0	4/0
Output Cable, max.	[mm²]	35,0	35,0	150,0	150,0	150,0
	[AWG]	2	2	300	300	300
Tightening torques for power terminals	[Nm]	10		50		
	[lbf.in]	89		445		
Required cooling air flow	[l/s]	2 × 54,9		150		
Weight	[kg]	20,0	20,0	56,0	56,0	56,0
	[lbs]	44,0	44,0	123,0	123,0	123,0

1) Secondary conditions: Input current at the rated operating point - applies for the short-circuit voltage of the line supply V_k = 2 % referred to the rated drive inverter power and a rated line supply voltage of 400 V without line commutating reactor.

* UL listed fuses such as Class NON from Bussmann are required for use in America)

Input voltage range 3 AC 380 V – 480 V, ± 10 % (Unfiltered)

Order No.	6SE6430-	2UD41-1FA0	2UD41-3FA0	2UD41-6GA0	2UD42-0GA0	2UD42-5GA0
Frame Size		FX		GX		
Output Rating (VT)	**[kW]**	110	132	160	200	250
	[hp]	150	200	250	300	333
Output Power	**[kVA]**	145,4	180	214,8	263,2	339,4
VT-Input Current 1)	**[A]**	200	245	297	354	442
VT-Output Current max.	**[A]**	205	250	302	370	477
Recommended Fuse	**[A]**	250	315	400	450	560
		3NE1227-0	3NE1230-0	3NE1332-0	3NE1333-0	3NE1435-0
Input Cable, min.	**[mm^2]**	1 x 95 or 2 x 35	1 x 150 or 2 x 50	1 x 185 or 2 x 70	1 x 240 or 2 x 70	2 x 95
	[AWG] or [kcmil]	1 x 4/0 or 2 x 2	1 x 300 or 2 x 1/0	1 x 400 or 2 x 2/0	1 x 500 or 2 x 2/0	2 x 4/0
Input Cable, max.	**[mm^2]**	1 x 185 or 2 x 120	1 x 185 or 2 x 120	2 x 240	2 x 240	2 x 240
	[AWG] or [kcmil]	1 x 350 or 2 x 4/0	1 x 350 or 2 x 4/0	2 x 400	2 x 400	2 x 400
Output Cable, min.	**[mm^2]**	1 x 95 or 2 x 35	1 x 150 or 2 x 50	1 x 185 or 2 x 70	1 x 240 or 2 x 70	2 x 95
	[AWG] or [kcmil]	1 x 4/0 or 2 x 2	1 x 300 or 2 x 1/0	1 x 400 or 2 x 2/0	1 x 500 or 2 x 2/0	2 x 4/0
Output Cable, max.	**[mm^2]**	1 x 185 or 2 x 120	1 x 185 or 2 x 120	2 x 240	2 x 240	2 x 240
	[AWG] or [kcmil]	1 x 350 or 2 x 4/0	1 x 350 or 2 x 4/0	2 x 400	2 x 400	2 x 400
Tightening torques for power terminals	**[Nm]**	25				
	[lbf.in]	(222,5)				
Pipe cable shoe to DIN 46235	**[mm]**	10	10	10	10	10
Required cooling air flow	**l/s**	225	225	430	430	430
Weight	**[kg]**	110	110	190	190	190
	[lbs]	242	242	418	418	418

1) Secondary conditions: Input current at the rated operating point - applies for the short-circuit voltage of the line supply $V_k \geq 2.33$ % referred to the rated drive inverter power and a rated line supply voltage of 400 V without line commutating reactor.

2.2 Power terminals

You can gain access to the mains and motor terminals by removing the front covers.

- Frame Size C (Fig. 2-1)
- Frame sizes D and E (Fig. 2-2)
- Frame Size F (Fig. 2-3)
- Frame Sizes FX and GX (Fig. 2-4)
- Connection terminals for Frame Sizes C -F (Fig. 2-5)
- Connection overview for Frame Size FX (Fig. 2-6)
- Connection overview for Frame Size GX (Fig. 2-7)

Frame Size C

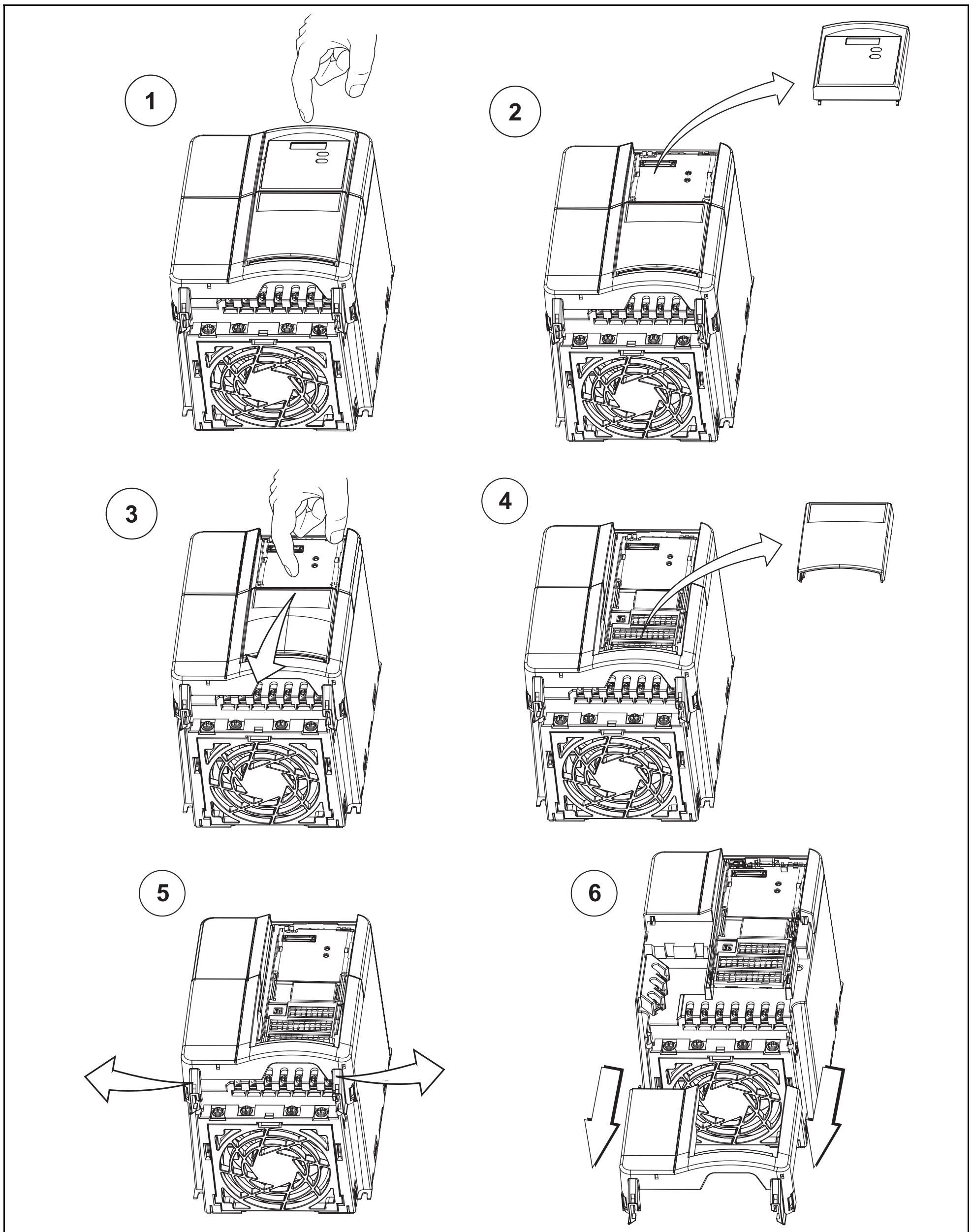


Fig. 2-1 Removing front covers (Frame Size C)

Frame Sizes D and E

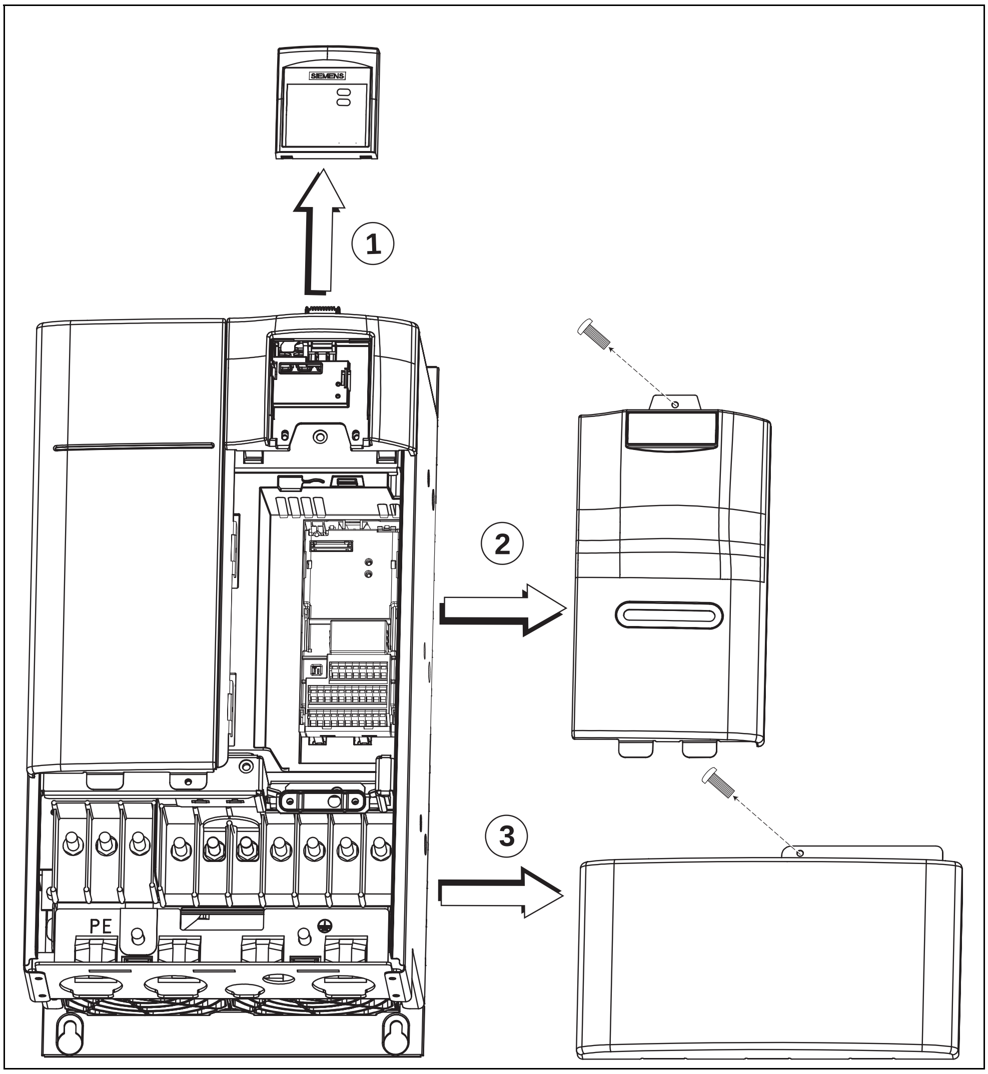


Fig. 2-2 Removing front covers (Frame Sizes D and E)

Frame Size F

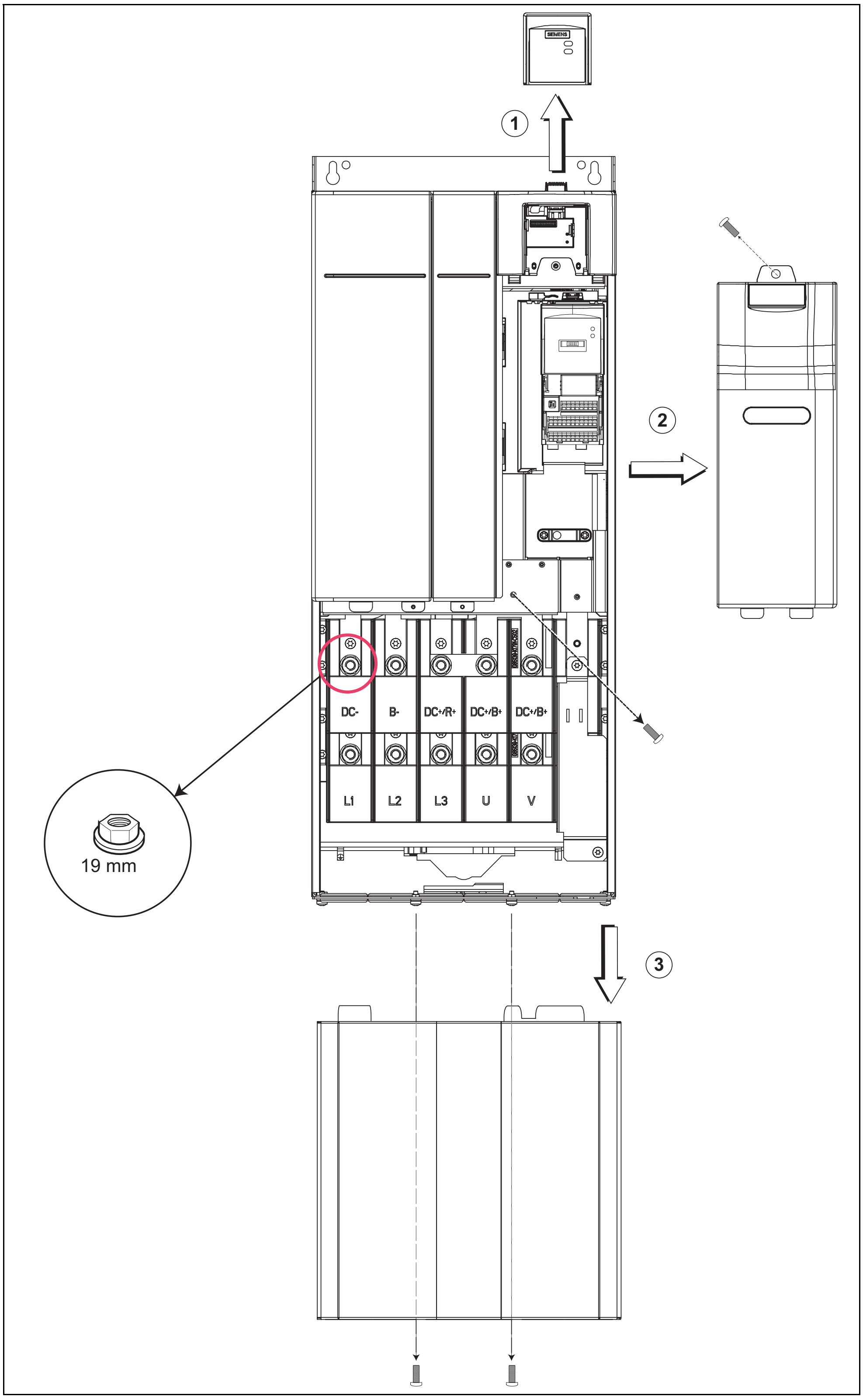


Fig. 2-3 Removing front covers (Frame Size F)

Frame Sizes FX and GX

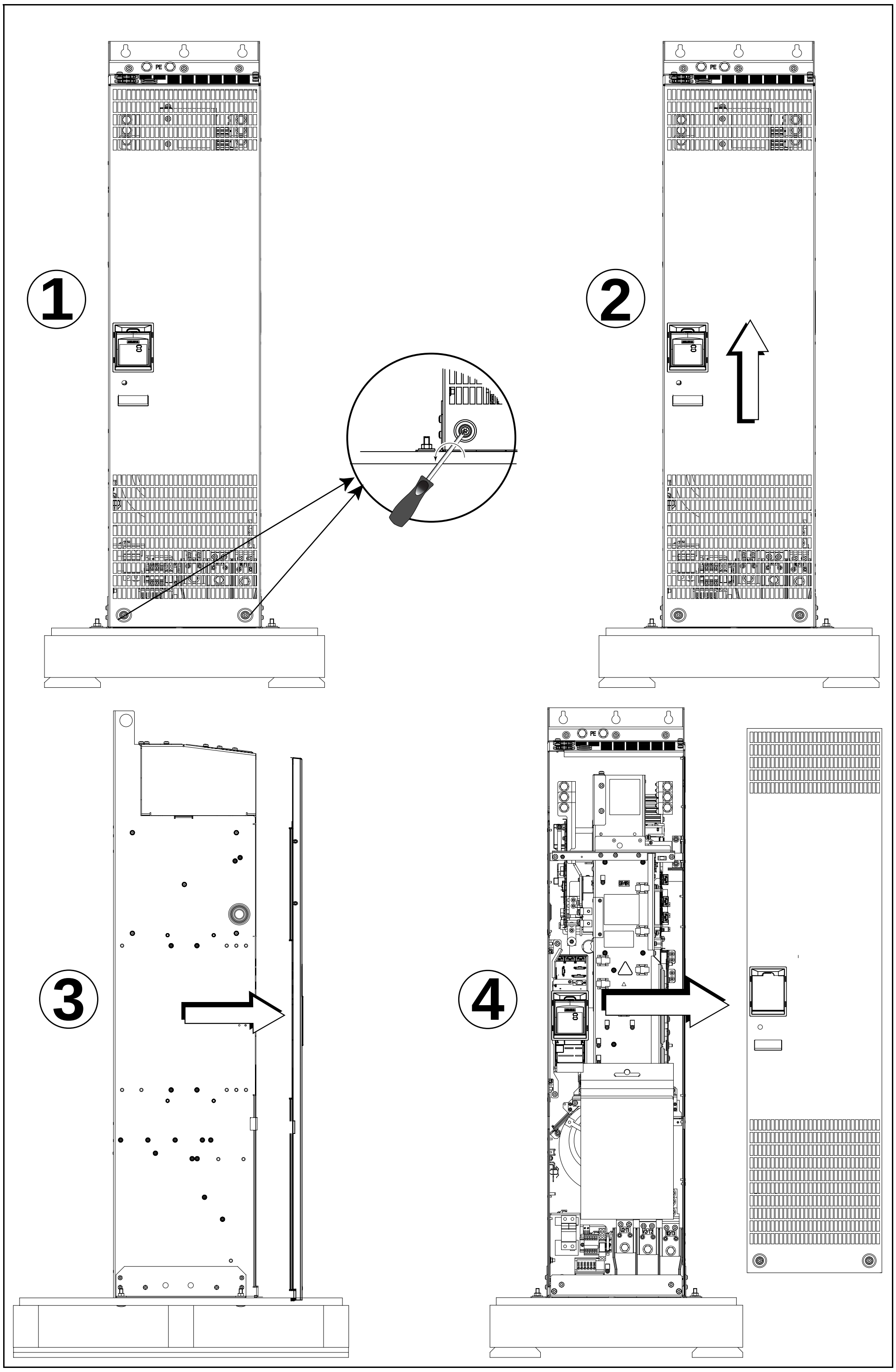


Fig. 2-4 Removing front covers (Frame Sizes FX and GX)

Access to the power supply and motor terminals is possible by removing the front covers.

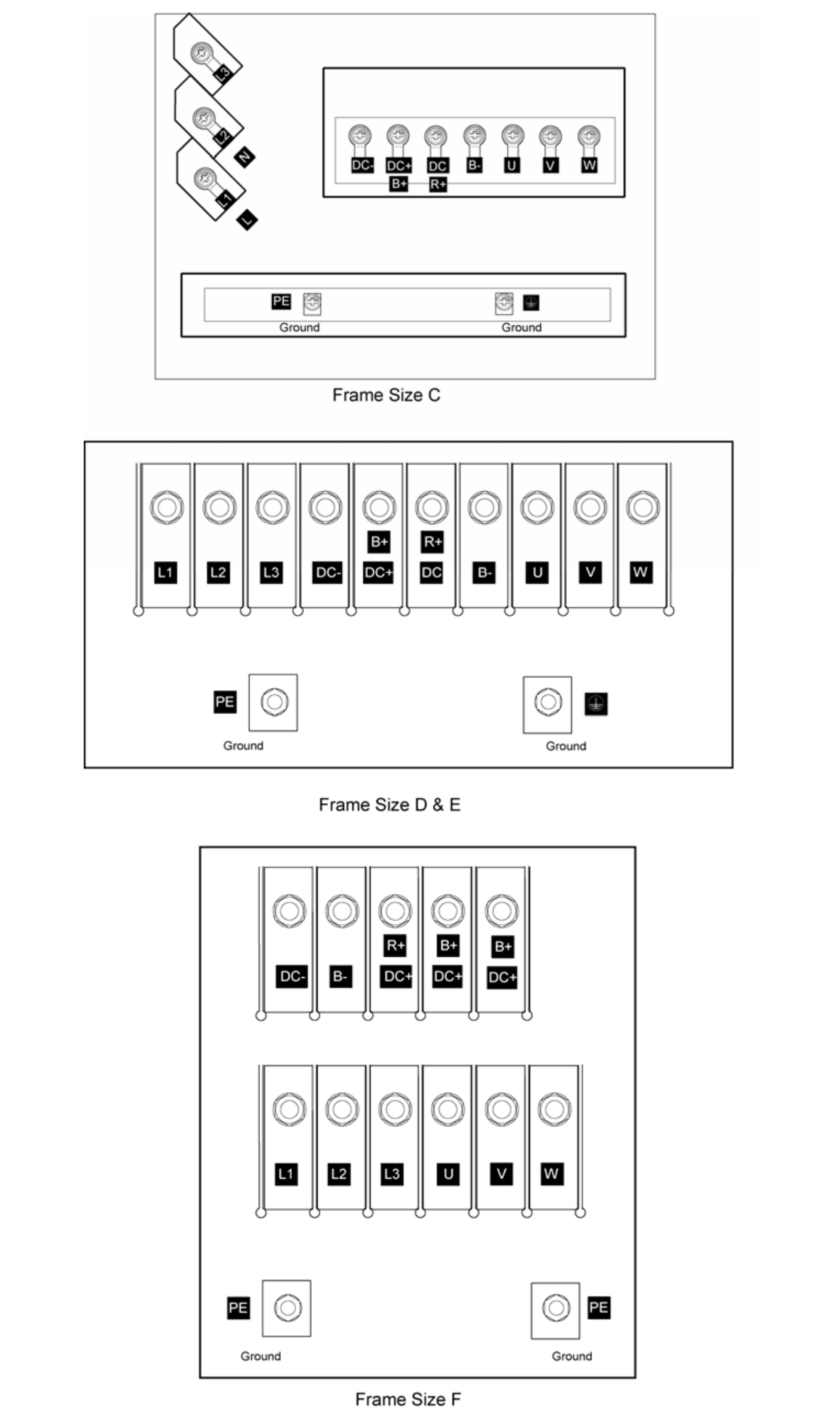


Fig. 2-5 Connection terminals for Frame Sizes C- F

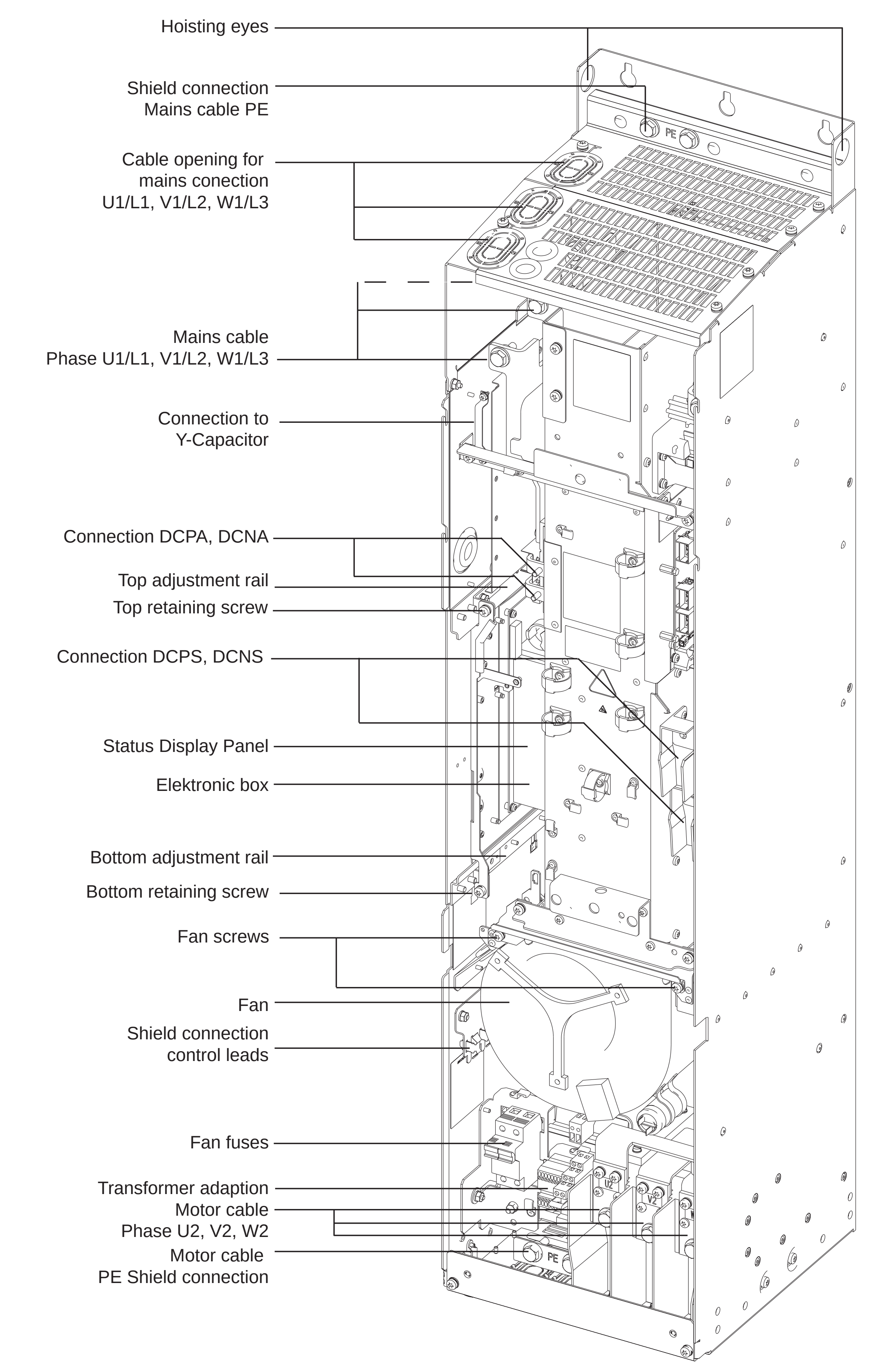


Fig. 2-6 Connection overview for Frame Size FX

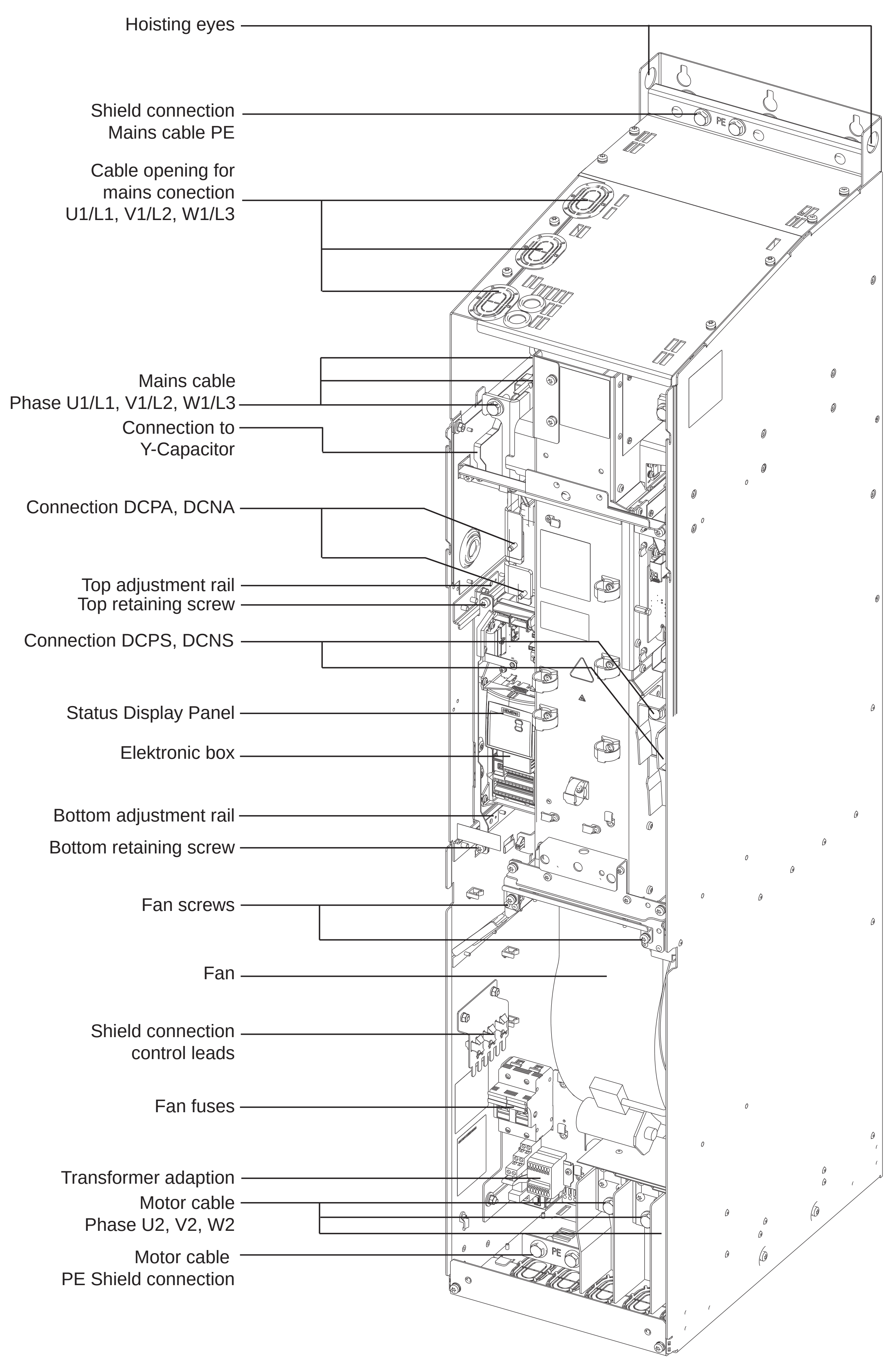


Fig. 2-7 Connection overview for Frame Size GX

2.3 Control terminals

Possible cable diameter: 0.08 - 2.5 mm^2 (AWG: 28 - 12)

Terminal	Designation	Function
1	–	Output +10 V
2	–	Output 0 V
3	ADC1+	Analog input 1 (+)
4	ADC1–	Analog input 1 (–)
5	DIN1	Digital input 1
6	DIN2	Digital input 2
7	DIN3	Digital input 3
8	DIN4	Digital input 4
9	–	Isolated output +24 V / max. 100 mA
10	ADC2+	Analog input 2 (+)
11	ADC2–	Analog input 2 (–)
12	DAC1+	Analog output 1 (+)
13	DAC1–	Analog output 1 (–)
14	PTCA	Connection for PTC / KTY84
15	PTCB	Connection for PTC / KTY84
16	DIN5	Digital input 5
17	DIN6	Digital input 6
18	DOUT1/NC	Digital output 1 / NC contact
19	DOUT1/NO	Digital output 1 / NO contact
20	DOUT1/COM	Digital output 1 / Changeover contact
21	DOUT2/NO	Digital output 2 / NO contact
22	DOUT2/COM	Digital output 2 / Changeover contact
23	DOUT3/NC	Digital output 3 / NC contact
24	DOUT3/NO	Digital output 3 / NO contact
25	DOUT3/COM	Digital output 3 / Changeover contact
26	DAC2+	Analog output 2 (+)
27	DAC2–	Analog output 2 (–)
28	–	Isolated output 0 V / max. 100 mA
29	P+	RS485 port
30	N–	RS485 port

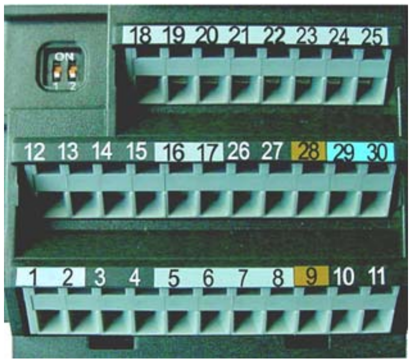


Fig. 2-8 Control terminals of MICROMASTER 430

2.4 Block diagram

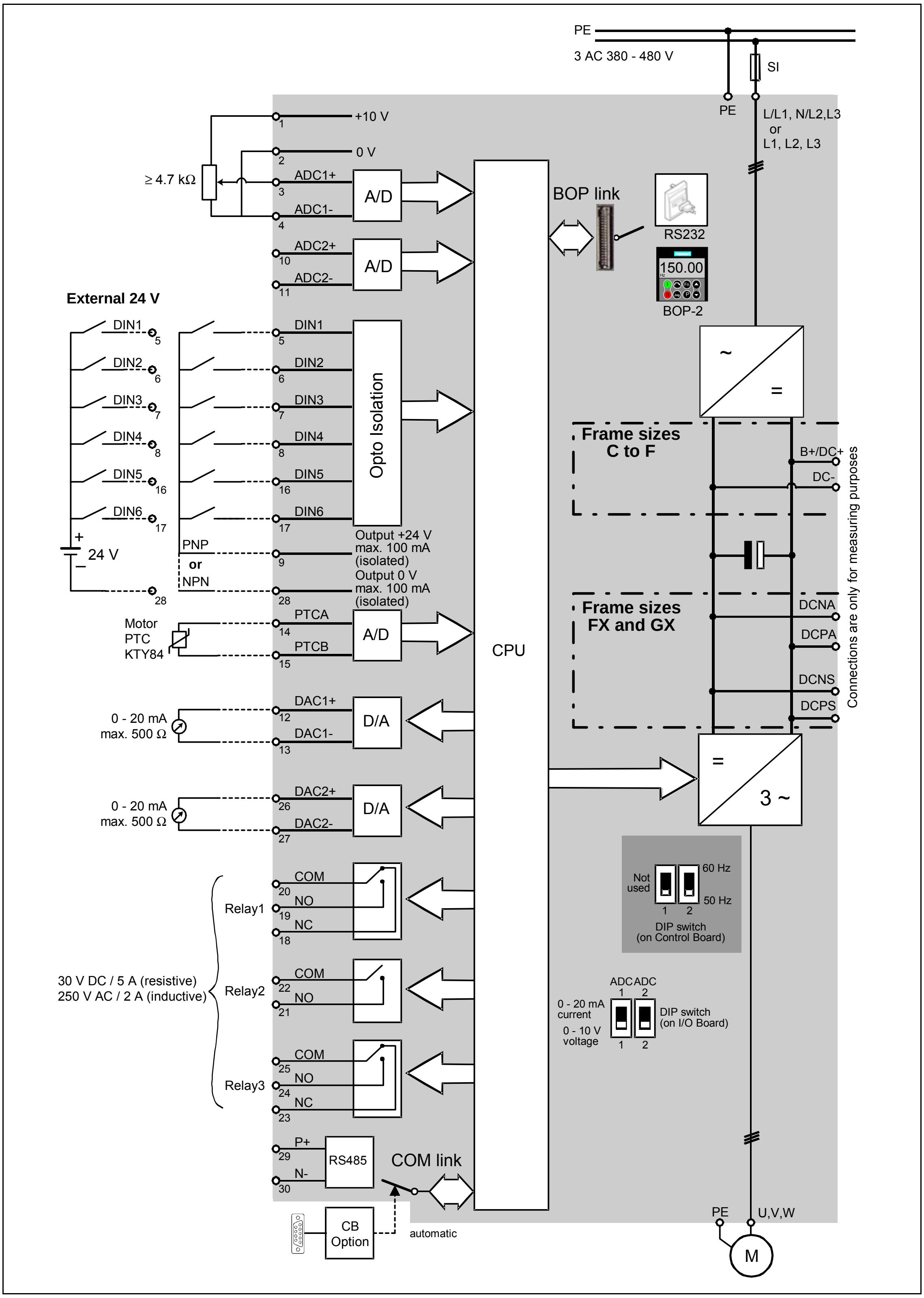


Fig. 2-9 Block diagram

3 Factory setting

The MICROMASTER 430 frequency inverter is set in the factory so that it can be operated without any additional parameterization. To do this, the motor parameters set in the factory (P0304, P0305, P0307, P0310), that correspond to a 4-pole 1LA7 Siemens motor, must match the rated data of the connected motor (refer to the rating plate).

Further factory setting:

- Command sources P0700 = 2 (Digital input, see Fig. 3-1)
- Setpoint source P1000 = 2 (Analog input, see Fig. 3-1)
- Motor cooling
  P0335 = 0
- Motor current limit
  P0640 = 110 %
- Min. frequency
  P1080 = 0 Hz
- Max. frequency
  P1082 = 50 Hz
- Ramp-up time
  P1120 = 10 s
- Ramp-down time
  P1121 = 10 s
- Control mode
  P1300 = 0

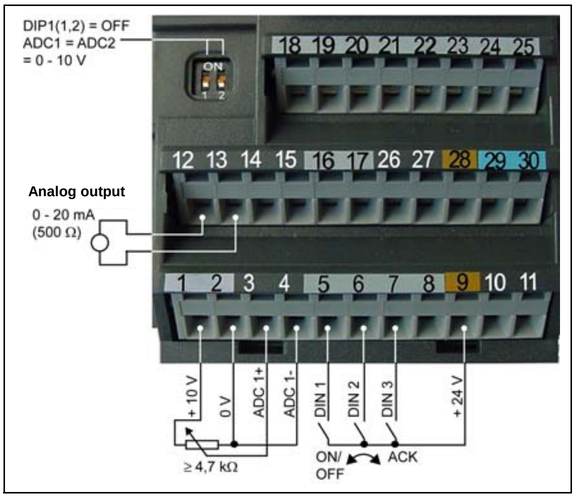
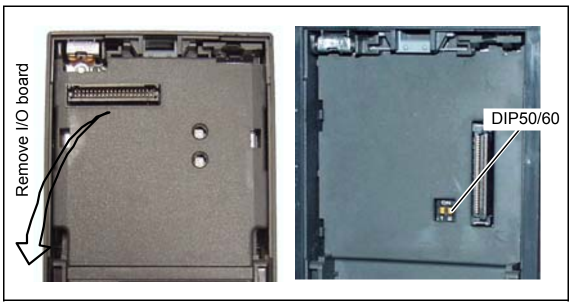


Fig. 3-1 Pre-assignment of the inputs

Input/Output	Terminals	Parameter	Function
Digital input 1	5	P0701 = 1	ON / OFF1 (I/O)
Digital input 2	6	P0702 = 12	Reversing (↶↷)
Digital input 3	7	P0703 = 9	Fault acknowledge (Ack)
Digital input 4	8	P0704 = 15	Fault acknowledge
Digital input 5	16	P0705 = 15	Fixed setpoint (direct)
Digital input 6	17	P0706 = 15	Fixed setpoint (direct)
Digital input 7	Via ADC1	P0707 = 0	Fixed setpoint (direct)
Digital input 8	Via ADC2	P0708 = 0	Digital input disabled

3.1 50/60 Hz DIP switch

The default motor base frequency of the MICROMASTER inverter is 50 Hz. For motors, which are designed for a base frequency of 60 Hz, the inverters can be set to this frequency using the DIP50/60 switch.



- OFF position:
  European defaults
  (Rated motor frequency = 50 Hz, Power in kW etc.)
- ON position:
  North American defaults
  (Rated motor frequency = 60 Hz, Power in hp etc.)

4 Communications

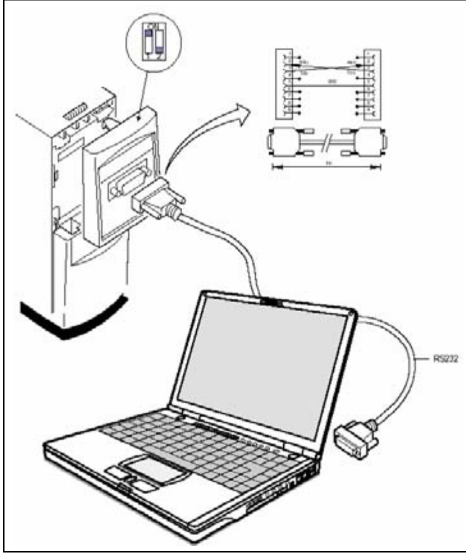
4.1 Establishing communications MICROMASTER 430 ⇔ STARTER

The following optional components are additionally required in order to establish communications between STARTER and MICROMASTER 430:

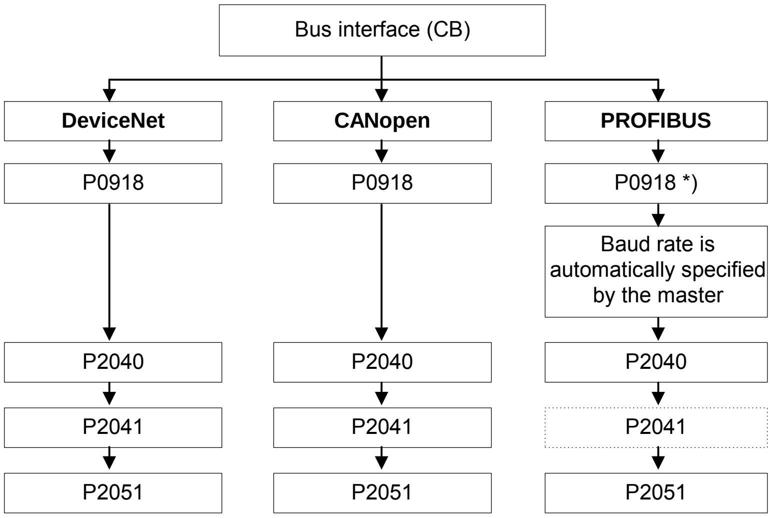
- PC <-> frequency inverter connecting set
- BOP-2 if the USS standard values (refer to Section 6.3.1 "Serial Interface (USS)") are changed in the MICROMASTER 430 frequency inverter

NOTE

- The hardware must be carefully checked in order to ensure that it is correctly located and connected.
- When in the error-free state, the orange and green LEDs are continuously lit (steady light) at the BOP link.
- The COM interface must be selected on a computer-for-computer basis (port COM2 should be selected for a field PG with I box).
- The baud rate test executed by the PC cannot always determine a baud rate that deviates from the factory setting; if necessary, this can be determined by changing the setting on the PC interface (PC port) side.
- We recommend a BOP-2 in cases such as these so that parameters can be quickly and simply checked.

PC <-> frequency inverter connecting set	**MICROMASTER 430**
	USS settings, refer to 6.3.1 "Serial Interface (USS)"
	STARTER
	Menu, Options --> Set PG/PC interface --> Select "PC COM-Port (USS)" --> Properties --> Interface "COM1", select a baud rate
	NOTE The USS parameter settings in the MICROMASTER 430 frequency inverter and the settings in STARTER must match!

4.2 Bus interface (CB)



*) DIP switch for addressing the hardware must be observed

	DeviceNet	CANopen	PROFIBUS
P2041[0]	PZD length Status/actual value	Data transfer type from T_PD0_1, T_PD0_5	Setting is not required (only in special cases). Refer to the Operating Instructions "PROFIBUS option module"
P2041[1]	PZD length control/setpoint	Data transfer type T_PD0_6 R_PD0_1 R_PD0_5 R_PD0_6	
P2041[2]	Baud rate 0: 125 kbaud 1: 250 kbaud 2: 500 kbaud	Mapping CANopen <--> MM4	
P2041[3]	Diagnostics	Mapping CANopen <--> MM4	
P2041[4]	_	- response to communication errors - baud rate	

5 BOP-2 (Option)

5.1 Buttons and their Functions

Panel/ Button	Function	Effects
	Indicates Status	The LCD displays the settings currently used by the inverter.
	Start inverter	Pressing the button starts the inverter. This button is disabled by default. **Activate the button: P0700 = 1 or P0719 = 10 ... 16**
	Stop inverter	OFF1 Pressing the button causes the motor to come to a standstill at the selected ramp down rate. This button is disabled by default. **Activate the button: see button "Start inverter"** OFF2 Pressing the button twice (or once long) causes the motor to coast to a standstill. This function is always enabled (independent of P0700 or P0719).
	Manual mode	Manual operation is selected by pressing the button. The drive inverter is then controlled from the sources P0700[1] (command source) or P1000[1] (setpoint source). The following applies for the pre-setting: • Manual operation de-activated (CDS 2 de-activated) CDS 2 : P0700[1] = 1 (BOP-2) P1000[1] = 1 (MOP)
	Automatic mode	The automatic mode is selected by pressing the button. The drive inverter is then controlled from the sources P0700[0] (command source) or P1000[0] (setpoint source). The following applies for the pre-setting: • Automatic mode activated (CDS 1 activated) CDS 1 : P0700[0] = 2 (terminals) P1000[0] = 2 (ADC)
	Functions	This button can be used to view additional information. It works by pressing and holding the button. It shows the following, starting from any parameter during operation: 1. DC link voltage (indicated by d – units V). 2. output current. (A) 3. output frequency (Hz) 4. output voltage (indicated by o – units V). 5. The value selected in P0005 (If P0005 is set to show any of the above (1 - 4) then this will not be shown again). Additional presses will toggle around the above displays. **Jump Function** From any parameter (rxxxx or Pxxxx) a short press of the Fn button will immediately jump to r0000, you can then change another parameter, if required. Upon returning to r0000, pressing the Fn button will return you to your starting point. **Acknowledgement** If alarm and fault messages are present, then these can be acknowledged by pressing key Fn.
	Access parameters	Pressing this button allows access to the parameters.
	Increase value	Pressing this button increases the displayed value.
	Decrease value	Pressing this button decreases the displayed value.

CAUTION

A MICROMASTER 430 can only be operated using the BOP-2.
If an attempt is made to use either a BOP or AOP, then ----- is displayed.

5.2 Changing parameters using as an example P0004 "Parameter filter function"

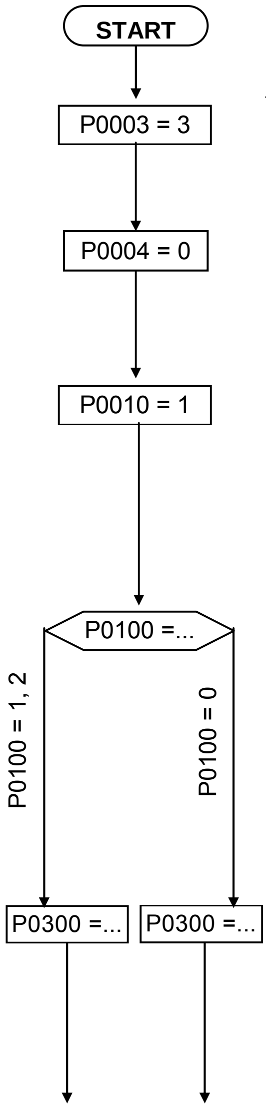
Step		Result on the display
1	Press P in order to access the parameter	r0000
2	Press ▲ until P0004 is displayed	P0004
3	Press P in order to reach the parameter value level	0
4	Press ▲ or ▼ in order to obtain the required value	7
5	Press P to acknowledge the value and to save the value	P0004
6	The user can only see the command parameters.	

6 Commissioning

6.1 Quick commissioning

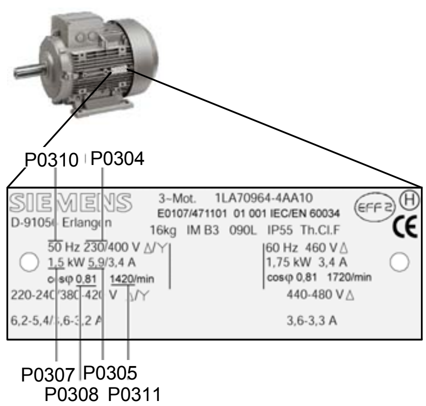
The frequency inverter is adapted to the motor using the quick commissioning function and important technological parameters are set. The quick commissioning shouldn't be carried-out if the rated motor data saved in the frequency inverter (4-pole 1LA Siemens motor, star circuit configuration ≙ frequency inverter (FU)-specific) match the rating plate data.

Parameters, designated with a * offer more setting possibilities than are actually listed here. Refer to the parameter list for additional setting possibilities.

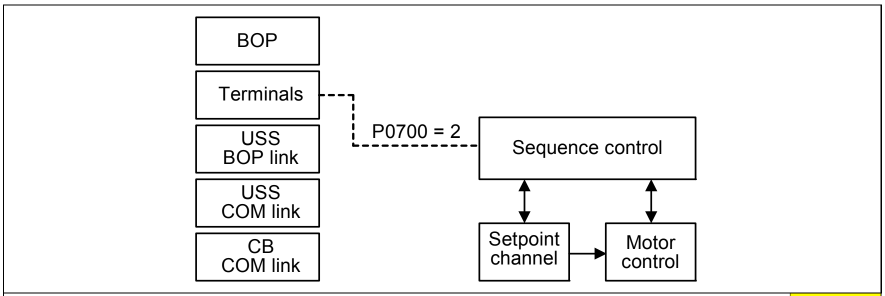


	Factory setting
User access level * 1 Standard: Allows access into most frequently used parameters 2 Extended: Allows extended access e.g. to inverter I/O functions 3 Expert (For expert use only)	1
Parameter filter * 0 All parameters 2 Inverter 3 Motor 4 Speed sensor	0
Commissioning parameter * 0 Ready 1 Quick commissioning 30 Factory setting **NOTE** P0010 should be set to 1 in order to parameterize the data of the motor rating plate.	0
Europe/ North America (enters the line supply frequency) 0 Europe [kW], **frequency default 50 Hz** 1 North America [hp], frequency default 60 Hz 2 North America [kW], frequency default 60 Hz **NOTE** For P0100 = 0 or 1, the setting of switch DIP50/60 determines the value of P0100. OFF = kW, 50 Hz ON = hp, 60 Hz	0
Select motor type 1 Asynchronous motor (induction motor) 2 Synchronous motor **NOTE** For P0300 = 2 (synchronous motor), only the V/f control types (P1300 < 20) are permitted.	1

Parameter	Description	Default
P0304 =... / P0304 =...	**Rated motor voltage** (Nominal motor voltage [V] from rating plate) The rated motor voltage on the rating plate must be checked, regarding the star/delta circuit configuration to ensure that it matches with the circuit connection configured at the motor terminal board	FU-spec.
P0305 =... / P0305 =...	**Rated motor current** (Nominal motor current [A] from rating plate)	FU-spec.
P0307 =... / P0307 =...	**Rated motor power** (Nominal motor power [kW/hp] from rating plate) If P0100 = 0 or 2, value will be in kW. If P0100 = 1, value will be in in hp.	FU-spec.
P0308 =... / P0308 =...	**Rated motor cosPhi** (Nominal motor power factor (cos φ) from rating plate) If the setting is 0, the value is automatically calculated P0100 = 1,2: P0308 no significance, no entry required.	FU-spec.
P0309 =... / P0309 =...	**Rated motor efficiency** (Nominal motor efficiency in [%] from rating plate) Setting 0 causes internal calculation of value. P0100 = 0: P0309 no significance, no entry required.	FU-spec.
P0310 =...	**Rated motor frequency** (Nominal motor frequency in [Hz] from rating plate) Pole pair number recalculated automatically if parameter is changed.	50.00 Hz
P0311 =...	**Rated motor speed** (Nominal motor speed in [rpm] from rating plate) Setting 0 causes internal calculation of value. **NOTE** An entry <u>must</u> be made for V/f control with FCC and for slip compensation.	FU-spec.
P0320 = ...	**Motor magnetizing current** (this is entered as a % referred to P0305) Motor magnetizing current as a % relative to P0305 (rated motor current). With P0320 = 0, the motor magnetizing current is calculated using P0340 = 1 or using P3900 = 1 - 3 (end of the quick commissioning) – and is displayed in parameter r0331.	0.0
P0335 =...	**Motor cooling** (Selects motor cooling system used) 0 Self-cooled: Using shaft mounted fan attached to motor 1 Force-cooled: Using separately powered cooling fan 2 Self-cooled and internal fan 3 Force-cooled and internal fan	0
P0640 =...	**Motor overload factor** (Motor overload factor in [%] relative to P0305) This defines the limit of the maximum output current as a % of the rated motor current (P0305). This parameter is set, using P0205 for constant torque, to 150 %, and for variable torque, to 110 %.	150 %
P0700 =...	**Selection of command source** (enters the command source) 0 Factory default setting 1 BOP-2 (keypad) 2 Terminal 4 USS on BOP-2 link 5 USS on COM link (control terminals 29 and 30) 6 CB on COM link (CB = communications module)	2



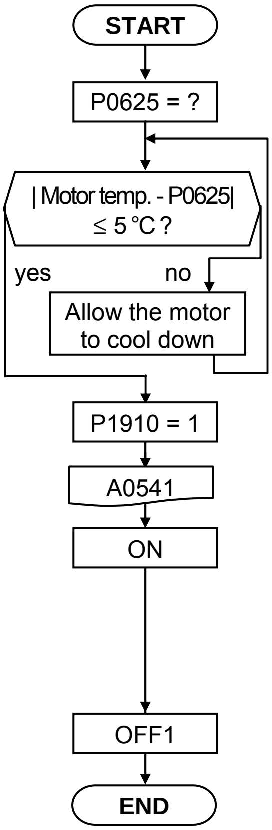
Example of a typical motor rating plate (data for a delta circuit configuration).



Parameter	Description	Default
P1000 =...	**Selection of frequency setpoint *** Enters the frequency setpoint source (also refer to Section 6.3.5). 1 MOP setpoint 2 Analog setpoint 3 Fixed frequency 4 USS on BOP-2 link 5 USS on COM link (control terminals 29 and 30) 6 CB on COM link (CB = communications module) 7 Analog setpoint 2	2
P1080 =...	**Min. frequency** (enters the minimum motor frequency in Hz) Sets minimum motor frequency at which motor will run irrespective of frequency setpoint. The value set here is valid for both clockwise and anticlockwise rotation.	0.00 Hz
P1082 =...	**Max. frequency** (enters the maximum motor frequency in Hz) Sets maximum motor frequency at which motor will run irrespective of the frequency setpoint. The value set here is valid for both clockwise and anticlockwise rotation.	50.00 Hz
P1120 =...	**Ramp-up time** (enters the ramp-up time in s) Time taken for motor to accelerate from standstill up to maximum motor frequency (P1082) when no rounding is used. If a ramp-up time is parameterized which is too low, then this can result in alarm A0501 (current limit value) or the drive inverter being shutdown with fault F0001 (overcurrent).	10.00 s
P1121 =...	**Ramp-down time** (enters the deceleration time in s) Time taken for motor to decelerate from maximum motor frequency (P1082) down to standstill when no rounding is used. If the ramp-down time is parameterized too low, then this can result in alarms A0501 (current limit value), A0502 (overvoltage limit value) or the drive inverter being powered-down with fault F0001 (overcurrent) or F0002 (overvoltage).	10.00 s
P1135 =...	**OFF3 ramp-down time** (enters the fast stop ramp-down time in s) Enters the time, for example, with which the motor should be braked from the maximum frequency P1082 down to standstill for an OFF3 command (fast stop). If the ramp-down time is parameterized too low, then this can result in alarms A0501 (current limit value), A0502 (overvoltage limit value) or the drive inverter being shutdown with fault F0001 (overcurrent) or F0002 (overvoltage).	5.00 s

Parameter	Description	Default
P1300 =...	**Control mode** (enters the required control mode) 0 V/f with linear characteristic 1 V/f with FCC 2 V/f with parabolic characteristic 3 V/f with programmable characteristic 5 V/f for textile applications 6 V/f with FCC for textile applications 19 V/f control with independent voltage setpoint	0
P1910 = ...	**Select motor data identification** * 0 Disabled	0
P3900 = 1	**End of quick commissioning** (start of the motor calculation) 0 No quick commissioning (no motor calculations) 1 Motor calculation and reset of all of the other parameters, which are not included in the quick commissioning (attribute "QC" = no), to the factory setting 2 Motor calculation and reset of the I/O settings to the factory setting 3 Only motor calculation. The other parameters are not reset. **NOTE** For P3900 = 1,2,3 → P0340 is internally set to 1 and the appropriate data calculated.	0
END	**End of the quick commissioning/drive setting** If additional functions must be implemented at the drive inverter, please use the Section **"Commissioning the application"** (refer to Section 6.3). We recommend this procedure for drives with a high dynamic response.	

6.2 Motor data identification



	Factory setting
Ambient motor temperature (**entered in** °C) The motor ambient temperature is entered at the instant that motor data is being determined (factory setting: **20 °C**). The difference between the motor temperature and the motor ambient temperature P0625 must lie in the tolerance range of approx. ± 5 °C. If this is not the case, then the motor data identification routine can only be carried-out after the motor has cooled down.	20 °C
Select motor data identification with P1910 = 1 p1910 = 1: Identifies the motor parameter with parameter change. When p1910 = 1 is selected, Alarm A0541 (motor data identification active) is output, and internally p0340 is set to 3.	0
Starts the motor data identification run with p1910 = 1 The measuring operation is initiated with the continuous (steady-state) ON command. The motor aligns itself and current flows through it. After the motor data identification routine has been completed, p1910 is reset (p1910 = 0, motor data identification routine inhibited) and Alarm A0541 is cleared (deleted).	
In order to set the frequency inverter into a defined state, an OFF1 command must be issued before the next step.	

6.3 Commissioning the application

An application is commissioned to adapt/optimize the frequency inverter - motor combination to the particular application. The frequency inverter offers numerous functions - but not all of these are required for the particular application. These functions can be skipped when commissioning the application. A large proportion of the possible functions are described here; refer to the parameter list for additional functions.

Parameters, designated with a * offer more setting possibilities than are actually listed here. Refer to the parameter list for additional setting possibilities.

START

P0003 = 3

User access level *	1
1 Standard: Allows access into most frequently used parameters 2 Extended: Allows extended access e.g. to inverter I/O functions 3 Expert (For expert use only)	

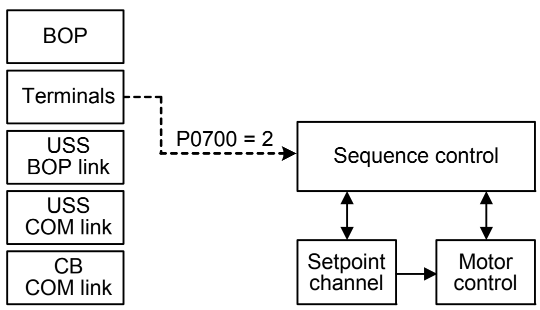
6.3.1 Serial Interface (USS)

P2010 =...	**USS baud rate** Sets baud rate for USS communication.	6	**Possible Settings:** 4 2400 Baud 5 4800 Baud 6 9600 Baud 7 19200 Baud 8 38400 Baud 9 57600 Baud 10 76800 Baud 11 93750 Baud 12 115200 Baud
P2011 =...	**USS address** Sets unique address for inverter.	0	
P2012 =...	**USS PZD length** Defines the number of 16-bit words in PZD part of USS telegram.	2	
P2013 =...	**USS PKW length** Defines the number of 16-bit words in PKW part of USS telegram.	127	

6.3.2 Selection of command source

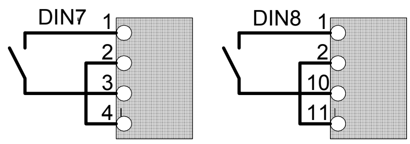
P0700 =...

Selection of command source Selects digital command source. 0 Factory fault setting 1 BOP-2 (keypad) 2 Terminal 4 USS on BOP-2 link 5 USS on COM link 6 CB on COM link	2



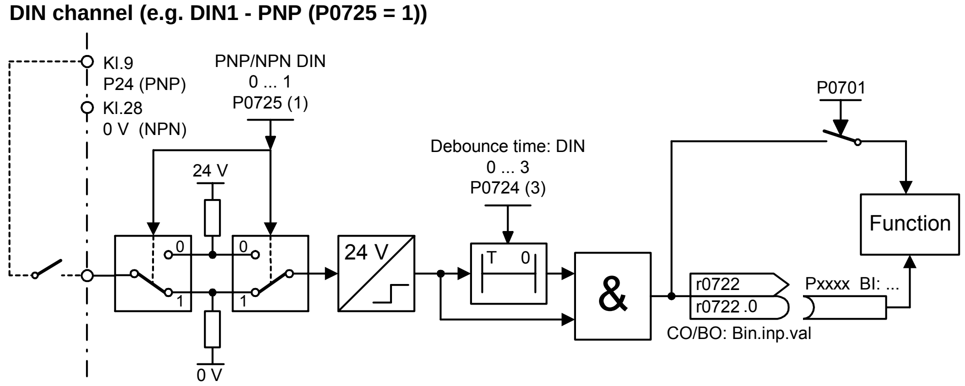
6.3.3 Digital input (DIN)

Parameter	Description	Default	Possible Settings
P0701 = ...	**Function digital input 1** Terminal 5	1	**Possible Settings:** 0 Digital input disabled 1 ON / OFF1 2 ON + Reverse / OFF1 3 OFF2 – coast to standstill 4 OFF3 – quick ramp-down 9 Fault acknowledge 12 Reverse 13 MOP up (increase frequency) 14 MOP down (decrease frequency) 15 Fixed setpoint (Direct selection) 16 Fixed setpoint (Direct selection + ON) 17 Fixed setpoint (Binary coded selection + ON) 25 DC brake enable 27 Enable PID 28 Bypass mode command input 29 External trip 33 Disable additional freq setpoint 99 Enable BICO parameterization
P0702 = ...	**Function digital input 2** Terminal 6	12	
P0703 = ...	**Function digital input 3** Terminal 7	9	
P0704 = ...	**Function digital input 4** Terminal 8	15	
P0705 = ...	**Function digital input 5** Terminal 16	15	
P0706 = ...	**Function digital input 6** Terminal 17	15	
P0707 = 0	**Function digital input 7** Via analog input, Terminal 3	0	ON > 3,9 V, OFF < 1,7 V
P0708 = 0	**Function digital input 8** Via analog input, Terminal 10	0	



Parameter	Description	Default
r0722	**CO/BO: Binary input values** Displays status of digital inputs.	
P0724 = ...	**Debounce time for digital inputs** Defines debounce time (filtering time) used for digital inputs. 0 No debounce time 1 2.5 ms debounce time 2 8.2 ms debounce time 3 12.3 ms debounce time	3
P0725 = ...	**PNP / NPN digital inputs** Change-over (toggles) between high active (PNP) and low active (NPN). This applies to all digital inputs simultaneously. 0 NPN mode ==> low active 1 PNP mode ==> high active	1

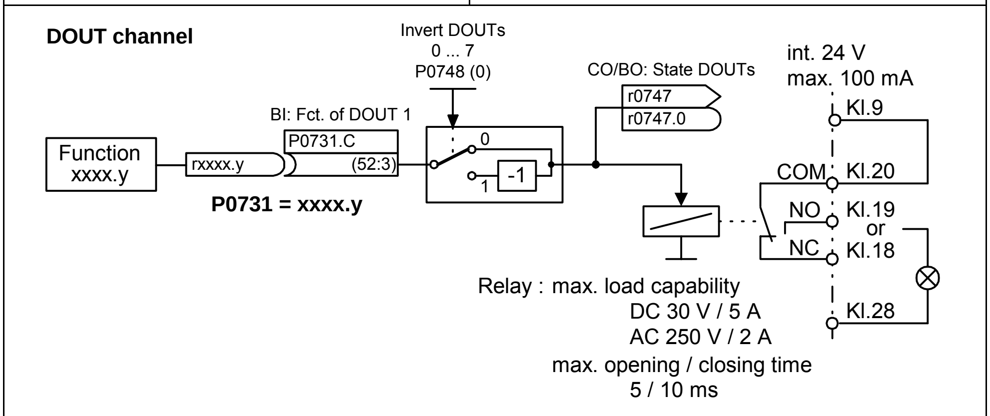
DIN channel (e.g. DIN1 - PNP (P0725 = 1))



6.3.4 Digital outputs (DOUT)

Parameter	Description	Default
P0731 = ...	**BI: Function of digital output 1 *** Defines source of digital output 1.	52.3
P0732 = ...	**BI: Function of digital output 2 *** Defines source of digital output 2.	52.7
P0733 = ...	**BI: Function of digital output 3 *** Defines source of digital output 3.	0.0
r0747 = ...	**CO/BO: State of digital outputs** Displays status of digital outputs (also includes inversion of digital outputs via P0748).	
P0748 = ...	**Invert digital output** Defines high and low states of relay for a given function.	0

Common Settings:		Closed
52.0	Drive ready	0
52.1	Drive ready to run	0
52.2	Drive running	0
52.3	Drive fault active	0
52.4	OFF2 active	1
52.5	OFF3 active	1
52.6	Switch on inhibit active	0
52.7	Drive warning active	0
52.8	Deviation setpoint/actual value	1
52.9	PZD control (Process Data Control)	0
52.A	Maximum frequency reached	0
52.B	Warning: Motor current limit	1
52.C	Motor holding brake (MHB) active	0
52.D	Motor overload	1
52.E	Motor running direction right	0
52.F	Inverter overload	1
53.0	DC brake active	0
53.1	Act. freq. f_act > P2167 (f_off)	0
53.2	Act. freq. f_act <= P1080 (f_min)	0
53.3	Act. current r0027 > P2170	0
53.4	Act. freq. f_act > P2155 (f_1)	0
53.5	Act. freq. f_act <= P2155 (f_1)	0
53.6	Act. freq. f_act >= setpoint	0
53.7	Act. Vdc r0026 < P2172	0
53.8	Act. Vdc r0026 > P2172	0
53.A	PID output r2294 == P2292 (PID_min)	0
53.B	PID output r2294 == P2291 (PID_max)	0



6.3.5 Selection of frequency setpoint

P1000 =...

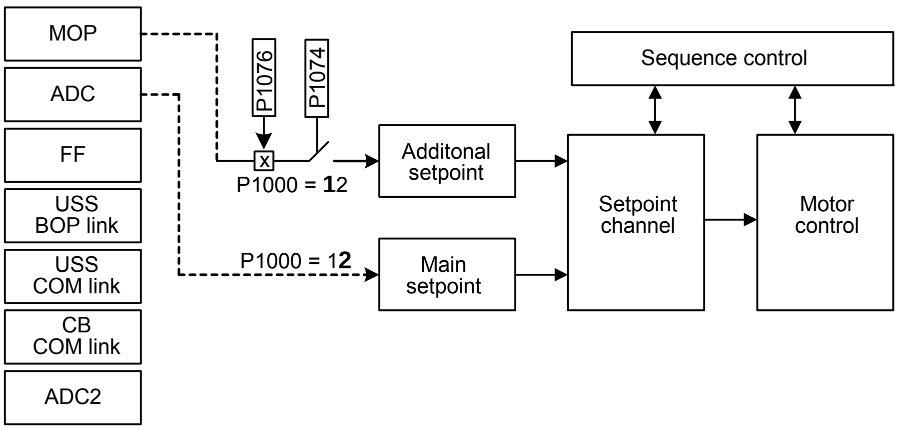
Selection of frequency setpoint 2

0 No main setpoint
1 MOP setpoint
2 Analog setpoint
3 Fixed frequency
4 USS on BOP-2 link
5 USS on COM link
6 CB on COM link
7 Analog setpoint 2
10 No main setpoint + MOP setpoint
11 MOP setpoint + MOP setpoint
12 Analog setpoint + MOP setpoint
⋮
76 CB on COM link + Analog setpoint 2
77 Analog setpoint 2 + Analog setpoint 2

NOTE
In addition to the main setpoint, a supplementary setpoint can be entered using P1000

Example P1000 = 12 :

P1000 = **1**2 ⇒ P1070 = 755	P1070	CI: Main setpoint
	r0755	CO: Act. ADC after scal. [4000h]
P1000 = 1**2** ⇒ P1075 = 1050	P1075	CI: Additional setpoint
	r1050	CO: Act. Output freq. of the MOP



P1074 = ...

BI: Disable additional setpoint 0:0

Disables additional setpoint (ZUSW).

P1076 = ...

CI: Additional setpoint scaling 1:0

Defines the source to scale the additional setpoint.

Common settings:

1 Scaling of 1.0 (100 %)
755 Analog input setpoint
1024 Fixed frequency setpoint
1050 MOP setpoint

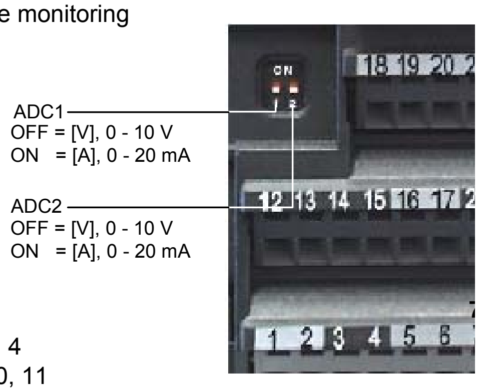
6.3.6 Analog input (ADC)

P0756 = ...

ADC type — 0

Defines the analog input type and activates the monitoring function of the analog input.

0 Unipolar voltage input (0 to +10 V)
1 Unipolar voltage input with monitoring (0 to 10 V)
2 Unipolar current input (0 to 20 mA)
3 Unipolar current input with monitoring (0 to 20 mA)
4 Bipolar voltage input (-10 to +10 V)



NOTE

For P0756 to P0760, the following applies:
Index 0 : Analog input 1 (ADC1), terminals 3, 4
Index 1 : Analog input 2 (ADC2), terminals 10, 11

P0757 =...

Value x1 of ADC scaling — 0 V

P0758 =...

Value y1 of ADC scaling — 0.0 %

This parameter represents the value of x1 as a % of P2000 (reference frequency).

P0759 =...

Value x2 of ADC scaling — 10 V

P0760 =...

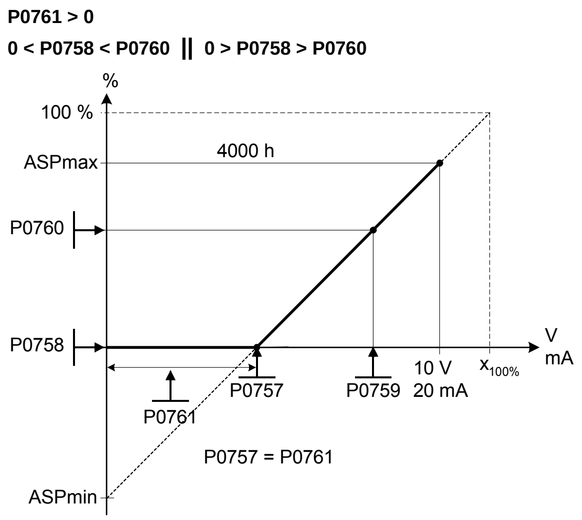
Value y2 of ADC scaling — 100.0 %

This parameter represents the value of x2 as a % of P2000 (reference frequency).

P0761 =...

Width of ADC deadband — 0 V

Defines width of deadband on analog input.

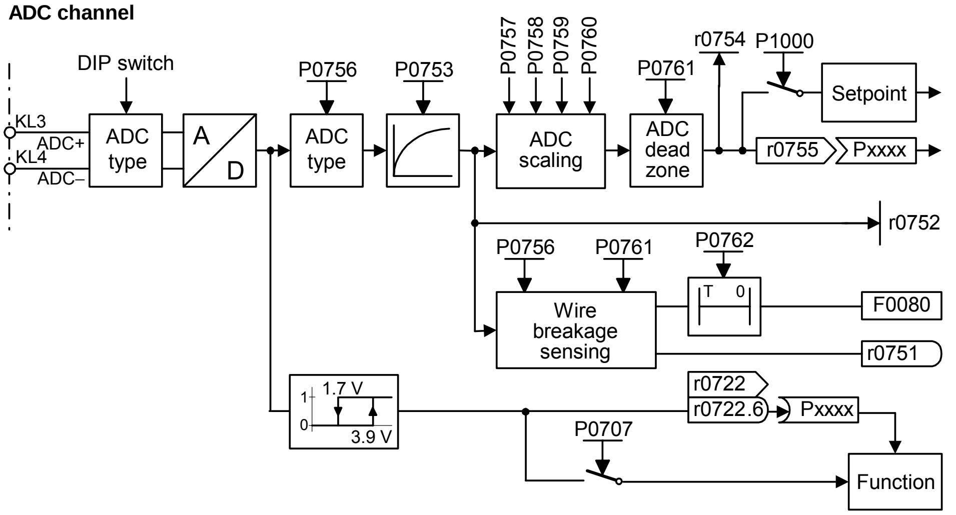


P0762 = ...

Delay, ADC signal loss — 10 ms

Defines the delay time between the loss of the analog setpoint and fault message F0080 being displayed.

ADC channel



6.3.7 Analog output (DAC)

P0771 = ...

CI: DAC — Default: 21

Defines function of the 0 - 20 mA analog output.

21 CO: Output frequency (scaled according to P2000)
24 CO: Frequency inverter output frequency (scaled according to P2000)
25 CO: Output voltage (scaled according to P2001)
26 CO: DC link voltage (scaled according to P2001)
27 CO: Output current (scaled according to P2002)

NOTE

For P0771 to P0781, the following applies:
Index 0 : Analog output 1 (DAC1), terminals 12, 13
Index 1 : Analog output 2 (DAC2), terminals 26, 27

P0773 =...

Smooth time DAC — Default: 2 ms

Defines smoothing time [ms] for analog output signal. This parameter enables smoothing for DAC using a PT1 filter.

P0776 = ...

DAC type — Default: 0

Defines the analog output type.
0 Current output
1 Voltage output

NOTE

- P0776 changes the scaling of r0774 (0 – 20 mA ⇔ 0 – 10 V)
- Scaling parameters P0778, P0780 and the dead zone are always entered in 0 – 20 mA

For the DAC as voltage output, the DAC outputs must be terminated using a 500 Ω resistor

P0777 = ...

Value x1 of DAC scaling — Default: 0.0 %

Defines the output characteristic value x1 as a %.
This parameter represents the lowest analog value as a % of P200x (depending on the setting of P0771).

P0778 = ...

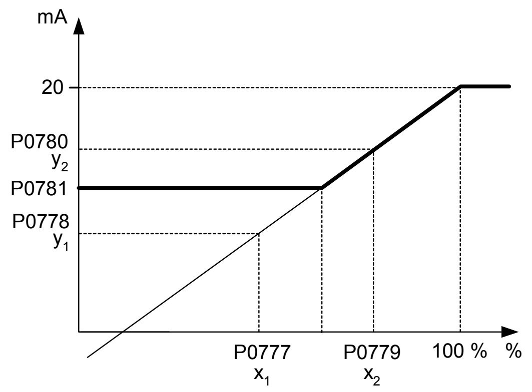
Value y1 of DAC scaling — Default: 0

This parameter represents the value for x1 in mA.

P0779 = ...

Value x2 of DAC scaling — Default: 100.0 %

Defines the output characteristic value x2 as a %.
This parameter represents the lowest analog value as a % of P200x (depending on the setting of P0771).



P0780 = ...

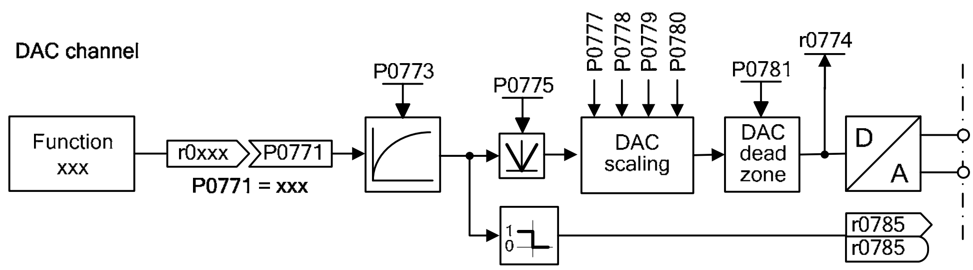
Value y2 of DAC scaling — Default: 20

This parameter represents the value for x2 in mA.

P0781 = ...

Width of DAC deadband — Default: 0

Sets width of deadband in [mA] for analog output.



6.3.8 Motor potentiometer (MOP)

P1031 =...

Setpoint memory of the MOP 0

Saves last motor potentiometer setpoint (MOP) that was active before OFF command or power down.

0 MOP setpoint will not be stored

1 MOP setpoint will be stored (P1040 is updated)

P1032 =...

Inhibit negative MOP setpoints 1

0 Neg. MOP setpoint is allowed

1 Neg. MOP setpoint inhibited

P1040 =...

Setpoint of the MOP 5.00 Hz

Determines setpoint for motor potentiometer control.

MOP ramp-up and ramp-down times are defined by the parameters P1120 and P1121.

Possible parameter settings for the selection of MOP:

	Selection	MOP up	MOP down
DIN	P0719 = 0, P0700 = 2, P1000 = 1 or P0719 = 1, P0700 = 2	P0702 = 13 (DIN2)	P0703 = 14 (DIN3)
BOP-2	P0719 = 0, P0700 = 1, P1000 = 1 or P0719 = 1, P0700 = 1 or P0719 = 11	UP button	DOWN button
USS on BOP link	P0719 = 0, P0700 = 4, P1000 = 1 or P0719 = 1, P0700 = 4 or P0719 = 41	USS control word r2032 Bit13	USS control word r2032 Bit14
USS on COM link	P0719 = 0, P0700 = 5, P1000 = 1 or P0719 = 1, P0700 = 5 or P0719 = 51	USS control word r2036 Bit13	USS control word r2036 Bit14
CB	P0719 = 0, P0700 = 6, P1000 = 1 or P0719 = 1, P0700 = 6 or P0719 = 61	CB control word r2090 Bit13	CB control word r2090 Bit14

6.3.9 Fixed frequency (FF)

The fixed frequencies (P1001 - P1016) can be selected using the digital inputs (standard case), serial communication interfaces (ports) as well as using any BiCo parameter. For the digital inputs, the fixed frequencies can be selected using parameter P070x "function, digital input" (standard method) as well as also r0722 "status, digital inputs" (BiCo method).
When selecting fixed frequencies using digital inputs, the following applies:

- Standard method ==> P070x = 15, 16, 17

  15 = direct selection (binary-coded)
  In this particular mode, the appropriate digital input always selects the associated fixed frequency, e.g.:
  Digital input 3 = selects fixed frequency 3.
  If several inputs are simultaneously active, then these are summed. An ON command is additionally required.

  16 = Direct selection + ON command (binary-coded + On / Off1)
  In this mode, the fixed frequencies are selected as for 15, however these are combined with an ON command.

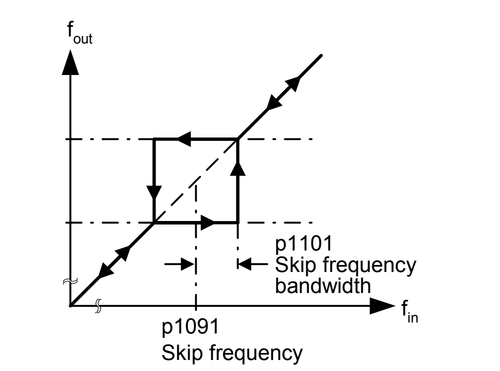
  17 = Binary coded selection + ON command (BCD-coded + On/ Off1)
  The BCD-coded operating mode is effective for digital inputs 1 to 6.

- BiCo method ==> P070x = 99, P102x = 722.x, P1016 = 1, 2, 3

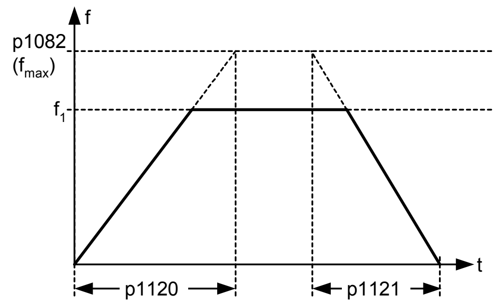
Parameter	Description	Default	Options
P1001 = ...	**Fixed frequency 1** Can be directly selected via DIN1 (P0701 = 15, 16)	0.00 Hz	
P1002 = ...	**Fixed frequency 2** Can be directly selected via DIN2 (P0702 = 15, 16)	5.00 Hz	
P1003 = ...	**Fixed frequency 3** Can be directly selected via DIN3 (P0703 = 15, 16)	10.00 Hz	
P1004 = ...	**Fixed frequency 4** Can be directly selected via DIN4 (P0704 = 15, 16)	15.00 Hz	
P1005 = ...	**Fixed frequency 5** Can be directly selected via DIN5 (P0705 = 15, 16)	20.00 Hz	
P1006 = ...	**Fixed frequency 6** Can be directly selected via DIN6 (P0706 = 15, 16)	25.00 Hz	
P1007 = ...	**Fixed frequency 7**	30.00 Hz	
P1008 = ...	**Fixed frequency 8**	35.00 Hz	
P1009 = ...	**Fixed frequency 9**	40.00 Hz	
P1010 = ...	**Fixed frequency 10**	45.00 Hz	
P1011 = ...	**Fixed frequency 11**	50.00 Hz	
P1012 = ...	**Fixed frequency 12**	55.00 Hz	
P1013 = ...	**Fixed frequency 13**	60.00 Hz	
P1014 = ...	**Fixed frequency 14**	65.00 Hz	
P1015 = ...	**Fixed frequency 15**	65.00 Hz	
P1016 = ...	**Fixed frequency code - Bit 0** Defines the selection method for fixed frequencies.	1	1 Direct selection 2 Direct selection + ON command 3 Binary coded selection + ON command **NOTE** For settings 2 and 3, all parameters P1016 to P1019 must be set to the selected value so that the drive inverter accepts the ON command.
P1017 = ...	**Fixed frequency code - Bit 1**	1	
P1018 = ...	**Fixed frequency code - Bit 2**	1	
P1019 = ...	**Fixed frequency code - Bit 3**	1	
P1025 = ...	**Fixed frequency code - Bit 4**	1	1 Direct selection 2 Direct selection + ON command
P1027 = ...	**Fixed frequency code - Bit 5**	1	

6.3.10 Ramp function generator (RFG)

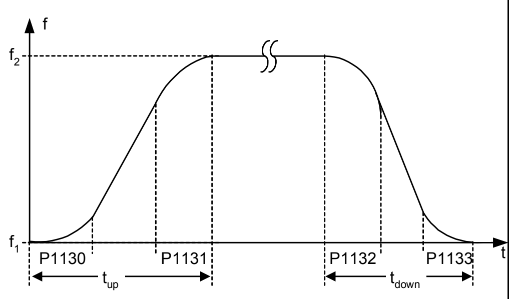
Parameter	Description	Default
P1091 = ...	**Skip frequency 1** (entered in Hz) Defines skip frequency 1, which avoids effects of mechanical resonance and suppresses frequencies within +/- p1101 (skip frequency bandwidth).	0.00 Hz
P1092 = ...	**Skip frequency 2**	0.00 Hz
P1093 = ...	**Skip frequency 3**	0.00 Hz
P1094 = ...	**Skip frequency 4**	0.00 Hz
P1101 = ...	**Skip frequency bandwidth** (entered in Hz)	2.00 Hz



Parameter	Description	Default
P1120 = ...	**Ramp-up time** (enters the accelerating time in s)	10.00 s
P1121 = ...	**Ramp-down time** (enters the deceleration time in s)	10.00 s



Parameter	Description	Default
P1130 = ...	**Rump-up initial rounding time** (entered in s)	0.00 s
P1131 = ...	**Ramp-up final rounding time** (entered in s)	0.00 s
P1132 = ...	**Rump-down initial rounding time** (entered in s)	0.00 s
P1133 = ...	**Ramp-down final rounding time** (entered in s)	0.00 s
P1134 = ...	**Rounding type** 0 Continuous smoothing 1 Discontinuous smoothing	0



The rounding times are recommended as abrupt responses can be avoided therefore reducing stress and damage to the mechanical system.
The ramp-up and ramp-down times are extended by the component of the rounding ramps.

Parameter	Description	Default
P1135 = ...	**OFF3 ramp-down time** Defines ramp-down time from maximum frequency to standstill for OFF3 command.	5.00 s

6.3.11 Reference/limit frequencies

Parameter	Description	Default
P1080 = ...	**Min. frequency** (entered in Hz) Sets minimum motor frequency [Hz] at which motor will run irrespective of frequency setpoint. If the setpoint falls below the value of p1080, then the output frequency is set to p1080 taking into account the sign.	0.00 Hz
P1082 = ...	**Max. frequency** (entered in Hz) Sets maximum motor frequency [Hz] at which motor will run irrespective of the frequency setpoint. If the setpoint exceeds the value p1082, then the output frequency is limited. The value set here is valid for both clockwise and anticlockwise rotation.	50.00 Hz
P2000 = ...	**Reference frequency** (entered in Hz) The reference frequency in Hertz corresponds to a value of 100 %. This setting should be changed if a maximum frequency of higher than 50 Hz is required. It is automatically changed to 60 Hz if the standard 60 Hz frequency was selected using p0100. **NOTE** This reference frequency effects the setpoint frequency as both the frequency setpoints via USS as well as via PROFIBUS (FB100) (4000H hex ≙ 100 % ≙ p2000) refer to this value.	50.00 Hz
P2001 = ...	**Reference voltage** (entered in V) The reference voltage in Volt (output voltage) corresponds to a value of 100 %. **NOTE** This setting should only be changed if it is necessary to output the voltage with a different scaling.	1000 V
P2002 = ...	**Reference current** (entered in A) The reference current in Amps (output current) corresponds to a value of 100 %. Factory setting = 200 % of the rated motor current (P0305). **NOTE** This setting should only be changed if it is necessary to output the current with a different scaling.	0.10 A
P2003 = ...	**Reference torque** (entered in Nm) The reference torque in Nm corresponds to a value of 100 %. Factory setting = 200 % of the rated motor torque at a constant motor torque determined from the appropriate motor data. **NOTE** This setting should only be changed if it is necessary to output the torque with a different scaling.	0.12 Nm

6.3.12 Inverter protection

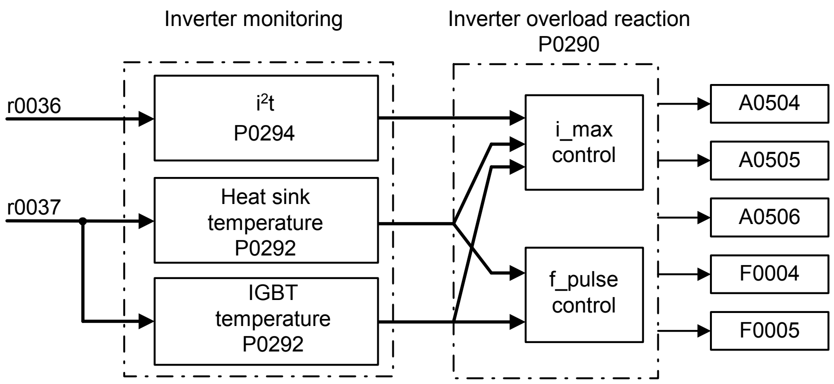
P0290 = ...

Inverter overload reaction

Selects reaction of inverter to an internal over-temperature.

0 Reduce output frequency
1 Trip (F0004)
2 Reduce pulse frequency and output frequency
3 Reduce pulse frequency then trip (F0004)

Default: 0



P0292 =...

Inverter temperature warning

Defines the temperature difference (in ºC) between the overtemperature trip threshold and the warning threshold of the inverter. The trip threshold is stored internally by the inverter and cannot be changed by the user.

Default: 15 °C

Temperature warning threshold of inverter T_{warn} :

$T_{warn} = T_{trip} - P0292$

Temperature shutdown threshold of inverter T_{trip} :

Temperature	**MM430, Frame Size**		
	C	**D - E**	**F**
Heat sink	110 °C	95 °C	90 °C
IGBT	140 °C	145 °C	145 °C

P0295 = ...

Delay, fan shutdown

This defines the delay time in seconds between powering down the frequency inverter and then powering-down the fan. A setting of 0 means that the fan is immediately shut down (powered-down).

Default: 0 s

6.3.13 Motor protection

In addition to the thermal motor protection, the motor temperature is also included in the adaptation of the motor equivalent circuit diagram data. For MM430 the motor temperature can only be measured using a KTY84 sensor. For the parameter setting P0601 = 0,1, the motor temperature is calculated / estimated using the thermal motor model.

If the frequency inverter is permanently supplied with an external 24V voltage, then the motor temperature is also tracked/corrected using the motor temperature time constant – even when the line supply voltage is switched-out.

P0335 = ...

Motor cooling (Selects motor cooling system used) — 0

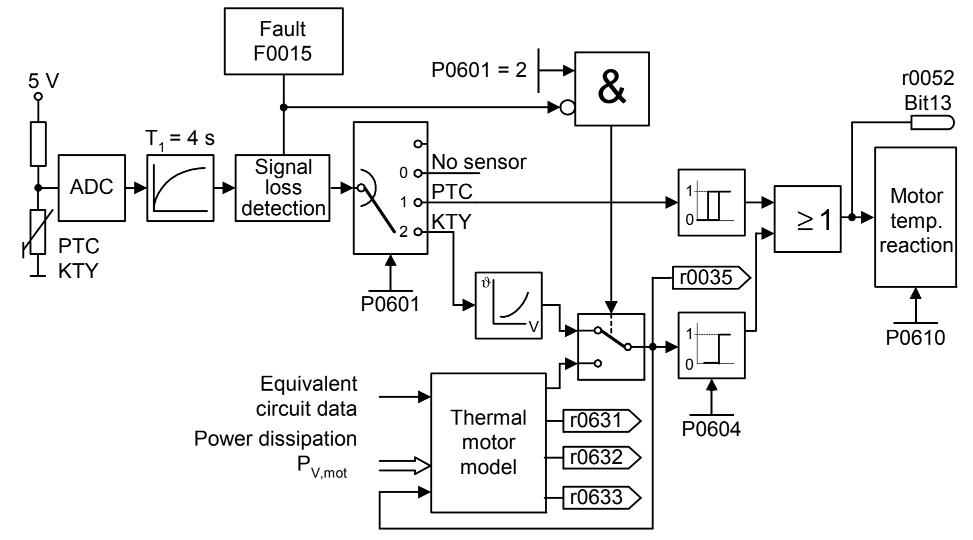
0 Self-cooled: Using shaft mounted fan attached to motor
1 Force-cooled: Using separately powered cooling fan
2 Self-cooled and internal fan
3 Force-cooled and internal fan

P0601 = ...

Motor temperature sensor — 0

Selects the motor temperature sensor.

0 No sensor
1 PTC thermistor (PTC)
2 KTY84



P0604 = ...

Alarm threshold, motor overtemperature — 130.0 °C

Defines the alarm threshold for the motor overtemperature protection. This threshold, where either a shutdown (trip) or Imax reduction is initiated (P0610) always lies 10 % above the alarm threshold.

$\vartheta_{trip} = 1.1 \cdot \vartheta_{warn} = 1.1 \cdot P0604$

ϑ_{warn} : Warning threshold (P0604)

ϑ_{trip} : Trip threshold (max. permissible temperature)

The alarm threshold should be at least 40 °C greater than the ambient temperature P0625.

P0604 ≥ P0625 + 40 °C

P0610 = ...

Inverter temperature reaction — 2

Defines reaction when motor temperature reaches warning threshold.

0 No reaction, warning only
1 Warning and I_{max} reduction (results in a lower output frequency)
2 Warning and trip (F0011)

P0640 = ...

Motor overload factor [%] — 150.0 %

Defines motor overload current limit in [%] relative to p0305 (rated motor current). Limited to maximum inverter current or to 400 % of rated motor current (p0305), whichever is the lower.

6.3.14 Encoder

P0400 =...

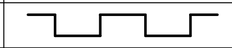
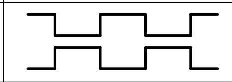
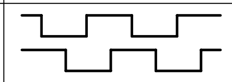
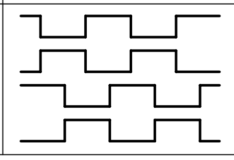
Select encoder type 0

Selects the encoder type.

0 Inhibited
1 Single-track pulse encoder
2 Two-track pulse encoder

For hoisting gear applications (4-quadrant operation!), a 2-track encoder must be used.

The table shows the values of P0400 as a function of the number of tracks:

Parameter	Terminal	Track	Encoder output
P0400 = 1	A		single ended
	A AN		differential
P0400 = 2	A B		single ended
	A AN B BN		differential

In order to guarantee reliable operation, the DIP switches on the encoder module must be set as follows depending on the encoder type (TTL, HTL) and encoder output:

Type	Output	
	single ended	differential
TTL (e.g. 1XP8001-2)	111111	010101
HTL (e.g. 1XP8001-1)	101010	000000

P0408 =...

Encoder pulses per revolution 1024

Specifies the number of encoder pulses per revolution.

$$f_{max} > f = \frac{p0408 \text{ x rpm}}{60}$$

P0492 =...

Allowed speed difference 10.00 Hz

Parameter P0492 defines the frequency threshold for the loss of the encoder signal (fault F0090).

CAUTION

p0492 = 0 (no monitoring function):

With p0492 = 0, the loss of the encoder signal at high frequency as well as at a low frequency is de-activated. As a result, the system does not monitor for the loss of the encoder signal.

P0494 =...

Delay speed loss reaction 10 ms

P0492 is used to detect the loss of the encoder signal at low frequencies. If the motor speed is less than the value of P0492, the loss of the encoder signal is determined using an appropriate algorithm. P0494 defines the delay time between detecting the loss of the speed signal and initiating the appropriate response.

CAUTION

p0494 = 0 (no monitoring function):

With p0494 = 0, the loss of the encoder signal at low frequencies is de-activated. As a result, at these frequencies, a loss of the encoder signal is not detected (loss of the encoder signal at high frequency remains active as long as parameter p0492 > 0).

6.3.15 V/f control

P1300 =...

Control mode 0

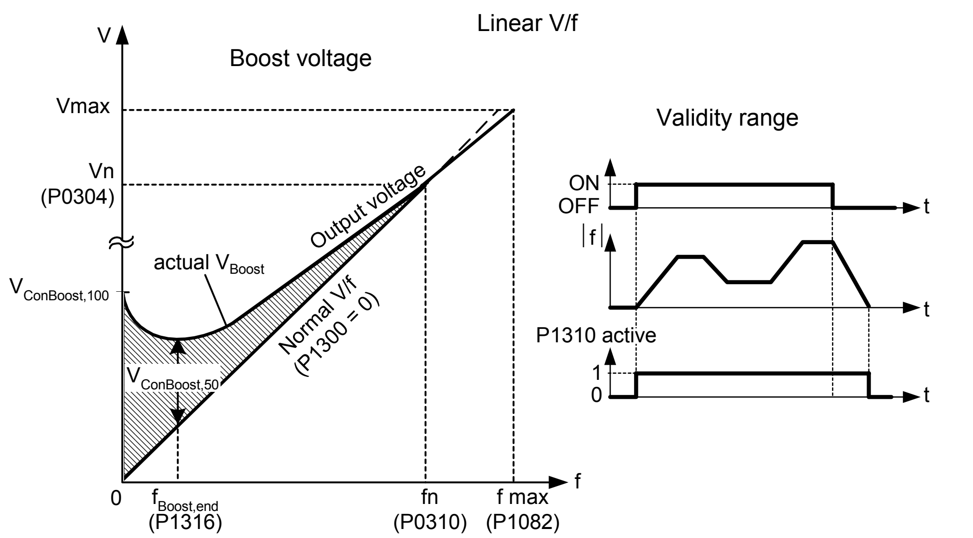
The control type is selected using this parameter. For the "V/f characteristic" control type, the ratio between the frequency inverter output voltage and the frequency inverter output frequency is defined.

0 V/f with linear
1 V/f with FCC
2 V/f with parabolic characteristic
3 V/f with programmable characteristic (→ P1320 – P1325)

P1310 =...

Continuous boost (entered in %) 50.00 %

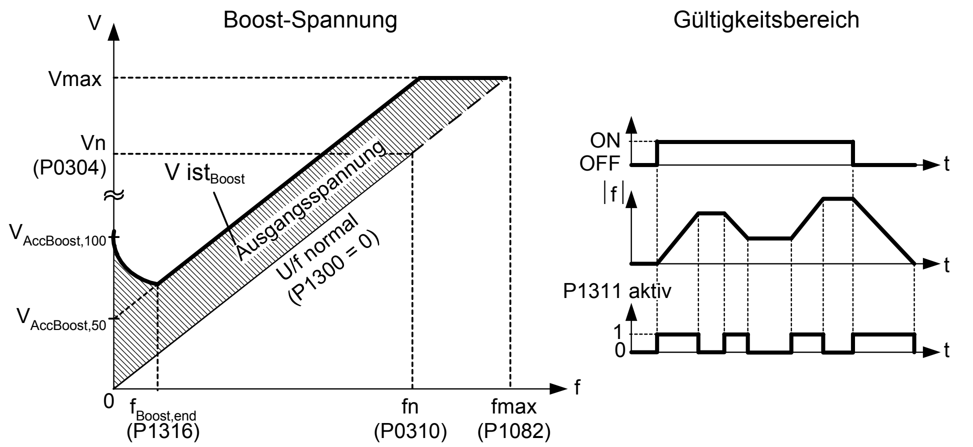
Voltage boost as a % relative to P0305 (rated motor current) and P0350 (stator resistance). P1310 is valid for all V/f versions (refer to P1300). At low output frequencies, the effective resistance values of the winding can no longer be neglected in order to maintain the motor flux.



P1311 =...

Acceleration boost (entered in %) 0.0 %

Voltage boost for accelerating/braking as a % relative to P0305 and P0350. P1311 only results in a voltage boost when ramping-up/ramp-down and generates an additional torque for accelerating/braking. Contrary to parameter P1312, that is only active for the 1st acceleration operation after the ON command, P1311 is effective each time that the drive accelerates or brakes.



P1312 =...

Starting boost (entered in %) — 0.0 %

Voltage boost when starting (after an ON command) when using the linear or square-law V/f characteristic as a % relative to P0305 (rated motor current) or P0350 (stator resistance). The voltage boost remains active until

1) the setpoint is reached for the first time and
2) the setpoint is reduced to a value that is less than the instantaneous ramp-function generator output.

P1320 =...

Programmable V/f freq. coord. 1 — 0.0 Hz

Sets V/f coordinates (P1320/1321 to P1324/1325) to define V/f characteristic.

P1321 =...

Programmable. V/f volt. coord. 1 — 0.0 Hz

P1322 =...

Programmable V/f freq. coord. 2 — 0.0 Hz

P1323 =...

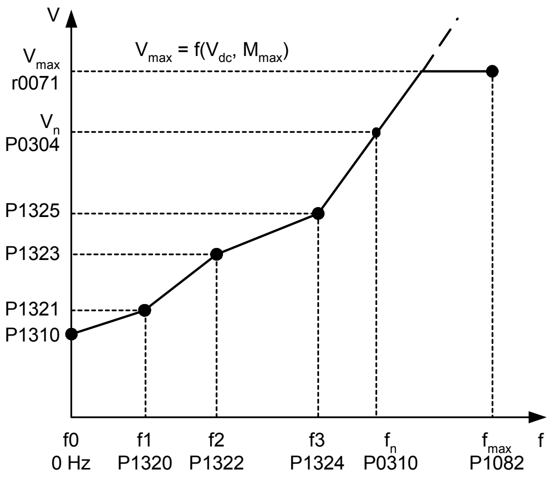
Programmable V/f volt. coord. 2 — 0.0 Hz

P1324 =...

Programmable V/f freq. coord. 3 — 0.0 Hz

P1325 =...

Programmable V/f volt. coord. 3 — 0.0 Hz



$$P1310[V] = \frac{P1310[\%]}{100[\%]} \cdot \frac{r0395[\%]}{100[\%]} \cdot P0304[V]$$

P1333 = ...

Starting frequency for FCC (entered as a %) — 10.0 %

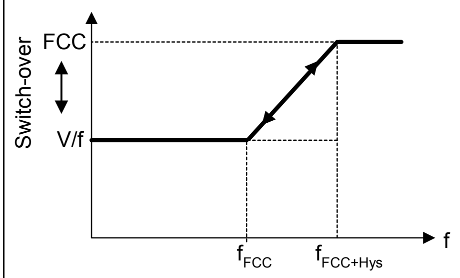
Defines the FCC starting frequency as a function of the rated motor frequency (P0310).

$$f_{FCC} = \frac{P0310}{100} \cdot P1333$$

$$f_{FCC+Hys} = \frac{P0310}{100} \cdot (P1333 + 6\%)$$

NOTE

The constant voltage boost P1310 is continually decreased analog to switching-in FCC.

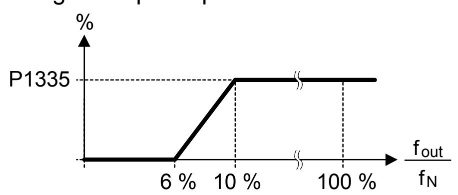


P1335 = ...

Slip compensation (entered in %) — 0.0 %

Dynamically adjusts output frequency of inverter so that motor speed is kept constant independent of motor load.

Range of slip compensation :



P1338 =...

Resonance damping gain V/f — 0.00

Defines resonance damping gain for V/f.

6.3.16 Inverter-specific Functions

6.3.16.1 Flying start

Parameter	Description	Default
P1200 = ...	**Flying start** Starts inverter onto a spinning motor by rapidly changing the output frequency of the inverter until the actual motor speed has been found. 0 Flying start disabled 1 Flying start is always active, start in direction of setpoint 2 Flying start is active if power on, fault, OFF2, start in direction of setpoint 3 Flying start is active if fault, OFF2, start in direction of setpoint 4 Flying start is always active, only in direction of setpoint 5 Flying start is active if power on, fault, OFF2, only in direction of setpoint 6 Flying start is active if fault, OFF2, only in direction of setpoint	0
P1202 = ...	**Motor-current: Flying start** (entered in %) Defines search current used for flying start.	100 %
P1203 = ?	**Search rate: Flying start** (entered in %) Sets factor by which the output frequency changes during flying start to synchronize with turning motor.	100 %

6.3.16.2 Automatic restart

Parameter	Description	Default
P1210 = ...	**Automatic restart** Configures automatic restart function. 0 Disabled 1 Trip reset after power on 2 Restart after mains blackout 3 Restart after mains brownout or fault 4 Restart after mains brownout 5 Restart after mains blackout and fault 6 Restart after mains brown/blackout or fault	1

6.3.16.3 Holding brake

- Series / commissioning for hazardous loads
  - lower the load to the floor
  - when replacing the frequency inverter, prevent (inhibit) the frequency inverter from controlling the motor holding brake (MHB)
  - secure the load or inhibit the motor holding brake control (so that the brake cannot be controlled) and then – and only then – carry-out quick commissioning / parameter download using the PC-based tool (STARTER)
- Parameterize the weight equalization for hoisting gear applications
  - magnetizing time P0346 greater than zero
  - min. frequency P1080 should approximately correspond to the motor slip r0330 (P1080 ≈ r0330)
    Adapt the voltage boost to the load (P1310, P1311)
- It is not sufficient to just select the status signal r0052 bit 12 "motor holding brake active" in P0731 – P0733. In order to activate the motor holding brake, in addition, parameter P1215 must be set to 1.
- It is not permissible to use the motor holding brake as operating brake. The reason for this is that the brake is generally only dimensioned/designed for a limited number of emergency braking operations.
- The brake closing / opening times can be taken from the appropriate manual. The following typical values have been taken from Motor Catalog M11 2003/2004, Page 2/51:

Motor size	Brake type	Opening time [ms]	Closing time [ms]
63	2LM8 005-1NAxx	25	56
71	2LM8 005-2NAxx	25	56
80	2LM8 010-3NAxx	26	70
90	2LM8 020-4NAxx	37	90
100	2LM8 040-5NAxx	43	140
112	2LM8 060-6NAxx	60	210
132	2LM8 100-7NAxx	50	270
160	2LM8 260-8NAxx	165	340
180	2LM8 315-0NAxx	152	410
200 225	2LM8 400-0NAxx	230	390

P1215 =...

Holding brake enable 0

Enables/disables holding brake function (MHB).

0 Motor holding brake disabled

1 Motor holding brake enabled

NOTE

The following must apply when controlling the brake relay via a digital output: P0731 = 52.C (= 52.12) (refer to Section 6.3.4 "Digital outputs (DOUT)").

P0731=52.C

BI: Fct digital output 1 — 52.3

Defines the source for digital output 1.

NOTE

The brake relay can also be controlled from another digital output (if this is available) or using a distributed I/O module. Analog to DOUT 1, it should be guaranteed that the I/Os are controlled by the status bit "MHB active".

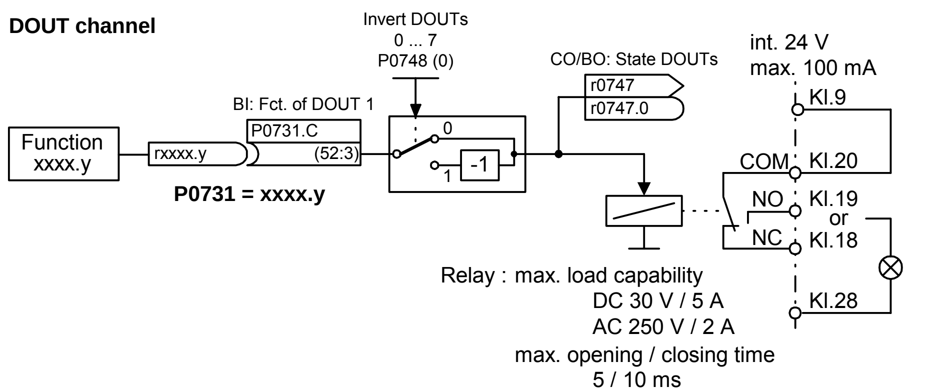
Frequent settings:

		Closed
52.0	Ready to power-up	0
52.1	Ready	0
52.2	Drive operational	0
52.3	Fault present	0
52.4	OFF2 active (present)	1
52.5	OFF3 active (present)	1
52.6	Power-on inhibit active (present)	0
52.7	Alarm active (present)	0
52.8	Deviation, setpoint/actual value	1
52.9	PZD / PLC control	0
52.A	Maximum frequency reached	0
52.B	Alarm: Motor current limit	1
52.C	Motor holding brake active	0
52.D	Motor overload	1
52.E	Motor dir. of rotation, clockwise	0
52.F	Frequency inverter overload	1
53.0	DC brake active	0
53.1	Actual freq. f_act > P2167 (f_off)	0
:		
:		

P0748 = 0

Inverting digital outputs — 0

This parameter allows the signals to be output to be inverted.



P1216 = ...

Holding brake release delay (entered in s) — 1.0 s

Defines the time interval during which the frequency inverter runs with the min. frequency p1080 after magnetizing, before the ramp-up starts.

P1216 ≥ brake opening time + relay opening time

P1217 = ...

Holding time after ramp-down (entered in s) — 1.0 s

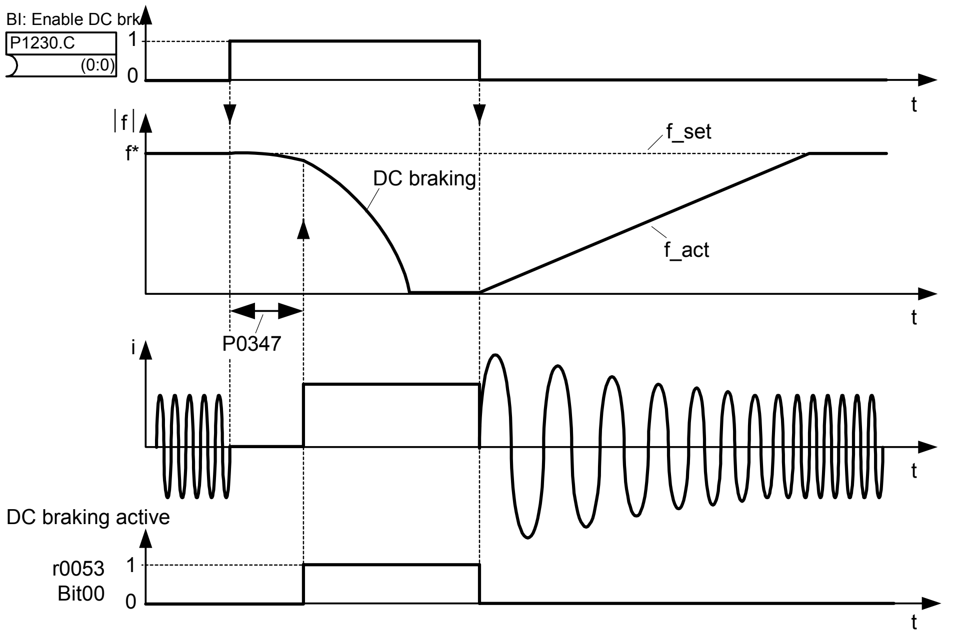
Defines time for which inverter runs at minimum frequency (p1080) after ramping down.

P1217 ≥ brake closing time + relay closing time

6.3.16.4 DC brake

P1230 = ...

BI: Enabling the DC brake
This enables DC braking using a signal that was used from an external source. The function remains active as long as the external input signal is active. DC braking causes the motor to quickly stop by injecting a DC current



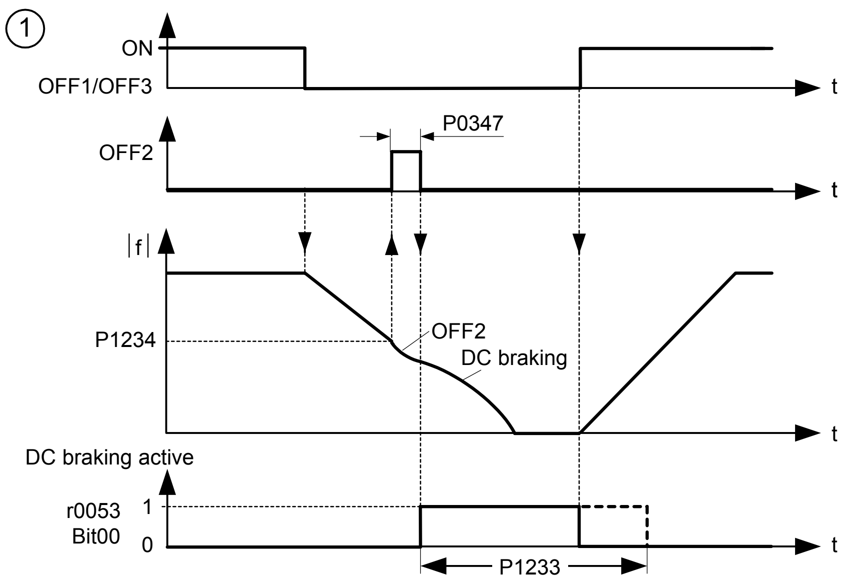
Note: DC brake can be applied in drive states r0002 = 1, 4, 5

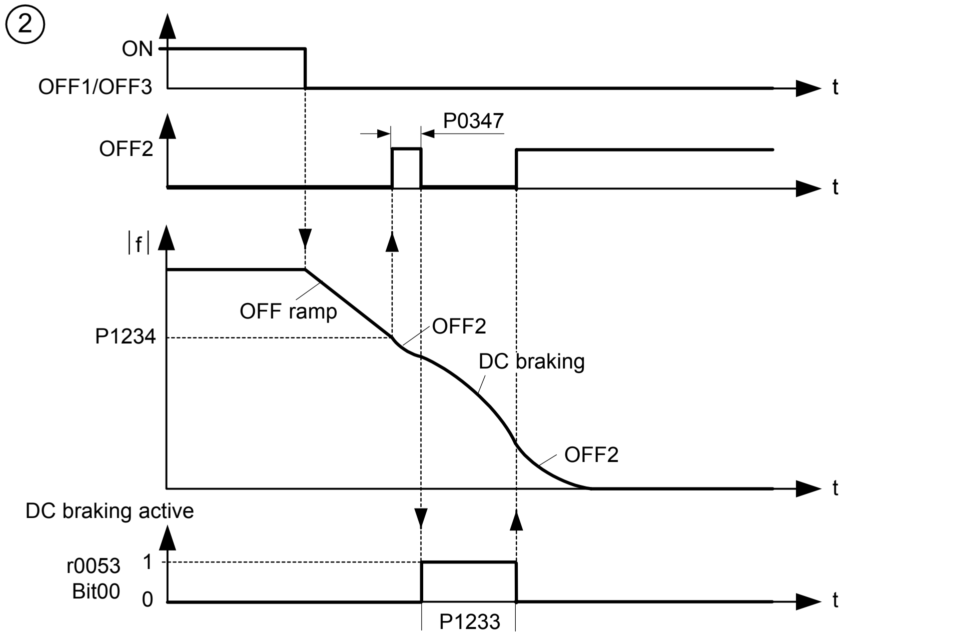
P1232 =...

DC braking current (entered in %) — 100 %
Defines level of DC current in [%] relative to rated motor current (P0305).

P1233 =...

Duration of DC braking (entered in s) — 0 s
Defines duration for which DC injection braking is to be active following an OFF1 or OFF3 command.





P1234 =...

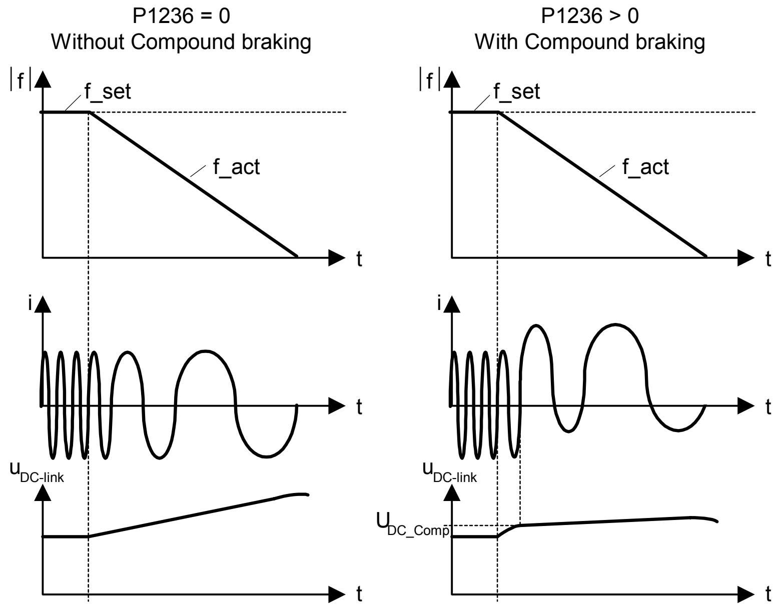
DC braking start frequency (entered in Hz) 650 Hz
Sets the start frequency for the DC brake.

6.3.16.5 Compound braking

P1236 =...

Compound braking current (entered in %) 0 %
Defines DC level superimposed on AC waveform after exceeding DC-link voltage threshold of compound braking. The value is entered in [%] relative to rated motor current (P0305). (see also 6.3.11").

If P1254 = 0 :
Compound braking switch-on level $U_{DC\_Comp} = 1.13 \cdot \sqrt{2} \cdot V_{mains} = 1.13 \cdot \sqrt{2} \cdot P0210$
otherwise :
Compound braking switch-on level $U_{DC\_Comp} = 0.98 \cdot r1242$



6.3.16.6 Vdc controller

P1240 =...

Configuration of Vdc controller — 1

Enables / disables Vdc controller.

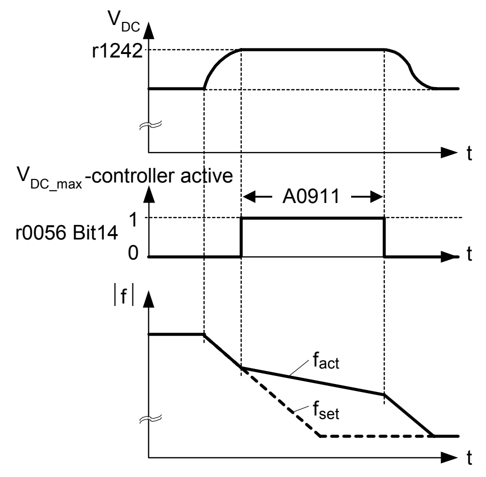
0 Vdc controller disabled
1 Vdc-max controller enabled

P1254 =...

Auto detect Vdc switch-on levels — 1

Enables/disables auto-detection of switch-on levels for Vdc control functionalities.

0 Disabled
1 Enabled



6.3.16.7 Bypass

Bypass is used to described the condition when a motor is ran alternatively between a mains supply and the inverter. For example, the bypass circuit can be used to switch over from the inverter to a mains supply when the inverter is faulty. This function can also be used to ramp-up a large rotation mass using the inverter and then, at the correct speed, switching over to the mains supply.

P1260 = ...

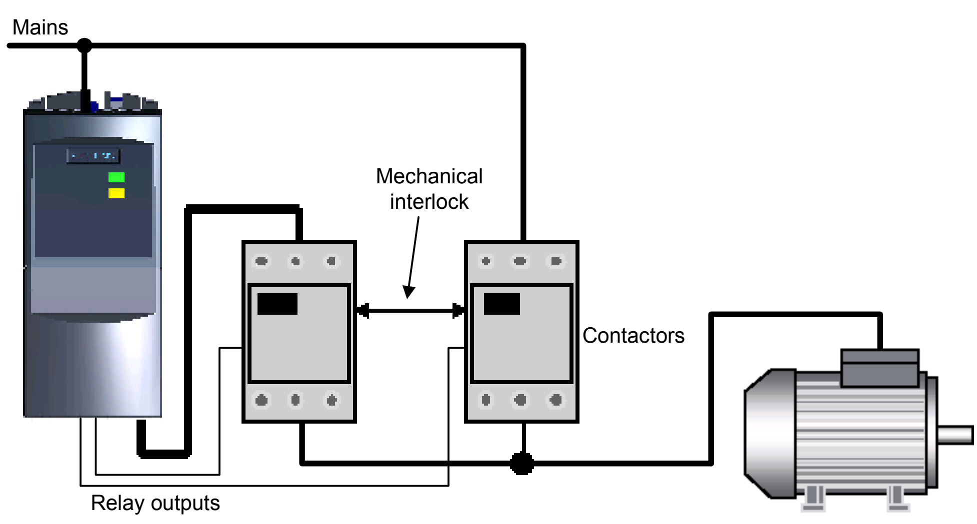
Bypass control — 0

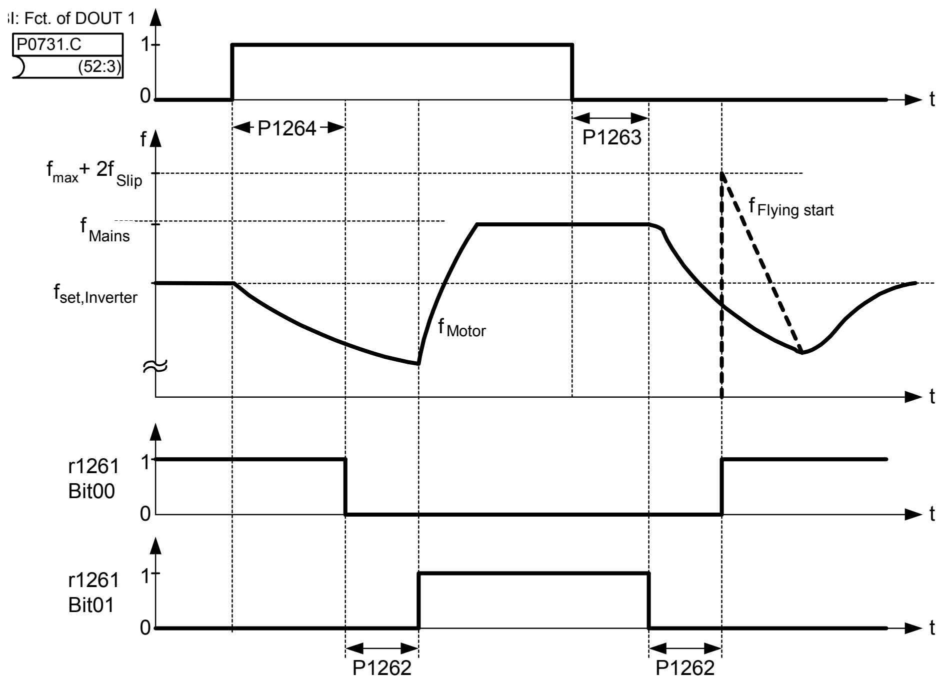
Selects the possible sources for contactor changeover control.

0 Bypass disabled
1 Controlled by inverter trip
2 Controlled by P1266
3 Controlled by P1266 or inverter trip
4 Controlled by act. frequency = P1265
5 Controlled by act. frequency = P1265 or inverter trip
6 Controlled by act. frequency = P1265 or P1266
7 Controlled by act. frequency = P1265 or P1266 or inverter trip

NOTE

Flying start P1200 should be enabled in cases where the motor may still be turning after switch-over from bypass-mode to inverter-mode.





r1261 **BO: Bypass status word**

Output word from the bypass feature that allows external connections to be made.

Bit00	Motor supplied by inverter	0	NO	1	YES
Bit01	Motor supplied by mains	0	NO	1	YES

P1262 = ... **Bypass dead time** 1.000 s

P1262 is the interlock time between switching one contactor OFF, and the other ON. Its minimum value should not be smaller than the motor demagnetization time P0347.

P1263 = ... **De-Bypass time** 1.0 s

This delay timer is used as a delay for all sources of switchover from bypass to inverter control. If the condition for switching from bypass is removed then this timer is reset, and must run through again before bypass will occur.

P1264 = ... **Bypass time** 1.0 s

This delay timer is used as a delay for all sources of switchover from inverter control to bypass. If the condition for switching to bypass is removed then this timer is reset, and must run through again before bypass will occur.

P1265 = ... **Bypass frequency** 50.00 Hz

Bypass frequency.

P1266 = ... **BI: Bypass command** 0.0

Bypass Control P1260 can be controlled by an external switch which is connected to the inverter. The P1266 BI: Bypass command selects the interface (e.g. DIN, USS or CB) from which the signal originates.

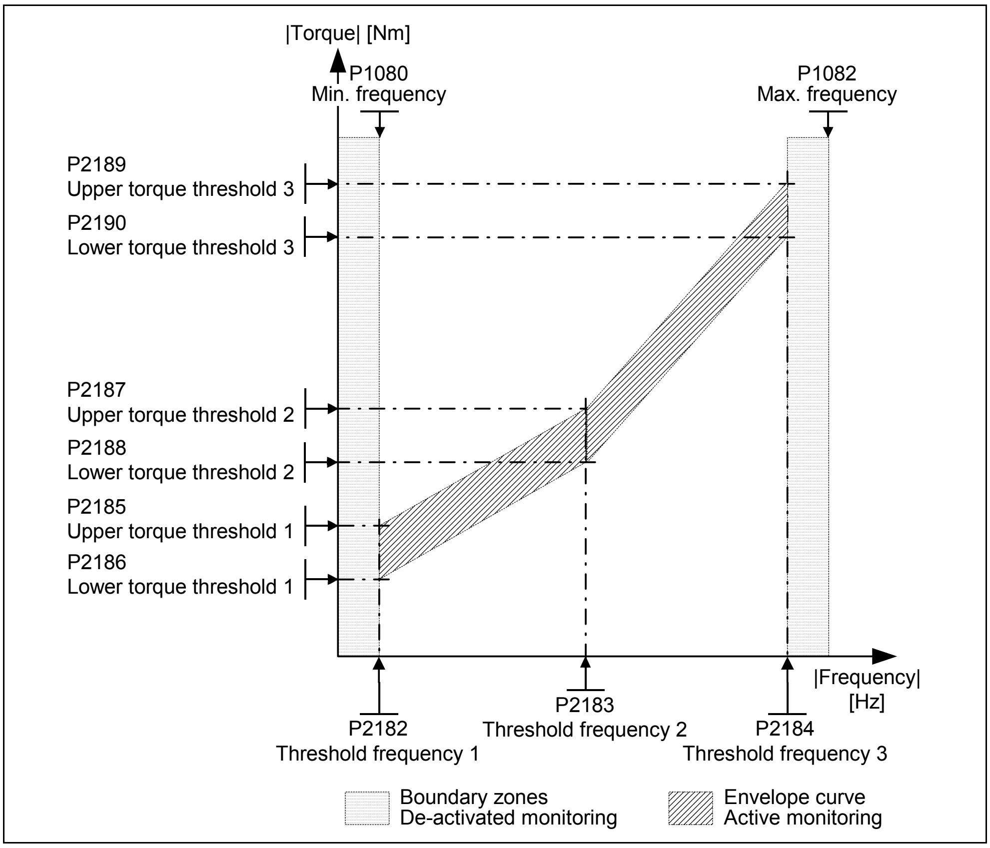
722.0 = Digital input 1
722.1 = Digital input 2
722.2 = Digital input 3
722.3 = Digital input 4
722.4 = Digital input 5
722.5 = Digital input 6
722.6 = Digital input 7
722.7 = Digital input 8

6.3.16.8 Load torque monitoring

This function monitors the transmission of force between a motor and driven load within a defined frequency range. Typical applications include, for example, detecting when a transmission belt breaks or detecting when a conveyor belt is in an overload condition.

For the load torque monitoring, the actual frequency/torque actual value is compared to a programmed frequency/torque characteristic (refer to P2182 – P2190). Depending on P2181, the system monitors whether the permissible torque curve is either exceeded or fallen below. If the actual value lies outside the tolerance bandwidth, then after the delay time P2192 has expired, either alarm A0952 is output or fault F0452.

P2181 = ...	**Belt failure detection mode** Parameter P2181 activates or de-activates the load torque monitoring and defines the response to a load torque fault. 0 Belt failure detection disabled 1 Warning: Low torque / frequency 2 Warning: High torque / frequency 3 Warning: High / low torque / frequency 4 Trip: Low torque / frequency 5 Trip: High torque / frequency 6 Trip: High / low torque / frequency	0
P2182 = ...	**Belt threshold frequency 1** Sets a frequency threshold 1 for comparing actual torque to torque the envelope for belt failure detection.	5.00
P2183 = ...	**Belt threshold frequency 2** Sets a frequency threshold 2.	30.00
P2184 = ...	**Belt threshold frequency 3** Sets a frequency threshold 3.	50.00
P2185 = ...	**Upper torque threshold 1** Upper limit threshold value 1 for comparing actual torque.	99999.0
P2186 = ...	**Lower torque threshold 1** Lower limit threshold value 1 for comparing actual torque.	0.0
P2187 = ...	**Upper torque threshold 2** Upper limit threshold value 2 for comparing actual torque.	99999.0
P2188 = ...	**Lower torque threshold 2** Lower limit threshold value 2 for comparing actual torque.	0.0
P2189 = ...	**Upper torque threshold 3** Upper limit threshold value 3 for comparing actual torque.	99999.0
P2190 = ...	**Lower torque threshold 3** Lower limit threshold value 3 for comparing actual torque.	0.0
P2192 = ...	**Time delay for belt failure** P2192 defines a delay before warning/trip becomes active. It is used to eliminate events caused by transient conditions. It is used for both methods of fault detection.	10


|Torque| [Nm]
P1080
Min. frequency
P1082
Max. frequency
P2189
Upper torque threshold 3
P2190
Lower torque threshold 3
P2187
Upper torque threshold 2
P2188
Lower torque threshold 2
P2185
Upper torque threshold 1
P2186
Lower torque threshold 1
|Frequency|
[Hz]
P2182
Threshold frequency 1
P2183
Threshold frequency 2
P2184
Threshold frequency 3
Boundary zones
De-activated monitoring
Envelope curve
Active monitoring

6.3.16.9 PID controller

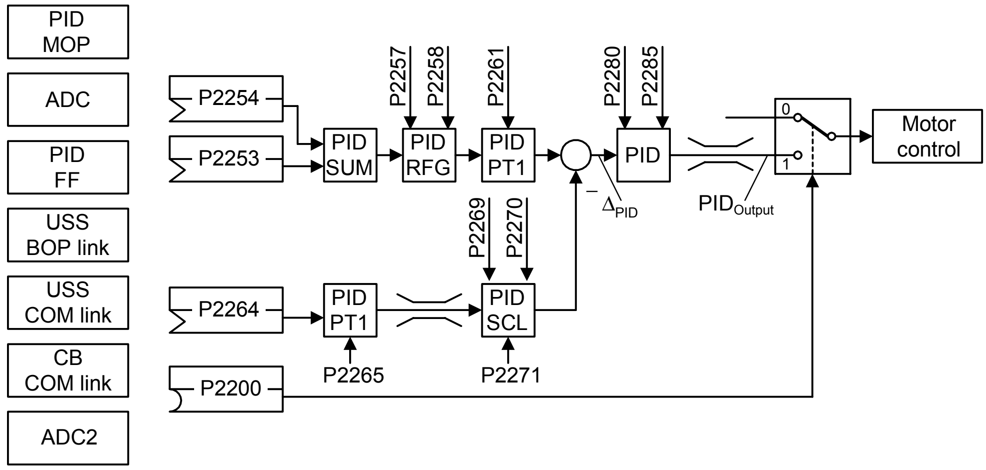
Process values can be controlled via PID control (e.g. pressure, liquid level). The process setpoint (PID setpoint) can be a fixed setpoint (e.g. PID-FF) or an analog setpoint (e.g. analog input). The current value of the process is determined by a sensor, which is connected to the inverter via an analog input.

NOTE

- PID-FF or PID-MOP are build up like FF (refer to Section 6.3.9) or MOP (refer to Section 6.3.8).
- The parameters of PID-FF are in the parameter range P2201 - P2228.
- For the PID-MOP parameters the range P2231 - r2250 is valid.

Parameter	Description	Default
P2200 =...	**BI: Enable PID controller** PID mode Allows user to enable/disable the PID controller. Setting to 1 enables the PID controller. Setting 1 automatically disables normal ramp times set in P1120 and P1121 and the normal frequency setpoints.	0.0
P2253 =...	**CI: PID setpoint** Defines setpoint source for PID setpoint input.	0.0
P2254 =...	**CI: PID trim source** Selects trim source for PID setpoint. This signal is multiplied by the trim gain and added to the PID setpoint.	0.0
P2257 =...	**Ramp-up time for PID setpoint** Sets the ramp-up time for the PID setpoint.	1.00 s
P2258 =...	**Ramp-down time for PID setpoint** Sets ramp-down time for PID setpoint.	1.00 s
P2264 =...	**CI: PID feedback** Selects the source of the PID feedback signal.	755.0
P2267 =...	**Max. value for PID feedback** Sets the upper limit for the value of the feedback signal in [%].	100.00 %
P2268 =...	**Min. value for PID feedback** Sets lower limit for value of feedback signal in [%].	0.00 %
r2273 =...	**CO: PID error** Displays PID error (difference) signal between setpoint and feedback signals in [%].	
P2274 =...	**PID derivative time** Sets PID derivative time. P2274 = 0: The derivative term does not have any effect (it applies a gain of 1).	0.000
P2280 =...	**PID proportional gain** Allows user to set proportional gain for PID controller.	3.000
P2285 =...	**PID integral time** Sets integral time constant for PID controller.	0.000 s
P2291 =...	**PID output upper limit** Sets upper limit for PID controller output in [%].	100.00 %
P2292 =...	**PID output lower limit** Sets lower limit for the PID controller output in [%].	0.00 %

PID controller structure



Example

Parameter	Parameter text	Example	
P2200	BI: Enable PID controller	P2200 = 1.0	PID controller active
P2253	CI: PID setpoint	P2253 = 2224	PID-FF1
P2264	CI: PID feedback	P2264 = 755	ADC
P2267	Max. PID feedback	P2267	Adapt to the application
P2268	Min. PID feedback	P2268	Adapt to the application
P2280	PID proportional gain	P2280	Determined by optimizing
P2285	PID integral time	P2285	Determined by optimizing
P2291	PID output upper limit	P2291	Adapt to the application
P2292	PID output lower limit	P2292	Adapt to the application

6.3.16.10 Staging

Motor staging allows the control of up to 3 additional staged pumps or fans, based on a PID control system. The complete system comprises a variable-speed pump/fan that is controlled by the drive inverter, and a maximum of 3 additional fixed-speed pumps/fans, that are controlled via contactors or motor starters. The contactors or motor starter are controlled by outputs from the inverter. The diagram below shows a typical pumping system. A similar system could be set up using fans and air ducts, instead of pumps and pipes.

P2370 = ...

Motor staging stop mode — 0

Using this parameter, the stop mode of external motors M1 - M3 is defined for an OFF1 command.

0 Normal stop
1 Sequence stop

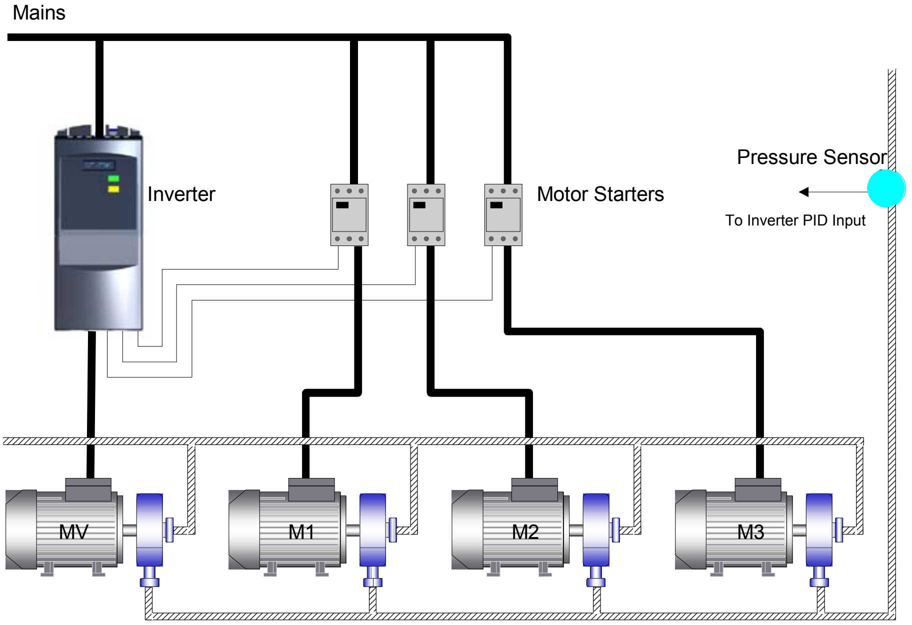
P2371 = ...

Staging-Configuration — 0

Selects configuration of external motors (M1, M2, M3).

0 Motor staging disabled
1 M1 = 1X
2 M1 = 1X, M2 = 1X
3 M1 = 1X, M2 = 2X
4 M1 = 1X, M2 = 1X, M3 = 1X
5 M1 = 1X, M2 = 1X, M3 = 2X
6 M1 = 1X, M2 = 2X, M3 = 3X
7 M1 = 1X, M2 = 1X, M3 = 3X
8 M1 = 1X, M2 = 2X, M3 = 3X

1X .... 1x power
2X .... 2x power
3X .....3x power



MV - Variable speed motor
M1 - Motor switched with relay 1
M2 - Motor switched with relay 2
M3 - Motor switched with relay 3

By default the motor starters are controlled from relay outputs (DOUT1,2,3).

Staging

When the inverter is running at maximum frequency (P1082), and the PID feedback indicates that a higher frequency is required, the inverter switches on (stages) one of the relay controlled motors M1 to M3. The drive inverter simultaneously ramps-down to the staging frequency (P2378); in so doing, an attempt is made to keep the controlled variable as constant as possible. Therefore, during the staging process, PID control is suspended (see P2378 and diagram below).

Staging of external motors (M1, M2, M3)

Switch-on

			1.	2.	3.	4.	5.	6.	7. → t
P2371 =	0	-	-	-	-	-	-	-	-
	1	-	M1	M1	M1	M1	M1	M1	M1
	2	-	M1	M1+M2	M1+M2	M1+M2	M1+M2	M1+M2	M1+M2
	3	-	M1	M2	M1+M2	M1+M2	M1+M2	M1+M2	M1+M2
	4	-	M1	M1+M2	M1+M2+M3	M1+M2+M3	M1+M2+M3	M1+M2+M3	M1+M2+M3
	5	-	M1	M3	M1+M3	M1+M2+M3	M1+M2+M3	M1+M2+M3	M1+M2+M3
	6	-	M1	M2	M1+M2	M2+M3	M1+M2+M3	M1+M2+M3	M1+M2+M3
	7	-	M1	M1+M2	M3	M1+M3	M1+M2+M3	M1+M2+M3	M1+M2+M3
	8	-	M1	M2	M3	M1+M3	M2+M3	M1+M2+M3	M1+M2+M3

De-staging

When the inverter is running at minimum frequency (P1080), and the PID feedback indicates that a lower frequency is required, the inverter switches off (de-stages) one of the relay controlled motors M1 to M3. In this particular case, the drive inverter ramps down from the minimum frequency to the staging frequency (P2378) outside the PID closed-loop control (see P2378 and diagram below).

De-staging of external motors (M1, M2, M3)

Switch-off

			1.	2.	3.	4.	5.	6.	7. → t
P2371 =	0	-	-	-	-	-	-	-	-
	1	M1	-	-	-	-	-	-	-
	2	M1+M2	M1	-	-	-	-	-	-
	3	M1+M2	M2	M1	-	-	-	-	-
	4	M1+M2+M3	M2+M1	M1	-	-	-	-	-
	5	M1+M2+M3	M3+M1	M3	M1	-	-	-	-
	6	M1+M2+M3	M3+M2	M2+M1	M2	M1	-	-	-
	7	M1+M2+M3	M3+M1	M3	M2+M1	M1	-	-	-
	8	M1+M2+M3	M3+M2	M3+M1	M3	M2	M1	-	-

P2372 = ...

Motor staging cycling — Default: 0

Enables motor cycling for the motor staging feature.

0 Disabled
1 Enabled

When activated (P2372 = 1), then the selection of the motor, that is to be switched-in or switched-out, depends initially on the operating hours counter P2380. This means:

- When switching-in a motor, the motor with the lowest operating hours, is always selected, and
- When switching-out a motor, the motor with the highest operating hours, is always switched-out.

With the same status of the operating hours counter, the motors are switched-in/switched-out corresponding to the settings in parameter P2371.

P2373 = ...

Motor staging hysteresis — Default: 20.0 %

P2373 as a percentage of PID setpoint that PID error P2273 must be exceeded before staging delay starts.

P2374 = ...

Motor staging delay — Default: 30 s

The staging delay time is set in this parameter.
This means that before an additional motor is switched-in, the system deviation must be present for at least the set time.

P2375 = ...

Motor destaging delay — Default: 30 s

The de-staging delay time is set in this parameter.
This means that before an additional motor can be switched-out, the system deviation must be present for at least the set time.

P2376 = ...

Motor staging delay override — Default: 25 %

If the system deviation exceeds the value set in this parameter, then external motors are instantaneously (without any delay) switched-in or switched-out.

P2377 = ...

Motor staging lockout timer — Default: 30 s

For the time set in this parameter, after switching-in and switching-out external motors, further instantaneous switching-in/switching-out is prevented corresponding to that of P2376.

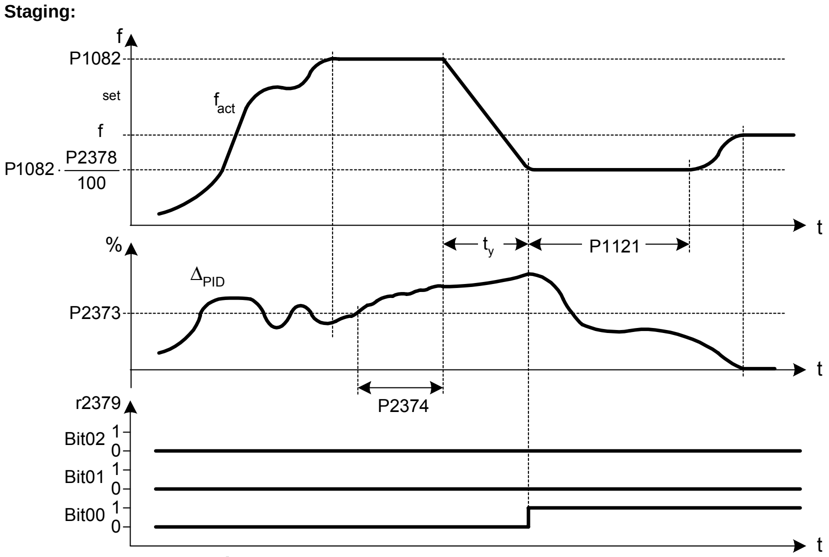
This prevents a second staging event immediately after a first, being caused by the transient conditions after the first staging event.

P2378 = ...

Motor staging frequency f_st [%] — Default: 50 %

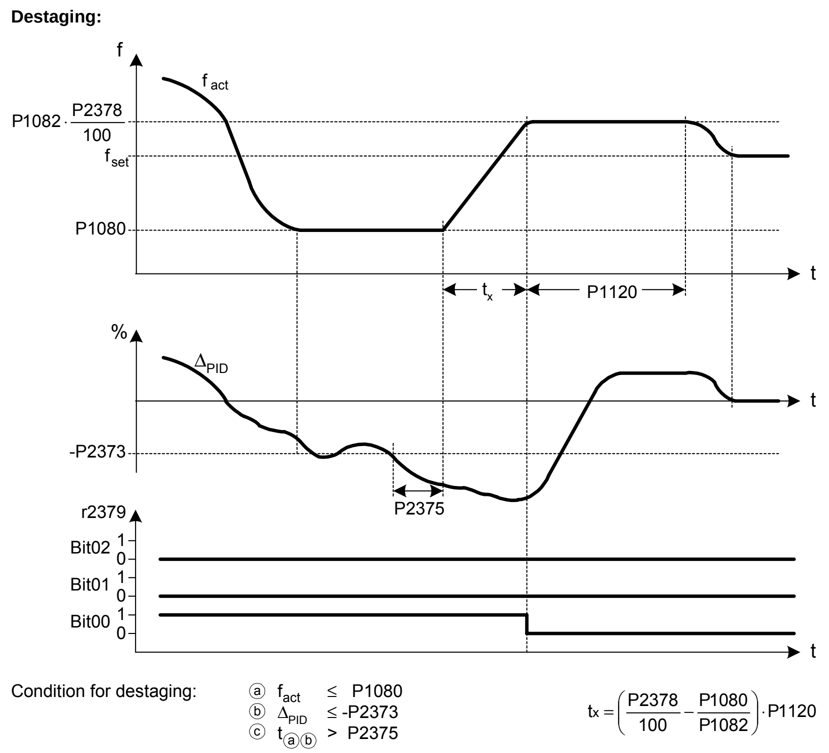
The set frequency corresponds to the drive inverter output frequency that is approached, after the staging / de-staging delay time has expired along the up and down ramps. After the staging frequency has been reached, the drive inverter controls the relay outputs to switch-in / switch-out motors M1 - M3.

Staging:



Condition for staging:
ⓐ $f_{act} \geq$ P1082
ⓑ $\Delta_{PID} \geq$ P2373
ⓒ $t_{ⓐⓑ} >$ P2374

$$t_y = \left(1 - \frac{P2378}{100}\right) \cdot P1121$$



r2379

CO/BO: Motor staging status word

Output word from the motor staging feature that allows external connections to be made.

Bit00	Start motor 1	0	NO	1	YES
Bit01	Start motor 2	0	NO	1	YES
Bit02	Start motor 3	0	NO	1	YES

P2380 = ...

Motor staging hours run 0.0 h

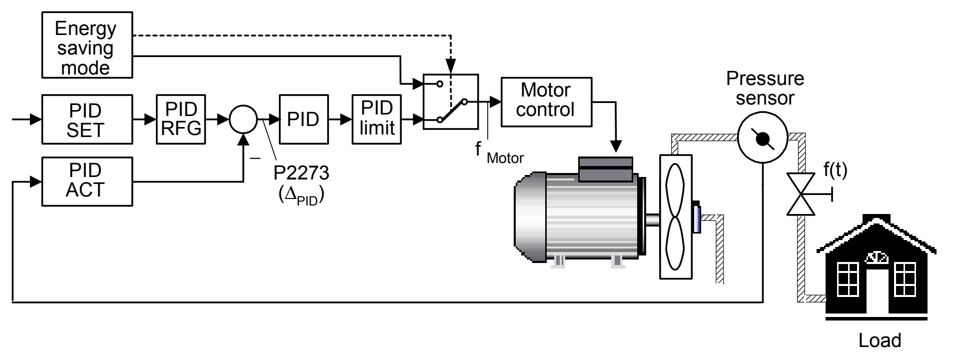
Displays hours run for external motors. To reset the running hours, set the value to zero, any other value is ignored.

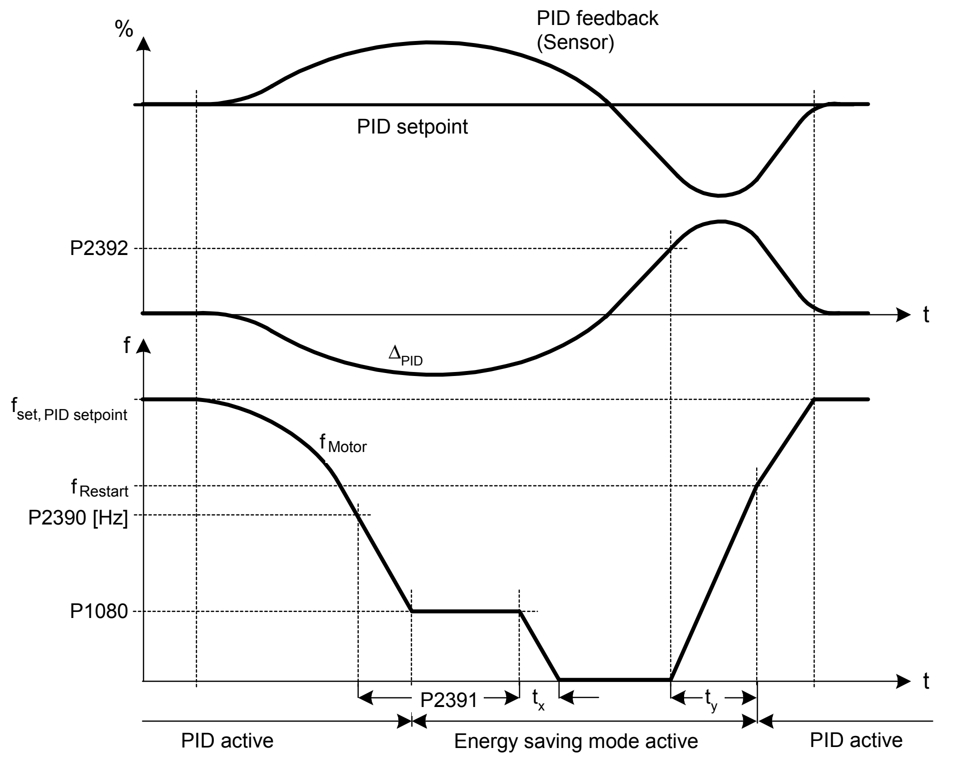
6.3.16.11 Energy saving mode

When the inverter under PID control drops below energy saving setpoint, the energy saving timer P2391 is started. When the energy saving timer has expired, the inverter is ramped down to stop and enters energy saving mode.

P2390 = ...

Energy saving setpoint 0 %





$$f_{Restart} = P2000 \cdot \frac{P2390 + 5\%}{100\ \%}$$

$$P2390\ [Hz] = P2000 \cdot \frac{P2390}{100\ \%}$$

$$t_x = \frac{P1080}{P1082} \cdot P1121$$

$$t_y = \frac{f_{Restart}}{P1082} \cdot P1120$$

NOTE

If energy saving setpoint is 0, the energy saving function is disabled.

Energy saving mode is an added feature to enhance PID functionality, and switches of the motor when the inverter is running at low setpoint.

P2391 = ...

Energy saving timer 0 s

When the energy saving timer P2391 has expired, the inverter is ramped down to stop and enters energy saving mode (see description and diagram of P2390).

P2392 = ...

Energy saving restart setpoint 0 %

While in energy saving mode, the PID controller continues to generate the error P2273 - once this reaches the restart point P2392 the inverter immediately ramps to the setpoint calculated by the PID controller (see description and diagram of P2390).

As soon as the energy-saving mode of the drive inverter has been deactivated, it can only be re-activated if the output setpoint of the converter has again reached the restart setpoint.

6.3.16.12 Free function blocks (FFB)

P2800 =...

Enable FFBs — 0

Parameter P2800 is used to activate all free function blocks (generally, P2800 is set to 1).

Possible settings:

0 Inhibited
1 Enabled

P2801 =...

Activate FFBs — 0.0

Parameter P2801 is used to individually enable (activate) the free function blocks P2801[0] to P2801[16] (P2801[x] > 0).

Further, parameters P2801 and P2802 are used to define the chronological sequence of all of the function blocks. The table below indicates that the priority increases from left to right and from bottom to top.

Possible settings:

0 Inactive
1 Level 1
2 Level 2
0 Level 3

Example:

P2801[3] = 2, P2801[4] = 2, P2802[3] = 3, P2802[4] = 2

FFBs are calculated in the following sequence:

P2802[3], P2801[3] , P2801[4], P2802[4]

The active function blocks are calculated every 132 ms.

P2802 =...

Activate FFBs

Parameter P2802 is used to individually enable (activate) the free function blocks P2802[0] to P2802[13] (P2802[x] > 0).

Possible settings:

0 Inactive
1 Level 1
2 Level 2
1 Level 3

low ◄ Priority 2 high

Priority 1: high (top) to low (bottom)

	P2802 [13] CMP 2	P2802 [12] CMP 1	P2802 [11] DIV 2	P2802 [10] DIV 1	P2802 [9] MUL 2	P2802 [8] MUL 1	P2802 [7] SUB 2	P2802 [6] SUB 1	P2802 [5] ADD 2	P2802 [4] ADD 1	P2802 [3] Timer 4	P2802 [2] Timer 3	P2802 [1] Timer 2	P2802 [0] Timer 1	P2801 [16] RS-FF 3	P2801 [15] RS-FF 2	P2801 [14] RS-FF 1	P2801 [13] D-FF 2	P2801 [12] D-FF 1	P2801 [11] NOT 3	P2801 [10] NOT 2	P2801 [9] NOT 1	P2801 [8] XOR 3	P2801 [7] XOR 2	P2801 [6] XOR 1	P2801 [5] OR 3	P2801 [4] OR 2	P2801 [3] OR 1	P2801 [2] AND 3	P2801 [1] AND 2	P2801 [0] AND 1
Level 3																															
Level 2																															
Level 1																															
Inactive 0																															

FFB	Input parameters		Output parameters		Setting parameters	
AND1	P2810[2]	BI: AND 1	r2811	BO: AND 1	–	
AND2	P2812[2]	BI: AND 2	r2813	BO: AND 2	–	
AND3	P2814[2]	BI: AND 3	r2815	BO: AND 3	–	
OR1	P2816[2]	BI: OR 1	r2817	BO: OR 1	–	
OR2	P2818[2]	BI: OR 2	r2819	BO: OR 2	–	
OR3	P2820[2]	BI: OR 3	r2821	BO: OR 3	–	
XOR1	P2822[2]	BI: XOR 1	r2823	BO: XOR 1	–	
XOR2	P2824[2]	BI: XOR 2	r2825	BO: XOR 2	–	
XOR3	P2826[2]	BI: XOR 3	r2827	BO: XOR 3	–	
NOT1	P2828	BI: NOT 1	r2829	BO: NOT 1	–	
NOT2	P2830	BI: NOT 2	r2831	BO: NOT 2	–	
NOT3	P2832	BI: NOT 3	r2833	BO: NOT 3	–	
D-FF1	P2834[4]	BI: D-FF 1	r2835 r2836	BO: Q D-FF 1 BO: NOT-Q D-FF 1	–	
D-FF2	P2837[4]	BI: D-FF 2	r2838 r2839	BO: Q D-FF 2 BO: NOT-Q D-FF 2	–	
RS-FF1	P2840[4]	BI: RS-FF 1	r2841 r2842	BO: Q RS-FF 1 BO: NOT-Q RS-FF 1	–	
RS-FF2	P2843[4]	BI: RS-FF 2	r2844 r2845	BO: Q RS-FF 2 BO: NOT-Q RS-FF 2	–	
RS-FF3	P2846[4]	BI: RS-FF 3	r2847 r2848	BO: Q RS-FF 3 BO: NOT-Q RS-FF 3	–	
Timer1	P2849	BI: Timer 1	r2852 r2853	BO: Timer 1 BO: NOT Timer 1	P2850 P2851	Delay time of Timer 1 Mode Timer 1
Timer2	P2854	BI: Timer 2	r2857 r2858	BO: Timer 2 BO: NOT Timer 2	P2855 P2856	Delay time of Timer 2 Mode Timer 2
Timer3	P2859	BI: Timer 3	r2862 r2863	BO: Timer 3 BO: NOT Timer 3	P2860 P2861	Delay time of Timer 3 Mode Timer 3
Timer4	P2864	BI: Timer 4	r2867 r2868	BO: Timer 4 BO: NOT Timer 4	P2865 P2866	Delay time of Timer 4 Mode Timer 4
ADD1	P2869[2]	CI: ADD 1	r2870	CO: ADD 1	–	
ADD2	P2871[2]	CI: ADD 2	r2872	CO: ADD 2	–	
SUB1	P2873[2]	CI: SUB 1	r2874	CO: SUB 1	–	
SUB2	P2875[2]	CI: SUB 2	r2876	CO: SUB 2	–	
MUL1	P2877[2]	CI: MUL 1	r2878	CO: MUL 1	–	
MUL2	P2879[2]	CI: MUL 2	r2880	CO: MUL 2	–	
DIV1	P2881[2]	CI: DIV 1	r2882	CO: DIV 1	–	
DIV2	P2883[2]	CI: DIV 2	r2884	CO: DIV 2	–	
CMP1	P2885[2]	CI: CMP 1	r2886	BO: CMP 1	–	
CMP2	P2887[2]	CI: CMP 2	r2888	BO: CMP 2	–	
FSW1	–		–		P2889	CO: FSW 1 in [%]
FSW2	–		–		P2890	CO: FSW 2 in [%]

6.3.17 Data sets

For many applications, it is advantageous, if several parameter settings can be simultaneously changed during operation or during operational readiness using an external signal. By using indexing, different settings can be saved under one parameter. These are then activated when the data set is changed-over. The following data sets are available:

- CDS Command Data Set
- DDS Drive Data Set

The “Hand/Auto” mode (refer to Chapter 5)) is a sub-set of the command data set.

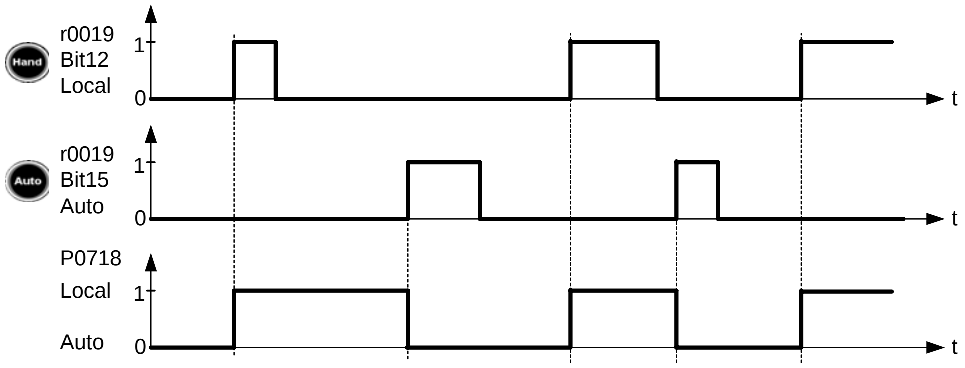
6.3.17.1 Command data set (Local/Remote)

P0718 =...

CO/BO: Hand / Auto — 0

0 automatic mode - i.e. the control (open-loop) via analog and digital inputs
1 manual mode – i.e. control via the BOP-2

This parameter can be modified using the “Hand/Auto” buttons on the BOP-2.



Default: P0810 = 718:0 ⇒ Local/Auto ⇔ CDS1/CDS2

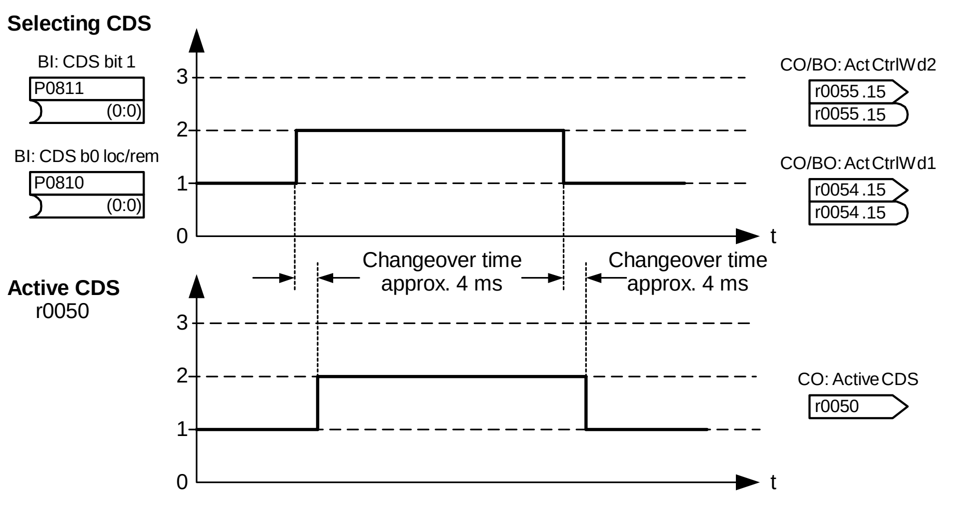
P0718 = 0 : P0700[0] = 2 (Terminal)
P1000[0] = 2 (ADC)

P0718 = 1 : P0700[1] = 1 (BOP)
P1000[1] = 1 (MOP)

P0810 =...

Command data set CDS bit 0 (local / remote) — 0

Selects the command source in which bit 0 should be read-out to select a command data set (CDS).



The currently active command data set (CDS) is displayed using parameter r0050.

P0811 =...

BI: CDS bit 1 — 0:0

Selects command source from which to read Bit 1 for selecting a command data set (see P0810).

Example for CDS changeover:

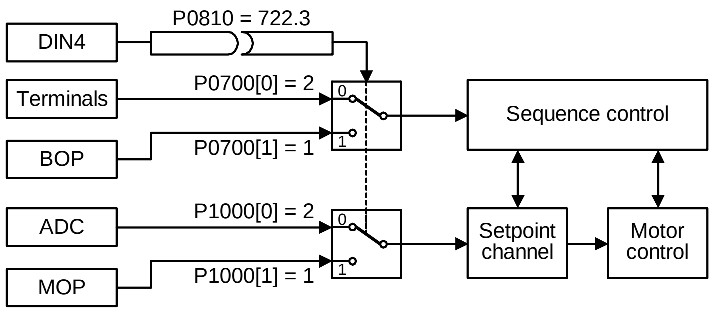
CDS1: Command source via terminals and setpoint source via analog input (ADC)

CDS2: Command source via BOP-2 and setpoint source via MOP

CDS changeover is realized using digital input 4 (DIN 4)

Steps:

1. Carry-out commissioning for CDS1 (P0700[0] = 2 and P1000[0] = 2)
2. Connect P0810 (P0811 if required) to the CDS changeover source (P0704[0] = 99, P0810 = 722.3)
3. Copy from CDS1 to CDS2 (P0809[0] = 0, P0809[1] = 1, P0809[2] = 2)
4. Adapt CDS2 parameters (P0700[1] = 1 and P1000[1] = 1)

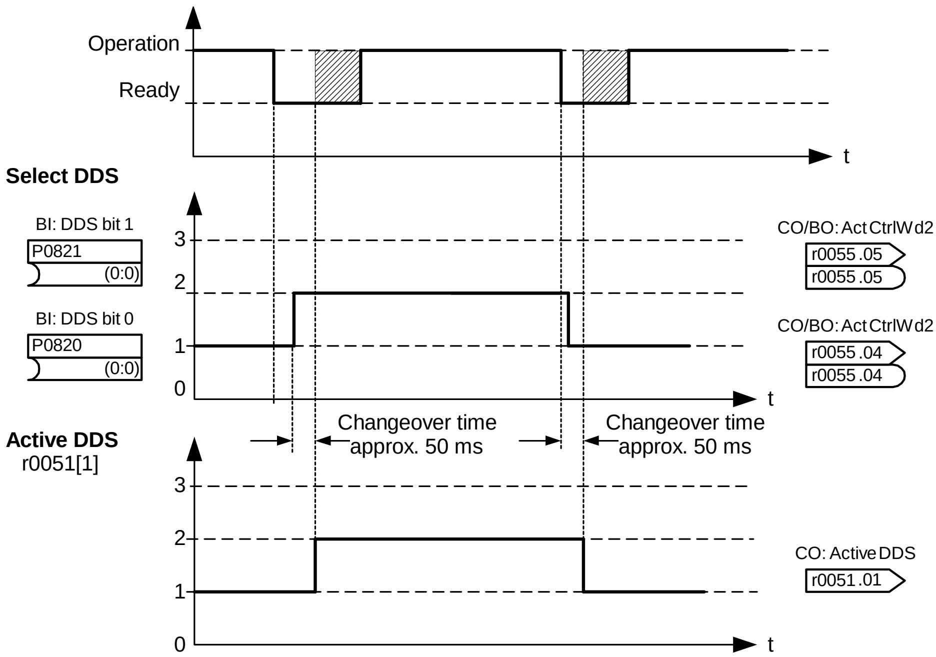


6.3.17.2 Drive data set (DDS)

P0820 = ...

Drive data set (DDS) bit 0 0

Selects the command source from which bit 0 should be read-out to select a drive data set.



The currently active drive data set (DDS) is displayed using parameter r0051[1].

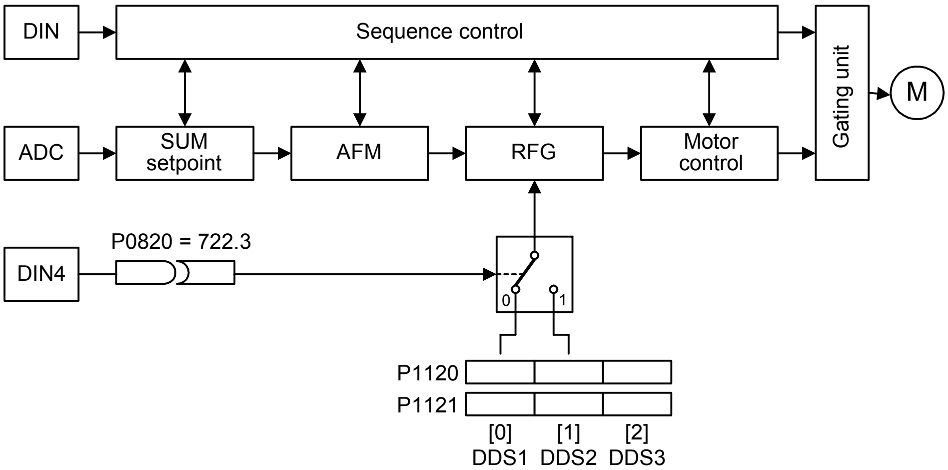
P0821 = ...

BI: DDS bit 1 0:0

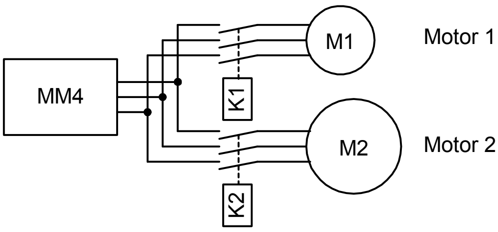
Selects command source from which Bit 1 for selecting a drive data set is to be read in (see parameter P0820).

Example:

1. Commissioning steps with a motor:
   - Carry-out commissioning at DDS1.
   - Connect P0820 (P0821 if required) to the DDS changeover source (e.g. using DIN 4: P0704[0] = 99, P0820 = 722.3).
   - Copy DDS1 to DDS2 (P0819[0] = 0, P0819[1] = 1, P0819[2] = 2).
   - Adapt DDS2 parameters (e.g. ramp-up / ramp-down times P1120[1] and P1121[1]).



2. Commissioning steps with 2 motors (motor 1, motor 2):
   - Commission motor 1; adapt the remaining DDS1 parameters.
   - Connect P0820 (P0821 if required) to the DDS changeover source (e.g. via DIN 4: P0704[0] = 99, P0820 = 722.3).
   - Changeover to DDS2 (check using r0051).
   - Commission motor 2; adapt the remaining DDS2 parameters.



6.3.18 Diagnostic parameters

r0021

CO: Act. filtered frequency
Displays actual inverter output frequency (r0021) excluding slip compensation, resonance damping and frequency limitation.

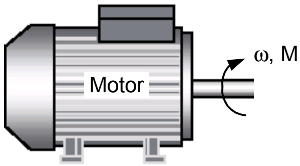
r0022

Act. filtered rotor speed
Displays calculated rotor speed based on inverter output frequency [Hz] x 120 / number of poles.

$$r0022\,[1/min] = r0021\,[Hz] \cdot \frac{60}{r0313}$$

r0032

CO: Act. filtered power
Displays motor power (power output at the motor shaft).



$$P_{mech} = \omega \cdot M = 2 \cdot \pi \cdot f \cdot M$$
$$\Rightarrow$$
$$r0032\,[kW] = \frac{1}{1000} \cdot 2 \cdot \pi \cdot \frac{r0022}{60}\,[1/min] \cdot r0031\,[Nm]$$

$$r0032\,[hp] = 0.75 \cdot r0032\,[kW]$$

r0035

CO: Motor temperature
Displays the measured motor temperature in °C.

r0036

CO: Frequency inverter utilization
Displays the frequency inverter utilization as a % referred to the overload. In so doing, the value is calculated using the I^2t model.
The I^2t actual value relative to the maximum possible I^2t value provides the level of utilization.

r0039

CO: Energy consumpt. meter [kWh]
Displays electrical energy used by inverter since display was last reset.

$$r0039 = \int_0^{t_{ist}} P_W \cdot dt = \int_0^{t_{ist}} \sqrt{3} \cdot u \cdot i \cdot \cos\varphi \cdot dt$$

r0052

CO/BO: Act. status word 1
Displays the first active status word (ZSW) of the frequency inverter (bit format) and can be used to diagnose the inverter status.

Bit00	Drive ready	0	NO	1	YES
Bit01	Drive ready to run	0	NO	1	YES
Bit02	Drive running	0	NO	1	YES
Bit03	Drive fault active	0	NO	1	YES
Bit04	OFF2 active	0	YES	1	NO
Bit05	OFF3 active	0	YES	1	NO
Bit06	ON inhibit active	0	NO	1	YES
Bit07	Drive warning active	0	NO	1	YES
Bit08	Deviation setpoint / act. value	0	YES	1	NO
Bit09	PZD control	0	NO	1	YES
Bit10	Maximum frequency reached	0	NO	1	YES
Bit11	Warning: Motor current limit	0	YES	1	NO
Bit12	Motor holding brake active	0	NO	1	YES
Bit13	Motor overload	0	YES	1	NO
Bit14	Motor runs right	0	NO	1	YES
Bit15	Inverter overload	0	YES	1	NO

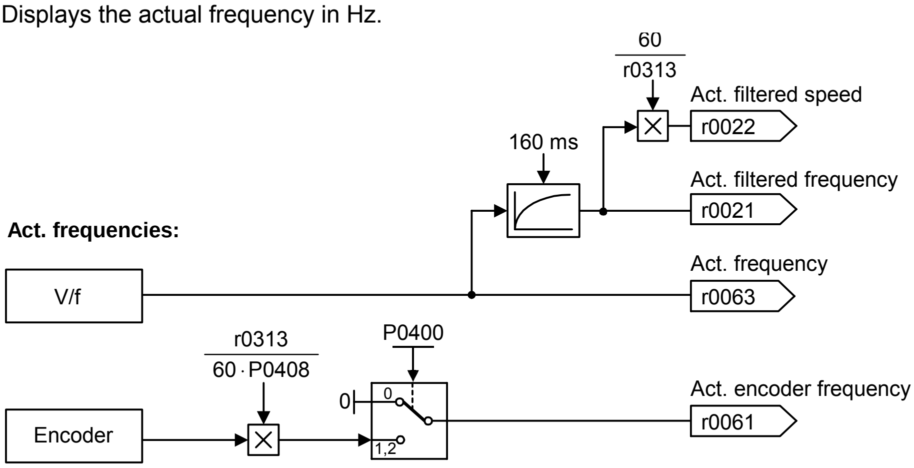
r0054

CO/BO: Control word 1
Displays the first control word (STW) of the frequency inverter and can be used to display the active commands.

Bit00	ON/OFF1	0	NO	1	YES
Bit01	OFF2: Electrical stop	0	YES	1	NO
Bit02	OFF3: Fast stop	0	YES	1	NO
Bit03	Pulse enable	0	NO	1	YES
Bit04	RFG enable	0	NO	1	YES
Bit05	RFG start	0	NO	1	YES
Bit06	Setpoint enable	0	NO	1	YES
Bit07	Fault acknowledge	0	NO	1	YES
Bit10	Control from PLC	0	NO	1	YES
Bit11	Reverse (setpoint inversion)	0	NO	1	YES
Bit13	Motor potentiometer MOP up	0	NO	1	YES
Bit14	Motor potentiometer MOP down	0	NO	1	YES
Bit15	CDS Bit 0 (Local/Remote)	0	NO	1	YES

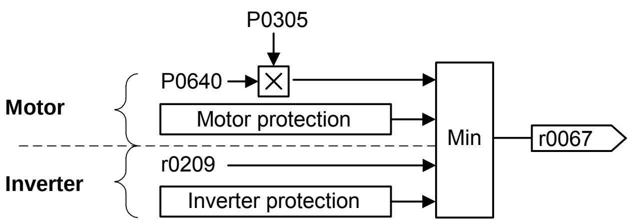
r0063

CO: Actual frequency
Displays the actual frequency in Hz.



r0067

CO: Act. output current limit
Displays valid maximum output current of inverter.



r1114

CO: Freq. setpoint after dir. ctrl.
Displays the setpoint (reference) frequency in Hz after the function block to reverse the direction of rotation.

r1170

CO: : Frequency setpoint after RFG
Displays the total frequency setpoint (reference value) in Hz after the ramp-function generator.

6.4 Series commissioning

An existing parameter set can be transferred to a MICROMASTER 430 frequency inverter using STARTER or DriveMonitor (refer to Section 4.1 "Establishing communications MICROMASTER 430 ⇔ STARTER").

Typical applications for series commissioning include:

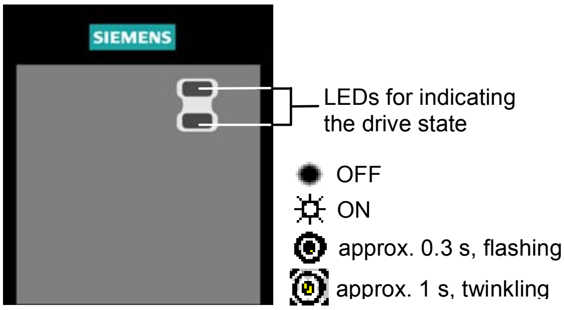
1. If several drives are to be commissioned that have the same configuration and same functions. A quick / application commissioning (first commissioning) must be carried-out for the first drive. Its parameter values are then transferred to the other drives.
2. When replacing MICROMASTER 430 frequency inverters.

6.5 Parameter reset of factory setting

START		
P0003 = 1	**User access level** 1 Standard	1
P0004 = 0	**Parameter filter** 0 All parameters	0
P0010 = 30	**Commissioning parameter** 30 Factory setting	0
P0970 = 1	**Factory reset** 0 disabled 1 Parameter reset	0
buSY	The drive inverter carries-out a parameter reset (duration, approx. 10 s) and then automatically exits the reset menu and sets: P0970 = 0 : disabled P0010 = 0 : ready	
END		

7 Displays and messages

7.1 LED status display



● ●	Mains not present	☼ ⊚	Fault inverter temperature
☼ ☼	Ready to run	⊚ ⊚	Warning current limit both LEDs twinkling **same time**
● ☼	Inverter fault other than the ones listed below	⊚ ⊚	Other warnings both LEDs twinkling **alternatively**
☼ ●	Inverter running	⊚ ◉	Undervoltage trip / undervoltage warning
● ⊚	Fault overcurrent	◉ ⊚	Drive is not in ready state
⊚ ●	Fault overvoltage	◉ ◉	ROM failure both LEDs flashing **same time**
⊚ ☼	Fault motor overtemperature	◉ ◉	RAM failure both LEDs flashing **alternatively**

7.2 Fault messages and Alarm messages

Fault	Significance
F0001	Overcurrent
F0002	Overvoltage
F0003	Undervoltage
F0004	Inverter Overtemperature
F0005	Inverter I^2t
F0011	Motor Overtemperature I^2t
F0012	Inverter temp. signal lost
F0015	Motor temperature signal lost
F0020	Mains Phase Missing
F0021	Earth fault
F0022	HW monitoring active
F0023	Output fault
F0030	Fan has failed
F0035	Auto restart after n
F0041	Motor Data Identification Failure
F0051	Parameter EEPROM Fault
F0052	Power stack Fault
F0053	IO EEPROM Fault
F0054	Wrong IO Board
F0060	Asic Timeout
F0070	CB setpoint fault
F0071	USS (BOP-2 link) setpoint fault
F0072	USS (COM link) setpoint fault
F0080	ADC lost input signal
F0085	External Fault
F0090	Encoder feedback loss
F0101	Stack Overflow
F0221	PID Feedback below min. value
F0222	PID Feedback above max. value
F0450	BIST Tests Failure (Service mode only)
F0452	Belt Failure Detected

Alarm	Significance
A0501	Current Limit
A0502	Overvoltage limit
A0503	Undervoltage Limit
A0504	Inverter Overtemperature
A0505	Inverter I^2t
A0511	Motor Overtemperature I^2t
A0522	I2C read out timeout
A0523	Output fault
A0541	Motor Data Identification Active
A0590	Encoder feedback loss warning
A0600	RTOS Overrun Warning
A0700	CB warning 1
…	
A0709	CB warning 10
A0710	CB communication error
A0711	CB configuration error
A0910	Vdc-max controller de-activated
A0911	Vdc-max controller active
A0912	Vdc-min controller active
A0920	ADC parameters not set properly
A0921	DAC parameters not set properly
A0922	No load applied to inverter
A0952	Belt Failure Detected

Information about MICROMASTER 430 is also available from:

Regional Contacts

Please get in touch with your contact for Technical Support in your Region for questions about services, prices and conditions of Technical Support.

Central Technical Support

The competent consulting service for technical issues with a broad range of requirements-based services around our products and systems.

Europe / Africa

Tel: +49 (0) 180 5050 222

Fax: +49 (0) 180 5050 223

Email: adsupport@siemens.com

America

Tel: +1 423 262 2522

Fax: +1 423 262 2589

Email: simatic.hotline@sea.siemens.com

Asia / Pacific

Tel: +86 1064 757 575

Fax: +86 1064 747 474

Email: adsupport.asia@siemens.com

Online Service & Support

The comprehensive, generally available information system over the Internet, from product support to service & support to the support tools in the shop.

http://www.siemens.com/automation/service&support

Internet Address

Customers can access technical and general information under the following address:
http://www.siemens.com/micromaster

Siemens AG
Bereich Automation and Drives (A&D)
Geschäftsgebiet Standard Drives (SD)
Postfach 3269, D-91050 Erlangen
Bundesrepublik Deutschland