

## PowerXL™

### DC1...E1 Variable Frequency Drives I/O Configuration



Level 2	<p>1 – Fundamental – No previous experience necessary</p> <p>2 – Basic – Basic knowledge recommended</p> <p>3 – Advanced – Reasonable knowledge required</p> <p>4 – Expert – Good experience recommended</p>
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## Danger! - Dangerous electrical voltage!

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Cover or enclose any adjacent live components.
- Follow the engineering instructions (AWA/IL) for the device concerned.
- Only suitably qualified personnel in accordance with EN 50110-1/-2 (VDE 0105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE, PES) must be connected to the protective earth (PE) or the potential equalization. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference does not impair the automatic control functions.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that an open circuit on the signal side does not result in undefined states.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specification, otherwise this may cause malfunction and/or dangerous operation.
- Emergency stop devices complying with IEC/EN 60204-1 must be effective in all operating modes. Unlatching of the emergency-stop devices must not cause a restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been properly installed and with the housing closed.
- Wherever faults may cause injury or material damage, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (e.g. by means of separate limit switches, mechanical interlocks etc.).
- Frequency inverters may have hot surfaces during and immediately after operation.
- Removal of the required covers, improper installation or incorrect operation of motor or frequency inverter may destroy the device and may lead to serious injury or damage.
- The applicable national safety regulations and accident prevention recommendations must be applied to all work carried on live frequency inverters.
- The electrical installation must be carried out in accordance with the relevant electrical regulations (e.g. with regard to cable cross sections, fuses, PE).
- Transport, installation, commissioning and maintenance work must be carried out only by qualified personnel (IEC 60364, HD 384 and national occupational safety regulations).
- Installations containing frequency inverters must be provided with additional monitoring and protective devices in accordance with the applicable safety regulations. Modifications to the frequency inverters using the operating software are permitted.
- All covers and doors must be kept closed during operation.
- To reduce the hazards for people or equipment, the user must include in the machine design measures that restrict the consequences of a malfunction or failure of the frequency inverter (increased motor speed or sudden standstill of motor). These measures include:
  - Other independent devices for monitoring safety related variables (speed, travel, end positions etc.).
  - Electrical or non-electrical system-wide measures (electrical or mechanical interlocks).
  - Never touch live parts or cable connections of the frequency inverter after it has been disconnected from the power supply. Due to the charge in the capacitors, these parts may still be alive after disconnection. Consider appropriate warning signs.

## Disclaimer

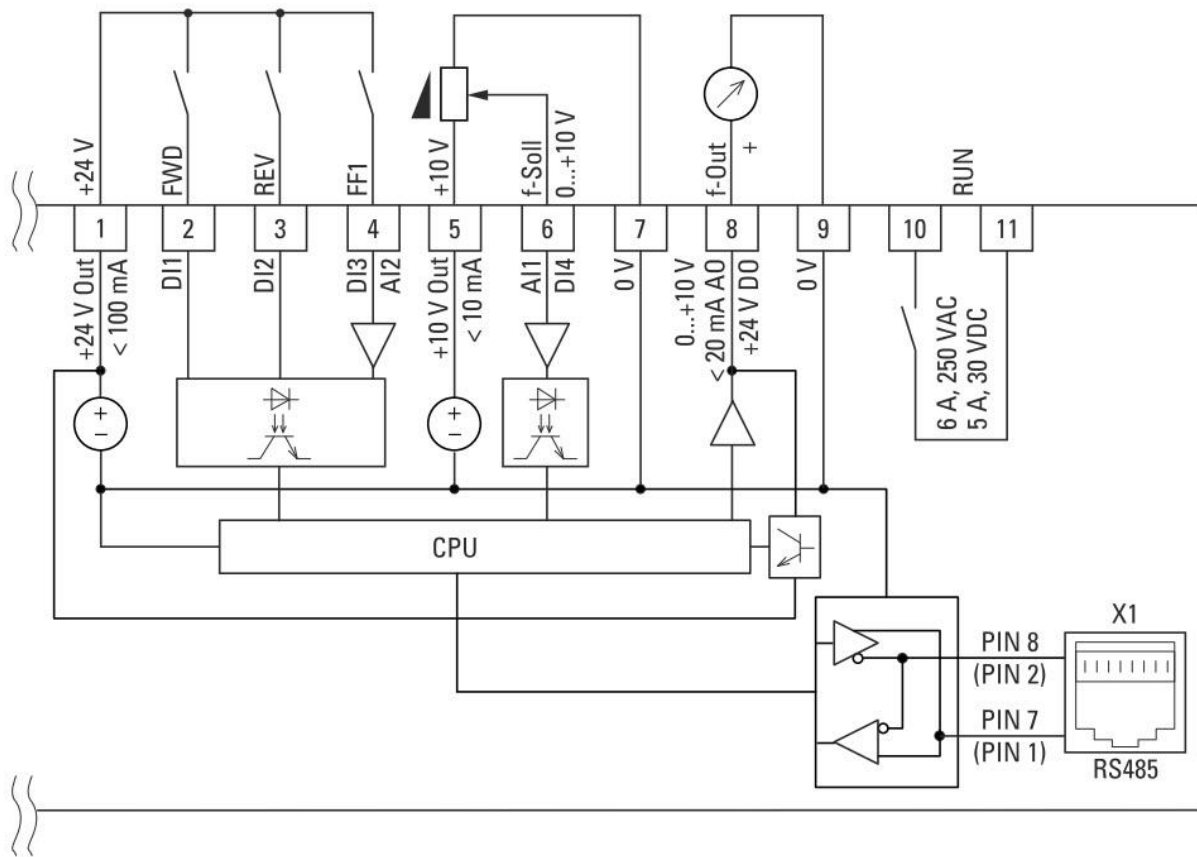
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# 1 General

Devices of the series **PowerXL™ DC1...E1** can be configured by parameterization to comply with the demands of the application. Not only internal variables like ramp times or speed are changed. It is also possible to modify the assignment of functions to control terminals. This possibility is universal inside the DC1...E1 series and does not depend on the power rating.

This Application Note describes:

- the existing input and output terminals
- the possibility to extend the number of I/Os or to modify their kind
- the technical data
- the assignment of functions to terminals
- the configuration of the I/Os



Wiring diagram of a variable frequency drive DC1...E1 with default settings

## 2 Hardware

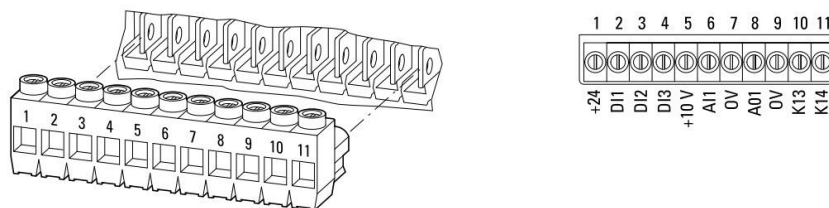
### 2.1 Designation of the control terminals and technical data basic unit DC1...E1

	Designation	Function		Default
Basic unit DC1...E1	1 (+24 V)	Control voltage for the digital inputs	100 mA max. Signal common: 0 V (terminals 7 and 9)	-
	2 (DI1)	Digital input 1	8 ... 30 V = High, $R_i > 6 \text{ k}\Omega$	FWD
	3 (DI2)	Digital input 2	8 ... 30 V = High, $R_i > 6 \text{ k}\Omega$	REV
	4 (DI3)	Analog input 2 or digital input 3	analog: 0 ... 10 V, $R_i > 72 \text{ k}\Omega$ 0/4 ... 20 mA, $R_B = 500 \Omega$ digital: 8...30 V = High, $R_i > 72 \text{ k}\Omega$	Select AI1REF / f-fix
	5 (+10 V)	Reference voltage	10 mA max. Signal common: 0 V (terminals 7 and 9)	-
	6 (AI1 / DI4)	Analog input 1 or digital input 4	analog: 0 ... 10 V, $R_i > 72 \text{ k}\Omega$ 0/4 ... 20 mA, $R_B = 500 \Omega$ digital: 8...30 V = High, $R_i > 72 \text{ k}\Omega$	AI1REF (analog, 0 ... 10 V)
	7 (0 V)	Signal common for all digital and analog inputs and outputs, together with terminal 9		-
	8 (AO1 / DO1)	Analog output 1 or digital output 1	analog: 0 ... 10 V, 20 mA max digital: 0 / 24 V, 20 mA max	Output frequency (analog, 0 ... 10 V)
	9 (0 V)	Signal common for all digital and analog inputs and outputs, together with terminal 7		-
	10 (K13)	Relay RO1 NO	250 V, 6 A AC / 30 V, 5 A DC	RUN, device enabled
	11 (K14)			

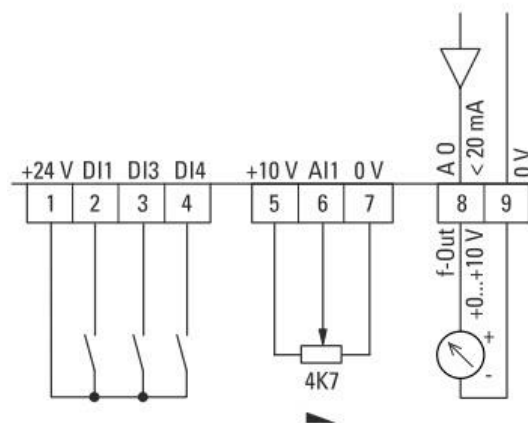
## 2.2 Connections

### 2.2.1 Terminal block for the control signals

The terminal block for the control signals is pluggable.

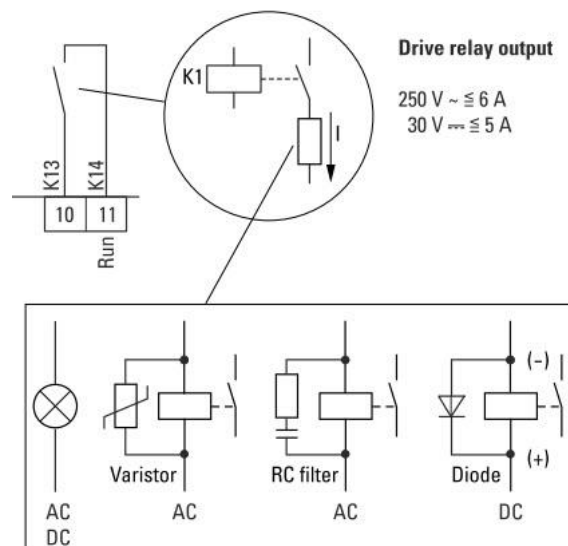


## 2.2.2 Wiring example



## 2.2.3 Relay output

Depending on the kind of load, we recommend the use of protection circuitry for the relay outputs.



## 2.3 Modification of the I/O configuration with option modules

The I/O configuration of the variable frequency drives DC1...E1 can be modified by using option modules. This is valid for the number of outputs as well as for the kind of signals.

- DXC-EXT 2RO converts the static output at the terminals 8 and 9 into a relay output.
- DXA-EXT-2RO1AO „RUN“ and „Trip because of a fault“ message with two separate relay contacts
- DXA-EXT-IO110 enables the use of control signals 100 ... 120 V
- DXA-EXT-IO230 enables the use of control signals 200 ... 240 V

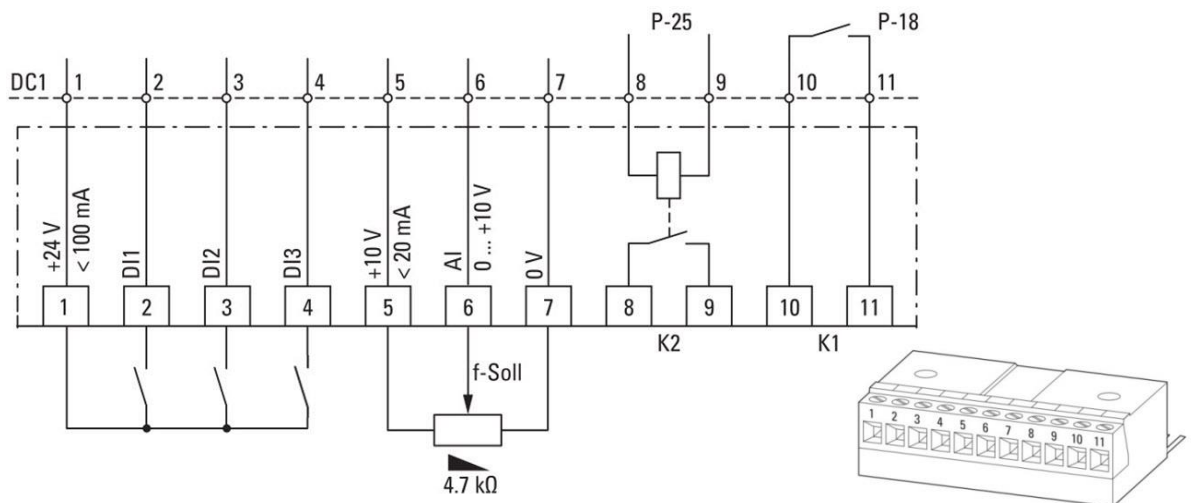
### 2.3.1 Mounting of the option modules

The option modules are the same for all frame sizes. They are inserted into the terminal block of the basic device DC1...E1 and fixed with screws. The control wiring is connected to the option module.

### 2.3.2 Designation of the terminals and technical data

#### 2.3.2.1 DC1...E1 + DXC-EXT-2RO (Relay instead of static output at the terminals 8 and 9)

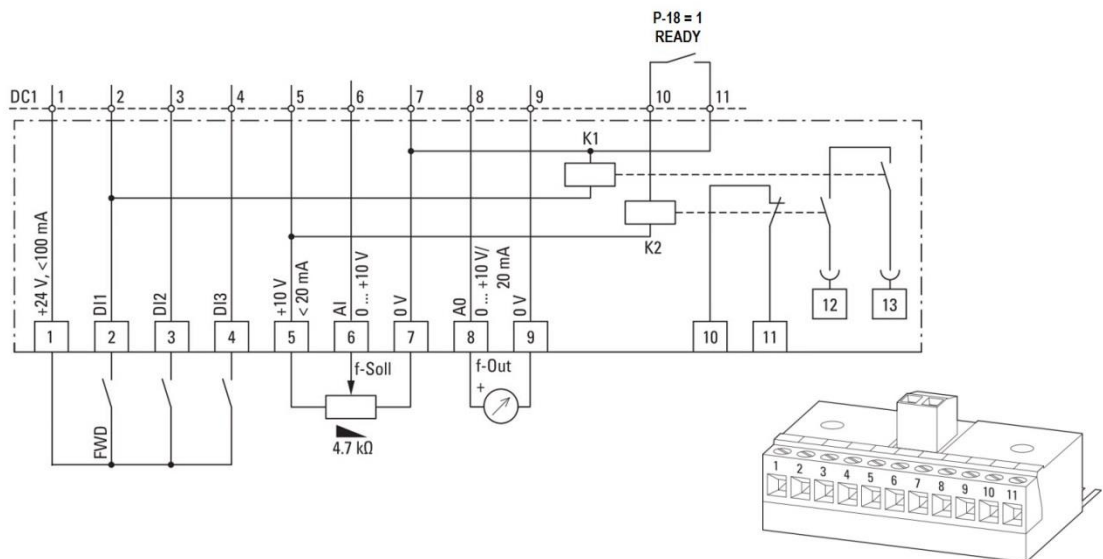
	Designation	Function		Default
Basic unit DC1...E1 + DXC-EXT-2RO	1 (+24 V)	Control voltage for the digital inputs	100 mA max. Signal common: 0 V (terminal 7)	-
	2 (DI1)	Digital input 1	8 ... 30 V = High, $R_i > 6 \text{ k}\Omega$	FWD
	3 (DI2)	Digital input 2	8 ... 30 V = High, $R_i > 6 \text{ k}\Omega$	REV
	4 (AI2 / DI3)	Analog input 2 or digital input 3	analog: 0 ... 10 V, $R_i > 72 \text{ k}\Omega$ 0/4 ... 20 mA, $R_B = 500 \Omega$ digital: 8...30 V = High, $R_i > 72 \text{ k}\Omega$	Select AI1REF / f-fix
	5 (+10 V)	Reference voltage	10 mA max. Signal common: 0 V (terminal 7)	-
	6 (AI1 / DI4)	Analog input 1 or digital input 4	analog: 0 ... 10 V, $R_i > 72 \text{ k}\Omega$ 0/4 ... 20 mA, $R_B = 500 \Omega$ digital: 8...30 V = High, $R_i > 72 \text{ k}\Omega$	AI1REF (analog, 0 ... 10 V)
	7 (0 V)	Signal common for all digital and analog inputs and outputs		-
	8 (K23)	Relay RO2 (NO)	250 V, 1 A AC / 220 V, 1 A DC	-
	9 (K24)			
	10 (K13)	Relay RO1 (NO)	250 V, 6 A AC / 30 V, 5 A DC	RUN, device enabled
11 (K14)				



Depending on the kind of load, we recommend the use of protection circuitry for the relay outputs (see 2.2.3).

**2.3.2.2 DC1...E1 + DXC-EXT-2RO1AO (additional relay output at the terminals 12 and 13)**

	Designation	Function	Default	
Basic device DC1...E1 + DXC-EXT-	1 (+24 V)	Control voltage for the digital inputs	100 mA max. Signal common: 0 V (terminals 7 and 9)	-
	2 (DI1)	Digital input 1	8 ... 30 V = High, $R_i > 6 \text{ k}\Omega$	FWD
	3 (DI2)	Digital input 2	8 ... 30 V = High, $R_i > 6 \text{ k}\Omega$	REV
	4 (AI2 / DI3)	Analog input 2 or digital input 3	analog: 0 ... 10 V, $R_i > 72 \text{ k}\Omega$ 0/4 ... 20 mA, $R_B = 500 \Omega$ digital: 8...30 V = High, $R_i > 72 \text{ k}\Omega$	Select AI1REF / f-fix
	5 (+10 V)	Reference voltage	10 mA max. Signal common: 0 V (terminals 7 and 9)	-
	6 (AI1 / DI4)	Analog input 1 or digital input 4	analog: 0 ... 10 V, $R_i > 72 \text{ k}\Omega$ 0/4 ... 20 mA, $R_B = 500 \Omega$ digital: 8...30 V = High, $R_i > 72 \text{ k}\Omega$	AI1REF (analog, 0 ... 10 V)
	7 (0 V)	Signal common for all digital and analog inputs and outputs, together with terminal 9		-
	8 (AO1 / DO1)	Analog output 1 or digital output 1	analog: 0 ... 10 V, 20 mA max digital: 0 / 24 V, 20 mA max	Output frequency (analog, 0 ... 10 V)
	9 (0 V)	Signal common for all digital and analog inputs and outputs, together with terminal 7		-
	10 (K13)	Relay RO1 (NC)	250 V, 1 A AC / 220 V, 1 A DC	see 3.2.2.2
	11 (K14)			
12 (K23)	Relay RO2 (NO)	250 V, 1 A AC / 220 V, 1 A DC	see 3.2.2.2	
13 (K24)				

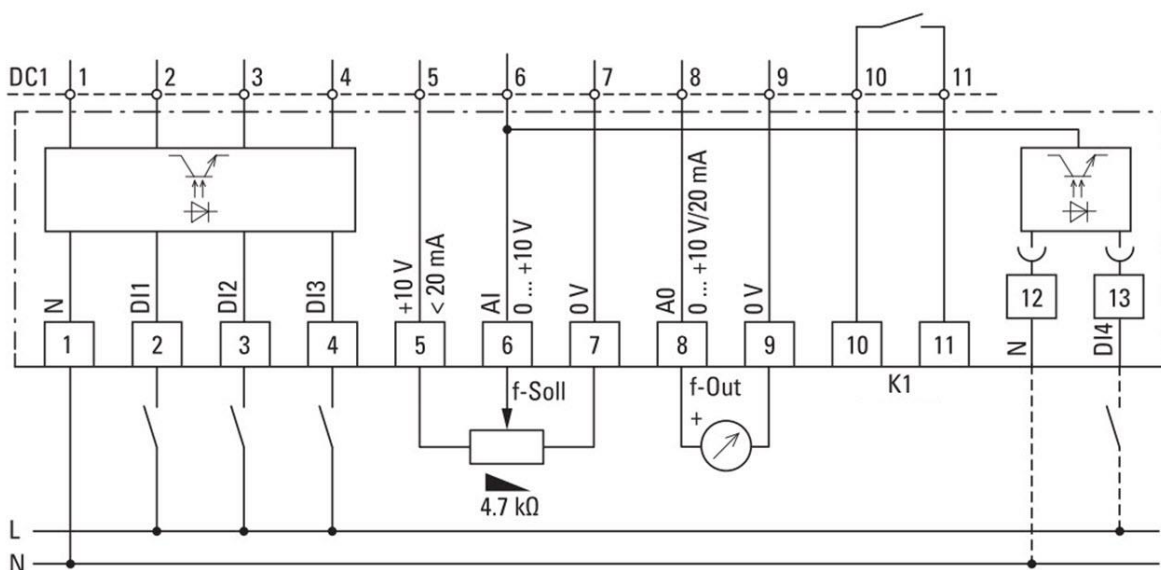


Depending on the kind of load, we recommend the use of protection circuitry for the relay outputs (see 2.2.3).

**2.3.2.3 DC1...E1 + DXC-EXT-IO110 or DC1...E1 + DXC-EXT-IO230 (Inputs for 110V resp. 230 V)**

	Designation	Function	Default	
Basic device DC1...E1 + DXC-EXT-IO110	1 (N)	Signal common for the digital inputs DI1 ... DI3		
	2 (DI1)	Digital input 1	DXC-EXT-IO110: 100 V – 10 % ... 120 V + 10 % DXC-EXT-IO230: 200 V – 10 % ... 240 V + 10 %	
	3 (DI2)	Digital input 2		
	4 (DI3)	Digital input 3		
	5 (+10 V)	Reference voltage	10 mA max. Signal common: 0 V (terminals 7 and 9)	-
	6 (AI1)	Analog input 1 <sup>1)</sup>	analog: 0 ... 10 V, R <sub>i</sub> > 72 kΩ 0/4 ... 20 mA, R <sub>B</sub> = 500 Ω	AI1REF (analog, 0 ... 10 V)
	7 (0 V)	Signal common for all digital and analog inputs and outputs, together with terminal 9		-
	8 (AO1 / DO1)	Analog output 1 or digital output 1	analog: 0 ... 10 V, 20 mA max digital: 0 / 24 V, 20 mA max	Output frequency (analog, 0 ... 10 V)
	9 (0 V)	Signal common for all digital and analog inputs and outputs, together with terminal 7		-
	10 (K13)	Relay RO1 (NO)	250 V, 1 A AC / 50 V, 1 A DC	RUN, device enabled
	11 (K14)			
	12 (N)	Signal common for the digital input DI4		-
	13 (DI4)	Digital input 4 <sup>1)</sup>	DXC-EXT-IO110: 100 V – 10 % ... 120 V + 10 % DXC-EXT-IO230: 200 V – 10 % ... 240 V + 10 %	-

<sup>1)</sup> The simultaneous use of analog input 1 (terminal 6) and digital input 4 (terminals 12 and 13) is forbidden. Function according to the setting with P-15.



Depending on the kind of load, we recommend the use of protection circuitry for the relay outputs (see 2.2.3).

### 3 Configuration

The table gives an overview, how to determine the function of the single I/Os.

	Designation	Selection / setting of				
		Function	Format (signal range)	Scaling (gain)	Offset	Hysteresis
Basic unit	1 (+24 V)	fixed	-	-	-	-
	2 (DI1)	P-12 / P-15	-	-	-	-
	3 (DI2)		-	-	-	-
	4 (AI2 / DI3)		P-47	-	-	-
	5 (+10 V)	fixed	-	-	-	-
	6 (AI1 / DI4)	P-12 / P-15	P-16	P-35	P-39	-
	7 (0 V)	fixed	-	-	-	-
	8 (AO1 / DO1)	P-25	-	-	-	-
	9 (0 V)	fixed	-	-	-	-
	10 (K13)	P-18	-	-	-	P-19 / P-54 / P-55
	11 (K14)					

	Designation	Selection / setting of				
		Function	Format (signal range)	Scaling (gain)	Offset	Hysteresis
DC1...E1 + DXC-EXT-2RO	1 (+24 V)	fixed	-	-	-	-
	2 (DI1)	P-12 / P-15	-	-	-	-
	3 (DI2)		-	-	-	-
	4 (AI2 / DI3)		P-47	-	-	-
	5 (+10 V)	fixed	-	-	-	-
	6 (AI1 / DI4)	P-12 / P-15	P-16	P-35	P-39	-
	7 (0 V)	fixed	-	-	-	-
	8 (K23)	P-25	-	-	-	-
	9 (K24)					
	10 (K11)	P-18	-	-	-	P-19 / P-54 / P-55
	11 (K12)					

	Designation	Selection / setting of				
		Function	Format (signal range)	Scaling (gain)	Offset	Hysteresis
DC1...E1 + DXC-EXT-	1 (+24 V)	fixed	-	-	-	-
	2 (DI1)	P-12 / P-15	-	-	-	-
	3 (DI2)		-	-	-	-
	4 (AI2 / DI3)		P-47	-	-	-
	5 (+10 V)	fixed	-	-	-	-
	6 (AI1 / DI4)	P-12 / P-15	P-16	P-35	P-39	-
	7 (0 V)	fixed	-	-	-	-
	8 (AO1 / DO1)	P-25	-	-	-	-
	9 (0 V)	fixed	-	-	-	-
	10 (K11)	P-18 = 1	-	-	-	P-19 / P-54 / P-55
	11 (K12)					
	12 (K23)	fixed	-	-	-	-
	13 (K24)					

	Designation	Selection / setting of				
		Function	Format (signal range)	Scaling (gain)	Offset	Hysteresis
DC1...E1 + DXC-EXT-IO110 (-	1 (+24 V)	fixed	-	-	-	-
	2 (DI1)	P-12 / P-15	-	-	-	-
	3 (DI2)		-	-	-	-
	4 (DI3)		-	-	-	-
	5 (+10 V)	fixed	-	-	-	-
	6 (AI1)	P-12 / P-15	P-16	P-35	P-39	-
	7 (0 V)	fixed	-	-	-	-
	8 (AO1 / DO1)	P-25	-	-	-	-
	9 (0 V)	fixed	-	-	-	-
	10 (K11)	P-18	-	-	-	P-19 / P-54 / P-55
	11 (K12)		-	-	-	
	12 (N)	fixed	-	-	-	-
	13 (DI4)	P-12 / P-15	-	-	-	-

### 3.1 Inputs

The determination of the input functions is done with parameter “DI Config Select” (P-15). There are 13 predefined combinations, which cover the majority of applications.

The available terminal combinations depend on the selection of the “Local ProcessData Source” (P-12). The information given for P-15 below refer to terminal mode (P-12 = 0) only. The possible terminal combinations for settings different from P-12 = 0 can be found in chapter 3 “Control terminals” of the parameter manual MN040Z0022Z-EN.

#### 3.1.1 Digital inputs

PNU	Parameter	Name	Range	Default
423.0	P-15	DI Config Select	0 ... 17	5

P-12 = 0: Terminal mode				
P-15	DI1 (Terminal 2)	DI2 (Terminal 3)	DI3/AI2 (Terminal 4)	DI4/AI1 (Terminal 6)
0	START	DIR	Select AI1 REF / f-Fix1	AI1 REF
1	FWD	Select AI1 REF / f-Fix	Select f-Fix Bit0	AI1 REF
2	FWD	Select f-Fix Bit0	Select f-Fix Bit1	Select f-Fix / f-max
3	FWD	Select AI1 REF / f-Fix1	EXTFLT	AI1 REF
4	FWD	Select AI1 REF / AI2 REF	AI2 REF	AI1 REF
5	FWD	REV	Select AI1 REF / f-Fix1	AI1 REF
6	START	DIR	EXTFLT	AI1 REF
7	FWD	REV	EXTFLT	AI1 REF
8	START	DIR	Select f-Fix Bit0	Select f-Fix Bit1
9	FWD	REV	Select f-Fix Bit0	Select f-Fix Bit1
10	Pulse FWD (NO)	Pulse STOP (NC)	Select AI1 REF / f-Fix1	AI1 REF
11	Pulse FWD (NO)	Pulse STOP (NC)	Pulse REV (NO)	AI1 REF
12	FWD	Select t-dec / t-QuickDec	Select AI1 REF / f-Fix1	AI1 REF
13	FWD	Select f-Fix Bit0	EXTFLT	Select f-Fix Bit1
14	Pulse FWD (NO)	Pulse STOP (NC)	Pulse REV (NO)	Select DIG REF / f-Fix1
15	FWD	Select f-Fix4 / AI1 REF	Select Fire Mode / Normal OP	AI1 REF
16	START	Select f-Fix4 / f-Fix2	Select Fire Mode / Normal OP	DIR
17	FWD	Select f-Fix Bit0	Select Fire Mode / Normal OP	Select f-Fix Bit1

For the terminal functions the following abbreviations are used:

Abbreviation	Function
AI1 REF	Analog input AI1 (terminal 6) is used as speed reference input. P-16: Format (voltage input / current input ...) P-35: Scaling P-39: Offset
AI2 REF	Analog input AI2 (terminal 4) is used as speed reference input. P-47: Format (voltage input / current input ...)
DIR	Used for the selection of the sense of rotation in connection with the START command. Low = cw (FWD ) High = ccw (REV) ATTENTION: in case of a wire break the drive reverses in case REV is selected! Alternative: use configuration with FWD/REV.
DOWN	“Reduce speed” command, when a digital reference is selected (P-12 = 1 or 2). Used in combination with the command UP.
ENA	Enable variable frequency drive. To start the drive an additional start signal (START, FWD, REV) is necessary. When removing ENA, the motor coasts to stop.
EXTFLT	External fault. Enables the inclusion of an external signal into the fault messages of the variable frequency drive. During operation a High signal must be applied to the terminal. A Low signal leads to a trip with the message “E-Err IP”.
FWD	START with a clockwise rotating field (FWD = Forward). When applying a High signal to the respective terminal, the drive accelerates with the predefined ramp. Removing the signal leads to a stop. The stop behavior depends on the setting of P-05 “Stop Mode”. At standstill the variable frequency drive is disabled. In applications with two directions, counter clockwise rotation is selected with REV. FWD and REV are logically connected (XOR). Applying both signals at the same time leads to a Quick Stop with the ramp defined with P-24.
INV	Inversion of the sense of rotation. During the change of direction the predefined ramps are active. Low = no inversion, High = Inversion
Pulse FWD (NO) Pulse REV (NO) Pulse STOP (NC)	Pulse control. The control of the drive is done with pulses, similar to a control of reversing contactors. To run the drive, the signal “PULSE STOP” must always be applied to the terminal. In case of a Low signal, the drive cannot be started, respectively the drive ramps to standstill. To start, only a pulse of the signal “PULSE FWD” or “PULSE REV” is necessary. The signal doesn’t need to be applied constantly during operation. To stop the drive, a short interruption of the signal “PULSE STOP” is sufficient.
REV	START with a counter clockwise rotating field (REV = Reverse). When applying a High signal to the respective terminal, the drive accelerates with the predefined ramp. Removing the signal leads to a stop. The stop behavior depends on the setting of P-05 “Stop Mode”. At standstill the variable frequency drive is disabled. In applications with two directions, clockwise rotation is selected with FWD. FWD and REV are logically connected (XOR). Applying both signals at the same time leads to a Quick Stop with the ramp defined with P-24.

Abbreviation	Function															
Select AI1 REF / AI2 REF	Selection between the analog references AI1 (at terminal 6) and AI2 (at terminal 4). Low = AI1, High = AI2															
Select AI1 REF / f-Fix	Selection between the analog speed reference at analog input AI1 (terminal 6) and a fixed frequency. The fixed frequency itself is selected with the commands "Select f-Fix Bit0 ... 1". Low = analog reference, High = Fixed frequency															
Select AI1 REF / f-Fix1	Selection between the analog speed reference at analog input AI1 (terminal 6) and the fixed frequency 1 (f-Fix1), set with P-20. Low = analog reference, High = f-Fix1															
Select BUS REF / AI1 REF	Selection between a digital reference, set with a keypad or via the commands UP and DOWN and the analog reference AI1 REF (terminal 6). Low: digital reference, High: AI1 REF															
Select BUS REF / f-Fix1	Selection between references. Low = reference from a field bus, High = f-Fix1, set with P-20															
Select DIG REF / AI1 REF	Selection between a digital reference, set with a keypad or via the commands UP and DOWN and the analog reference AI1 REF (terminal 6). Low: digital reference, High: AI1 REF															
Select DIG REF / f-Fix1	Selection between a digital reference, set with a keypad or via the commands UP and DOWN and f-Fix1, set with P-20 Low = digital reference, High = f-Fix1															
Select f-Fix Bit 0 Select f-Fix Bit 1	Selection of the fixed frequency with digital commands. The fixed frequencies f-Fix1 ... f-Fix4 are defined with P-20 ... P-23. <table border="1" data-bbox="544 1055 1177 1240" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>Bit 1</th> <th>Bit 0</th> </tr> </thead> <tbody> <tr> <td>f-Fix 1 (P-20)</td> <td>Low</td> <td>Low</td> </tr> <tr> <td>f-Fix 2 (P-21)</td> <td>Low</td> <td>High</td> </tr> <tr> <td>f-Fix 3 (P-22)</td> <td>High</td> <td>Low</td> </tr> <tr> <td>f-Fix 4 (P-23)</td> <td>High</td> <td>High</td> </tr> </tbody> </table>		Bit 1	Bit 0	f-Fix 1 (P-20)	Low	Low	f-Fix 2 (P-21)	Low	High	f-Fix 3 (P-22)	High	Low	f-Fix 4 (P-23)	High	High
	Bit 1	Bit 0														
f-Fix 1 (P-20)	Low	Low														
f-Fix 2 (P-21)	Low	High														
f-Fix 3 (P-22)	High	Low														
f-Fix 4 (P-23)	High	High														
Select f-fix / f-max	Selection between a fixed frequency and the maximum speed, set with P-01. The fixed frequency itself is selected with the commands "Select f-Fix Bit0 ... 1". Low = Fixed frequency, High = maximum speed															
Select f-fix4 / AI1REF	Selection between fixed frequency f-Fix4, set with P-23 and the analog reference at terminal 6 Low = f-Fix4, High = analog reference															
Select f-fix4 / f-Fix2	Selection between the fixed frequencies f-Fix4 (P-23) and f-Fix2 (P-21) Low = f-Fix4, High = f-Fix2															
Select Fire Mode / Normal OP	The Fire Mode function enables the operation of the variable frequency drive in emergency situations until it cannot work anymore. Potential fault messages are ignored. Low = Fire Mode, High = normal operation															
Select PI REF / AI1 REF	Selection between references. Low = reference from the output of the PID controller, High = AI1															
Select PI REF / f-Fix1	Selection between references. Low = reference from the output of the PID controller, High = f-Fix1, set with P-20															
Select t-dec1 / t-QuickDec	A High signal must be applied to the respective terminal to operate the variable frequency drive. Taking away the signal (Low) a quick stop is performed with the ramp defined with P-24.															

Abbreviation	Function
START	Starts the drive. When applying a High signal to the respective terminal, the drive accelerates with the predefined ramp. Removing the signal leads to a stop. The stop behavior depends on the setting of P-05 "Stop Mode". At standstill the variable frequency drive is disabled. In applications with two directions the commands DIR respectively REV are used.
START INV	In applications with a digital reference from the keypad the drive starts into the direction, which last selected before switching it off the last time. Starting with START INV the motor starts into the opposite direction.
UP	"Increase speed" command, when a digital reference is selected (P-12 = 1 or 2). Used in combination with the command DOWN.

### 3.1.2 Displaying input signals

The status of the inputs can be displayed by selecting the respective parameters.

PNU	Parameter	Name	Range	Default
560.0	P00-01	Analog Input1	0.0 ... 100 % input signal	-
560.1	P00-02	Analog Input2	0.0 ... 100 % input signal	-
550.0 ... 550.3	P00-04	DI1 Status	0 / 1	-

The value, displayed with P00-01, takes also a potential scaling factor (P-35) and an offset (P-39) into account. Example:  $P00-01 = (\text{Signal at AI1 [\%]} - P-39) \cdot P-35$

The display on the keypad can be used to see the status of the digital inputs DI1 ... DI4. It starts with DI1 on the left hand side of the display. □ = Low signal, ! = High signal at the respective input terminal.

Voltages between 8 and 30 V are identified as High signal. If an input is configured as analog input, its status is displayed in P00-04 with □ with voltage levels up to 8 V, above this with !.

When the terminals 6 and/or 4 are configured as digital input, the Parameters P00-01 respectively P00-02 show □□ when a Low signal is applied and !□□ when a High signal is applied.

### 3.1.3 Configuration of the analog inputs

Depending on which terminal configuration is selected with P1-13, up to two analog inputs are available. Both inputs can be adapted to the format (voltage or current) of the analog input signal.

#### 3.1.3.1 Analog input 1

At analog input 1 (terminal 6) it is also possible to take a scaling factor and an offset into account.

- Signal range: Selection of the kind of signal at the analog inputs. The maximum value of the signal corresponds to the maximum speed / frequency set with P-01.
- Gain: With the gain the analog inputs can be scaled. It applies to the value at terminal 6 (AI1) as well as to a possible offset.
- Offset: Offset of the analog input. 100 % corresponds to the maximum speed / frequency set with P-01.

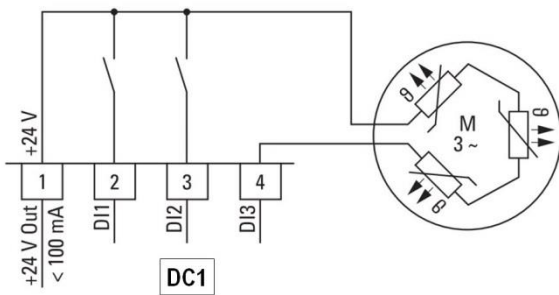
ATTENTION: the offset is subtracted from the value at terminal 6. Means: positive values result in a reduction, negative ones in an increase.

PNU	Parameter	Name	Range	Default
260.0	P-16	AI1 Signal Range	0: 0 ... 10 V ( <i>U 0-10</i> ) 1: bipolar 0 ... 10 V ( <i>- 10- 10</i> ) 2: 0 ... 20 mA ( <i>A 0-20</i> ) 3: t 4 ... 20 mA (trip in case of wire break) ( <i>t 4-20</i> ) 4: r 4 ... 20 mA (ramps to f-Fix1 (P-20) in case of wire break) ( <i>r 4-20</i> ) 5: t 20 ... 4 mA (trip in case of wire break) ( <i>t 20-4</i> ) 6: r 20 ... 4 mA (ramps to f-Fix1 (P-20) in case of wire break) ( <i>r 20-4</i> ) 7: 10 ... 0 V ( <i>U 10-0</i> )	0
261.0	P-35	AI1 Gain	0.0 ... 2000.0 %	100.0 %
262.0	P-39	AI1 Offset	-500.0 % ... + 500.0 %	0.0 %

### 3.1.3.2 Analog input 2

PNU	Parameter	Name	Range	Default
260.1	P-47	AI2 Signal Range	0: 0 ... 10 V ( <i>U 0-10</i> ) 1: 0 ... 20 mA ( <i>A 0-20</i> ) 2: t 4 ... 20 mA (trip in case of wire break) ( <i>t 4-20</i> ) 3: r 4 ... 20 mA (ramps to f-Fix1 (P-20) in case of wire break) ( <i>r 4-20</i> ) 4: t 20 ... 4 mA (trip in case of wire break) ( <i>t 20-4</i> ) 5: r 20 ... 4 mA (ramps to f-Fix1 (P-20) in case of wire break) ( <i>r 20-4</i> ) 6: Thermistor ( <i>Ptc-th</i> )	0

The inputs can be configured in a way, that a thermistor for motor protection can be connected.



Parameter P-15 has to be set in a way, that the function „External Fault“ (EXTFLT) is assigned to terminal 4 (DI3 / AI2). During proper operation, a High signal is applied to terminal 4. In case of fault the temperature contact must open respectively the resistance of the thermistor has to increase. DC1...E1 trips at a resistance of  $\geq 2.5 \text{ k}\Omega$ , Reset can be performed at values  $\leq 1.9 \text{ k}\Omega$ .

The behavior of the relay to indicate a fault depends on the setting of P-47 “AI2 Signal Range”.

Parameter P-47 „AI2 Signal Range“	Fault indication (relay contact opens)	displayed in case of fault
<i>Ptc-th</i>	in case of fault, not depending on the status of the drive	<i>F-Ptc</i>
All other settings	in case of fault AND only when the device is enabled (RUN)	<i>E-tr iP</i>

ATTENTION: Variable frequency drives of the series DC1...E1 are designed according IEC / EN 61800-5-1, which requires double isolation between mains circuits and circuits with low voltage. Inside the drive power part and control part are separated accordingly. In case temperature sensors inside the motor are connected to DC1...E1, the sensors have to be double isolated against the motor windings, not to weaken the overall insulation system!

### 3.1.3.3 Example for the configuration of analog input 1

A speed reference, coming from an external device (4 ... 20 mA), is applied to analog input 1 (terminal 6) of a variable frequency drive DC1...E1. With references below 8 mA the drive shall stand still and it shall reach its max. speed with a signal of 15 mA. In case of a wire break inside the reference circuit, the drive shall trip.

Trip in case of wire break:

„AI1 Signal Range“ (P-16) = 3 (trip in case of wire break) (~~4-20~~)

Scaling factor „AI1 Gain“ (P-35):

Under normal operating conditions (4 mA = standstill, 20 mA = 100 % speed) the current range corresponds to 16 mA (20 mA – 4 mA). In this example the range is 7 mA only (15 mA – 8 mA).

$$P-35 = \frac{20 \text{ mA} - 4 \text{ mA}}{15 \text{ mA} - 8 \text{ mA}} \cdot 100 \% = \frac{16 \text{ mA}}{7 \text{ mA}} \cdot 100 \% = 228.6 \%$$

„AI1 Offset“ (P-39)

The motor shall start to turn at 8 mA of the reference signal. 8 mA normally correspond to 25 % speed reference when using a signal of 4 ... 20 mA. Therefore the offset must be set to 25 %. The sign of the offset is positive, because the offset is subtracted from the input signal.

$$\text{Speed reference, displayed with P00-01} = (\text{Signal at AI1 [\%]} - P-39) \cdot P-35$$

The value doesn't drop below zero and is limited in the upper range by P-01 „f-max“.

## 3.2 Relay outputs

### 3.2.1 Selection of the functionality of RO1

The functionality of the relay on the basic device can be selected with P-18.

For the settings P-18 = 4 ... 7, switch on threshold levels (P-19) and a hysteresis of the relay can be defined.

Switch OFF threshold = „RO1 Upper Limit“ (P-19) – „RO1 Hysteresis“ (P-54)

P-18 = 4 or 5:            output will be logic 1 if the value  $\geq$  “RO1 Upper Limit” , output will be logic 0 if value < Switch OFF threshold

P-18 = 6 or 7:            output will be logic 0 if the value  $\geq$  “RO1 Upper Limit” , output will be logic 1 if value < Switch OFF threshold

P-55 defines a switch-on delay, before the relay switches from logic 0 to logic 1.

PNU	Parameter	Name	Range	Default
451.0	P-18	RO1 Function	0: RUN, enable (FWD/REV) 1: READY, DC1...E1 ready for operation 2: Speed = Speed reference value 3: Fault (DC1...E1 not ready) 4: Speed $\geq$ RO1 Upper Limit (P-19) 5: Motor current $\geq$ RO1 Upper Limit (P-19) 6: Speed < RO1 Upper Limit (P-19) 7: Motor current < RO1 Upper Limit (P-19) 8: Drive not enabled 9: Motor not at target speed 10: Analog Input AI2 > RO1 Upper Limit 11: READY. DC1...E1 ready for operation. The relay contact is closed when the drive is powered on and no trip condition is present. In addition the hardware enable signal (ENA) must be present at the terminal.	0
452.0	P-19	RO1 Upper Limit	0.0 ... 200.0 %	100.0 %
454.0	P-54	RO1 Hysteresis	0.0 ... 100.0 %	0.0 %
457.0	P-55	RO1 Switch-On Delay	0.0 ... 250 s	0.0 s

### 3.2.2 Using option modules DXC-EXT-2RO and DXC-EXT-2RO1AO

#### 3.2.2.1 DXC-EXT-2RO

When using the option module DXC-EXT-2RO a relay on the module is controlled by the static output at terminal 8 of the basic device DC1...E1. This creates an additional potential free control signal. In this case, terminal 8 cannot be used for other purposes. See also 2.3.2.1.

The functionality of the relay depends on the settings of P-25 (“AO1 Function”), see 3.3.1.

### 3.2.2.2 DXC-EXT-2RO1AO

This option module is used to get two independent signals for „RUN“ and „Device tripped“. P-18 has to be set to 1 „READY“. See also 2.3.2.2

Contact between terminals 10 and 11: closed in case of a fault or when DC1...E1 is not supplied.

Contact between terminals 12 and 13: closed when DC1...E1 is ready to operate and the FWD signal is applied.

## 3.3 Static output

### 3.3.1 Selection of the functionality

The static output of the variable frequency drives DC1...E1 (terminal 8) can be used as analog as well as digital one. The changeover between the two modes of operation is done automatically according to the selection of the functionality with P-25.

PNU	Parameter	Name	Range	Default
460.0	P-25	AO1 Function & Mode	P-25 = 0...7, 10, 11 = <b>digital output</b>  0: RUN, enable (FWD/REV) 1: READY, DC1...E1 ready for operation 2: Speed = speed reference value 3: Fault (DC1...E1 not ready) 4: Speed $\geq$ RO1 Upper Limit (P-19) 5: Motor current $\geq$ RO1 Upper Limit (P-19) 6: Speed < RO1 Upper Limit (P-19) 7: Motor current < RO1 Upper Limit (P-19) 10: Drive not enabled 11: Speed not at reference value  P-25 = 8,9,12 = <b>analog output</b>  8: Output Frequency (0...100 % f-max (P-01)) 9: Motor current (0...200 % Motor Nom Current (P-08)) 12: Motor power	8

Hint:

- Terminal 8 used as
  - Digital output → Signal 0 V / + 24 V
  - Analog output → Signal 0 ... 10 V
- When using the option module DXC-EXT-2RO, the static output at terminal 8 controls a relay, which is located on the option module. Therefore the static output cannot be used for other purposes. Parameter P-25 determines the functionality of the relay on the option module. Settings → 0 ... 7, 10, 11.