PowerXL™

DG1 Variable Frequency Drives
Configuration of the analog I/Os



Level 2	1 – Fundamental – No previous experience necessary 2 – Basic – Basic knowledge recommended 3 – Advanced – Reasonable knowledge required 4 – Expert – Good experience recommended

Powering Business Worldwide

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Contents

1 General 5
2 Hardware 6
2.1 Basic unit 6
2.2 Expansion module DXG-EXT-1AI2AO 7
3 Analog inputs 9
3.1 Assigning analog inputs to functions 9
3.2 Adaptation to the input signal 12
3.2.1 Basic Settings 12
3.2.2 AI… Mode 13
3.2.3 AI… Signal Range, AI… Custom Min, AI… Custom Max 13
3.2.4 Example how to configure analog input AI1: 13
3.2.5 AI… Signal Invert 14
3.2.6 Fine Adjust 14
3.2.7 Parameter list 15
3.3 Using a joystick 16
3.3.1 Configuration of the reference source 16
3.3.2 Setting the hysteresis 16
3.3.3 Sleep-Mode 17
3.3.4 Changing the neutral position 17
4 Analog outputs 18
4.1 Assigning functions to analog outputs 18
4.2 Adaptation of the output signal 19
4.2.1 AO… Mode 19
4.2.2 AO… Minimum 19
4.2.3 AO… Scaling 19
4.2.4 AO… Inversion 19
4.2.5 AO… Offset 20
4.2.6 Parameter list 21
5 Filters 22

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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.

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1 General

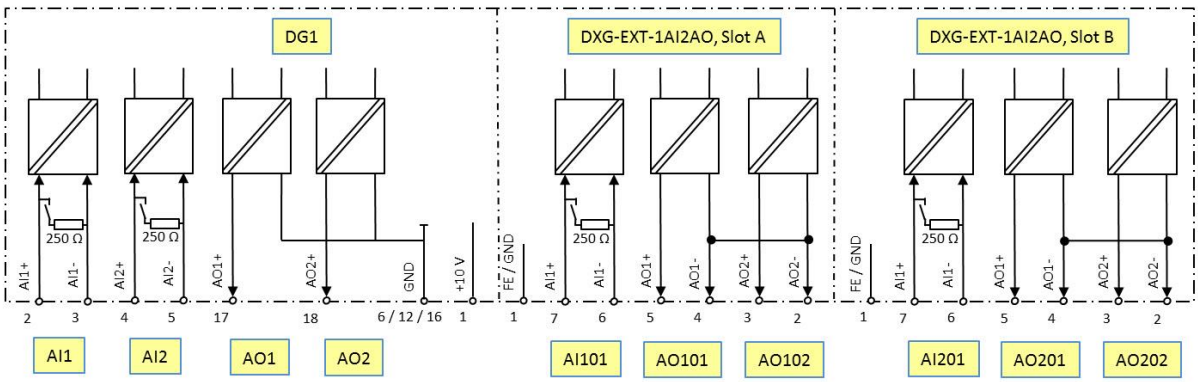
Devices of the series **PowerXL™ DG1** have analog inputs, which are mostly used to provide speed reference and feedback values. In addition analog outputs enable the connection of meters and the transmission of analog signals to other variable frequency drives.

There are two analog inputs and two analog outputs on the basic unit. The number of I/Os can be extended by using up to two expansion modules of the type DXG-EXT-1AI2AO. This leads to a maximum of four analog inputs and six analog outputs.

The assignment of in- and outputs to functions is freely configurable.

This application note describes

- the connection of analog signals
- the possibility to extend the number of I/Os
- the technical data
- the assignment of terminals to functions
- the configuration of the analog I/Os



The functions described here, refer to an application software version 1.02.0032 and above (see parameter P21.2.3).

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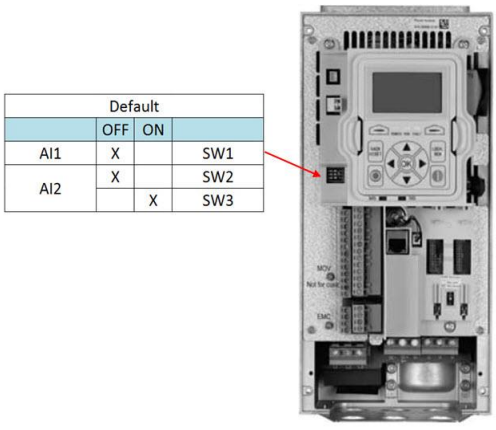
2 Hardware

The terminal blocks for the control signals and the analog signals are pluggable. The single blocks are mechanically coded to prevent mix-up. The wires must be shielded and the shield must be grounded on one end.

2.1 Basic unit

	Designation	Function		Default
Basic unit DG1	1 (+10 V)	Reference voltage	10 mA max. Signal common: GND (Terminals 6, 12 and 16)	-
	2 (AI1+)	Analog input AI1, signal	Differential input 0 … 10 V, R_i > 200 kΩ 0/4 … 20 mA, R_B = 250 Ω	0 … 10 V
	3 (AI1-)	Analog input AI1, reference potential		
	4 (AI2+)	Analog input AI2, signal	Differential Input 0 … 10 V, R_i > 200 kΩ -10 V … +10 V, R_i > 200 kΩ 0/4 … 20 mA, R_B = 250	Remote 1 Reference 0 … 20 mA
	5 (AI2-)	Analog input AI2, reference potential		
	6 / 12 / 16 (GND)	Ground	Signal common for the internal reference voltage (+ 10 V, terminal 1), the control voltage (+24 V, terminal 15) and the analog outputs AO1 (terminal 17) and AO2 (terminal 18)	-
	17 (AO1+)	Analog output AO1	0 … 10 V, 10 mA 0/4 … 20 mA, R_B = 500 Ω max Signal common: GND	Output Frequency (1) 0…20 mA
	18 (AO2+)	Analog output AO2	0 … 10 V, 10 mA 0/4 … 20 mA, R_B = 500 Ω max Signal common: GND	Motor Current (4) 0…20 mA



The selection of the input signals is carried out via parameters (see 3.2.2) as well as with DIP switches. When reconfiguring the device for another signal, the setting of the DIP switches has to be adapted accordingly. The DIP switches are located on the left hand side of the keypad.

Input	Signal	SW1	SW2	SW3
AI1	0…10 V	OFF	-	-
	0/4…20 mA	ON	-	-
AI2	0…10 V	-	OFF	OFF
	-10…+10 V	-	ON	OFF
	0/4…20 mA	-	OFF	ON

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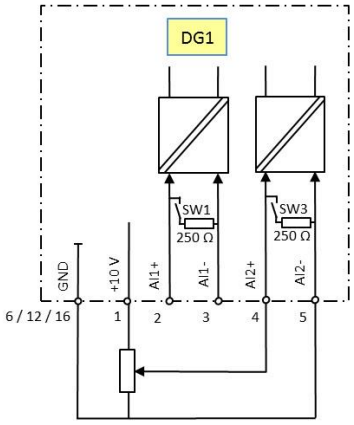
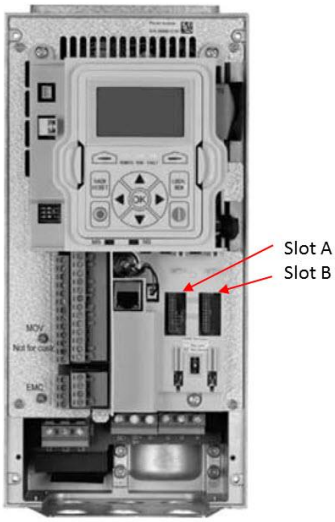


Connection example:

The reference signal is provided by the internal reference voltage as 0…10 V signal at analog input AI2. Because AI2 is a differential input, the reference potential from the internal voltage (terminals 6, 12 or 16) must be connected with the one of AI2 (terminal 5). DIP switches SW2 and SW3 must be in OFF position (left).

The wires must be shielded and the shield must be grounded on one end.

2.2 Expansion module DXG-EXT-1AI2AO



The expansion module DXG-EXT-1AI2AO has one analog input and two analog outputs. All I/Os are differential I/Os and not referred to the ground potential of the basic unit. When using the internal reference voltage, the reference potential of the respective analog input must be connected with GND (terminal 6, 12 or 16 of the basic unit). The reference potentials of the two analog outputs (AO1- and AO2-) are connected internally.

The wires must be shielded and the shield must be grounded on one end.

Up to two expansion modules can be used with one basic device. To connect the modules with the basic device, two slots (A and B) are available.

	Designation	Function		Default
Expansion module DXG-EXT-1AI2AO	1 (FE/GND)	Functional Earth / Ground	Shield connection	-
	2 (AO2-)	Analog output AO2, reference potential (internally connected with AO1-)	0 … 10 V, 10 mA 0/4 … 20 mA, R_B = 500 Ω max	0 … 10 V
	3 (AO2+)	Analog output AO2, signal		
	4 (AO1-)	Analog output AO1, reference potential (internally connected with AO2-)	0 … 10 V, 10 mA 0/4 … 20 mA, R_B = 500 Ω max	0 … 10 V
	5 (AO1+)	Analog output AO1, signal		
	6 (AI1-)	Analog input AI1, reference potential	Differential input 0 … 10 V, R_i > 200 kΩ -10 V … +10 V, R_i > 200 kΩ 0/4 … 20 mA, R_B = 250	0 … 10 V
	7 (AI1+)	Analog input AI1, signal		

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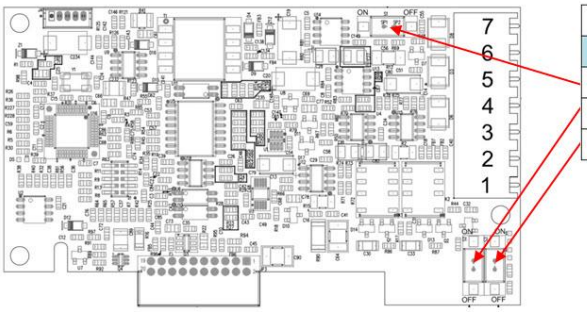

Default		
	OFF	ON
AI1	X	
AO1	X	
AO2	X	

The function of the input and output signals is selected via parameters (see 3.1 and 4.1) as well as via DIP switches. When reconfiguring the device for another signal, the setting of the DIP switches has to be adapted accordingly.

	Signal	Switch position
AI1	0…10 V	OFF
	-10…+10 V	OFF
	0/4…20 mA	ON
AO1	0…10 V	OFF
	0/4…20 mA	ON
AO2	0…10 V	OFF
	0/4…20 mA	ON

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3 Analog inputs

3.1 Assigning analog inputs to functions

The variable frequency drives of the series **PowerXL™ DG1** can be used universally and offer many combination possibilities. One can for example determine, if the speed reference is provided by an analog input or by the output of the internal PID controller… . The determination is done by a selection out of a list of possible “sources”.

A multiple selection is possible. The signal at analog input AI1 for example can simultaneously be used as “PID1 Set Point 1 Source” as well as “PID1 Feedforward 1 Source”.

The analog inputs on the basic device are designated AI1 and AI2.

In case expansion modules DXG-EXT-1AI2AO are used, their inputs are designated as follows:

- AI1 on DXG-EXT-1AI2AO in Slot A → Slot A: AI1
- AI1 on DXG-EXT-1AI2AO in Slot B → Slot B: AI1

Analog sources can be assigned to the following parameters:

Parameter	Name	Range	Default
P1.14	Local reference	AI1 (0) AI2 (1) Slot A: AI1 (2) Slot B: AI1 (3) AI1 Joystick (4)[1)] AI2 Joystick (5)[1)] Keypad (6) Fieldbus Ref (7) Motor Pot (8) Max Frequency (9) AI1 + AI2 (10) AI1 – AI2 (11) AI2 – AI1 (12) AI1 · AI2 (13) AI1 OR AI2 (14)[2)] MIN (AI1, AI2) (15) MAX (AI1, AI2) (16) PID1 Control Output (17) PID2 Control Output (18)	Keypad (6)
P1.15	Remote 1 Reference	like P1.14	AI2 (1)
P7.2	Remote 2 Reference	like P1.14	Fieldbus Ref (7)
P10.14	PID1 Set Point 1 Source	Not Used (0) PID1 Keypad Set Point 1 (1) PID1 Keypad Set Point 2 (2) AI1 (3) AI2 (4) Slot A: AI1 (5) Slot B: AI1 (6) FB Process Data Input 1 (7) FB Process Data Input 2 (8) FB Process Data Input 3 (9) FB Process Data Input 4 (10) FB Process Data Input 5 (11) FB Process Data Input 6 (12)	PID1 Keypad Set Point 1 (1)

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Parameter	Name	Range	Default
		FB Process Data Input 7 (13) FB Process Data Input 8 (14) PID2 Output (15) Multi Drive Network (16)	
P10.23	PID1 Set Point 2 Source	like P10.14	PID1 Keypad Set Point 2 (2)
P10.34	PID1 Feedback 1 Source	Not Used (0) AI1 (1) AI2 (2) Slot A: AI1 (3) Slot B: AI1 (4) FB Process Data Input 1 (5) FB Process Data Input 2 (6) FB Process Data Input 3 (7) FB Process Data Input 4 (8) FB Process Data Input 5 (9) FB Process Data Input 6 (10) FB Process Data Input 7 (11) FB Process Data Input 8 (12) PT100 Temperature (13) PID2 Output (14) SlotA PT100 Temp Channel 1 (15) SlotA PT100 Temp Channel 2 (16) SlotA PT100 Temp Channel 3 (17) SlotB PT100 Temp Channel 1 (18) SlotB PT100 Temp Channel 2 (19) SlotA PT100 Temp Channel 3 (20)	AI2 (2)
P10.37	PID1 Feedback 2 Source	like P10.34	Not Used (0)
P10.42	PID1 Feedforward 1 Source	like P10.34	Not Used (0)
P10.45	PID1 Feedforward 2 Source	like P10.34	Not Used (0)
P11.14	PID2 Set Point 1 Source	Not Used (0) PID1 Keypad Set Point 1 (1) PID1 Keypad Set Point 2 (2) AI1 (3) AI2 (4) Slot A: AI1 (5) Slot B: AI1 (6) FB Process Data Input 1 (7) FB Process Data Input 2 (8) FB Process Data Input 3 (9) FB Process Data Input 4 (10) FB Process Data Input 5 (11) FB Process Data Input 6 (12) FB Process Data Input 7 (13) FB Process Data Input 8 (14) PID1 Output (15) Multi Drive Network (16)	PID2 Keypad Set Point 1 (1)
P11.23	PID2 Set Point 2 Source	like P11-14	PID2 Keypad Set Point 2 (2)
P11.34	PID2 Feedback 1 Source	Not Used (0) AI1 (1) AI2 (2) Slot A: AI1 (3) Slot B: AI1 (4)	AI2 (2)

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Parameter	Name	Range	Default
		FB Process Data Input 1 (5) FB Process Data Input 2 (6) FB Process Data Input 3 (7) FB Process Data Input 4 (8) FB Process Data Input 5 (9) FB Process Data Input 6 (10) FB Process Data Input 7 (11) FB Process Data Input 8 (12) PT100 Temperature (13) PID1 Output (14) SlotA PT100 Temp Channel 1 (15) SlotA PT100 Temp Channel 2 (16) SlotA PT100 Temp Channel 3 (17) SlotB PT100 Temp Channel 1 (18) SlotB PT100 Temp Channel 2 (19) SlotA PT100 Temp Channel 3 (20)	
P11.37	PID2 Feedback 2 Source	like P11-34	Not Used (0)
P11.42	PID2 Feedforward 1 Source	like P11-34	Not Used (0)
P11.45	PID2 Feedforward 2 Source	like P11-34	Not Used (0)
P13.2	Torque Ref Select	Not Used (0) AI1 (1) AI2 (2) Slot A: AI1 (3) Slot B: AI1 (4) AI1 Joystick (5)[1)] AI2 Joystick (6)[1)] Keypad Torque Ref (7) FB Process Data Input 1 (8) PID1 Control Output (9) PID2 Control Output (10)	Not Used (0)

1) With the settings „AI1 Joystick“ and „AI2 Joystick“ the analog signal also contains the information about the sense of rotation. The neutral point is in the middle of the selected range. It can be moved to another position with parameter “AI1 JS Offset” respectively “AI2 JS Offset” (see 3.3.4). It is recommended to set the minimum frequency to zero (P1.1 “f-min”).

Example 1: Analog signal, selected with „AI… Mode“ = 0…10 V

0 V = -f-max (ccw)

5 V = standstill

10 V = +f-max (cw)

Example 2: Analog signal, selected with „AI2 Mode“ = -10 V to +10 V

-10 V = -f-max (ccw)

0 V = standstill

+10 V = +f-max (cw)

2) This is a selection between the references at AI1 and AI2 with a digital signal. The source for the selection is determined by P3-36 „AI Ref Source Select“. LOW = AI1, HIGH = AI2.

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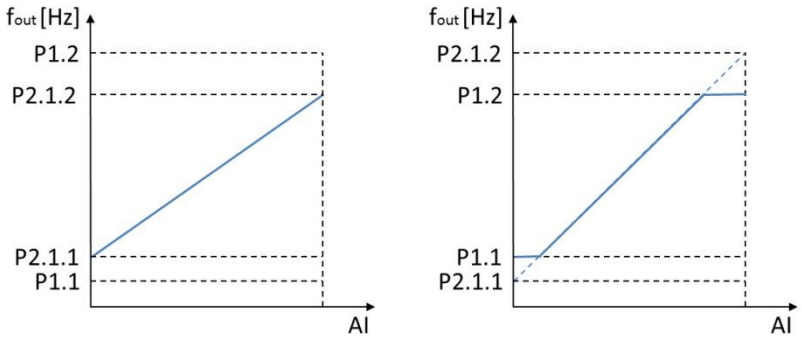
3.2 Adaptation to the input signal

3.2.1 Basic Settings

The basic settings are carried out with the parameters P2.1.1 “AI Ref Scale Min Value” and P2.1.2 “AI Ref Scale Max Value”. This setting is effective for all analog inputs (basic unit and expansion modules), in case the analog input is used as source for the speed reference. The setting defines the range, which is covered by the analog signal. P2.1.1 and P2.1.2 are not effective, when the analog value is used in connection with a PID controller or as source for the torque reference.

- AI Ref Scale Min Value
  - Output frequency in Hz, which corresponds to the lowest level of the selected signal, e.g. 0 V. When the value is set to 0.0 Hz, the output frequency at minimum level of the analog signal corresponds to the minimum frequency, set with P1.1 “f-min”.
- AI Ref Scale Max Value
  - Output frequency in Hz, which corresponds to the highest level of the selected signal, e.g. 10 V. When the value is set to 0.0 Hz, the output frequency at maximum level of the analog signal corresponds to the maximum frequency, set with P1.2 “f-max”.

Note: The limit values set with P1.1 “f-min” and P1.2 “f-max” are always effective and do not depend on the settings of P2.1.1 and P2.1.2.



Example 1: minimum speed at 0 V

- f-min = 20 Hz, f-max = 50 Hz, reference signal = 0 – 10 V
- In default, the signal at the analog input ranges from 0 Hz to the maximum frequency set with P1.2 “f-max”. This would mean that an adjustment of the potentiometer in the range from 0 to 40 % (20 Hz out of 50 Hz) is without any effect.
- With P2.1.1 = 20 Hz, the output frequency at zero position of the potentiometer would be 20 Hz.

Example 2: Speed adaptation between drives with the same speed reference signal
Three identical drives are supplied with the same speed reference signal. Drive 1 is acting as master. Drive 2 should have 95 % of the master’s speed, drive 3 105 %. Because of this requirement, the inputs of the drives 2 and 3 must be adapted.

- Drive 2: P2.1.1 = 0.00 Hz, P2.1.2 = P1.2 · 0,95
- Drive 3: P2.1.1 = 0.00 Hz, P2.1.2 = P1.2 · 1,05

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Note: It has to be kept in mind that the speed of drive 3 is limited by the setting of P1.2 “f-max”. In the upper range it is not possible to deliver 105 % of drive 1’s speed.

3.2.2 AI… Mode

Selection, if the analog signal is a voltage or a current one. It has to be noted, that the DIP switches (see 2.1 (basic unit) and 2.2 (expansion modules)) have to be set accordingly!

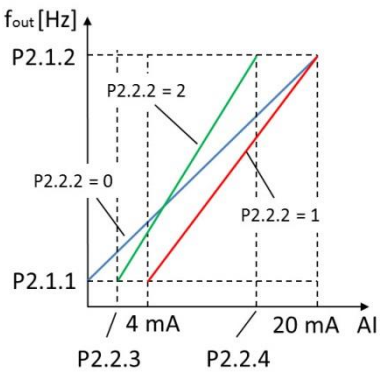
- 0 - 20 mA
  - The input signal is a current (0 - 20 mA respectively 4 - 20 mA). See also AI… Signal Range
- 0 – 10 V
  - The input signal is a unipolar voltage 0 – 10 V.
- -10 V - + 10 V
  - The input signal is a bipolar voltage
    - -10 V = standstill respectively f-min (P1.1)
    - 0 V = f-max / 2
    - + 10 V = f-max (P1.2)

3.2.3 AI… Signal Range, AI… Custom Min, AI… Custom Max

Determination of the used range of the input signal (live zero / dead zero). In most cases 0 … 100 % of the analog signal corresponds to 0 .. 100 % of the speed. Preferably in the process industry transducers with 4 … 20 mA are used to detect a possible wire break. The behavior at a detected wire break can be selected with P9.1 “4mA Input Fault” and P9.2 “4mA Fault Frequency”.

- 0 – 100 % / 0 – 20 mA / 0 – 10 V (0)
- P2.2.2 = 20 – 100 % / 4 – 20 mA / 2 – 10 V (1)
- Customized (2)
  - AI… Custom Min defines the level of input signal at speed = 0.
  - AI… Custom Max defines the level of input signal at maximum speed.

3.2.4 Example how to configure analog input AI1:



- Select with P2.2.1, if a voltage or a current signal is connected. In this example it is a current signal → P2.2.1 = 0-20 mA (0)
- Select the required speed range with P2.1.1 and P2.1.2 (see 3.2.1)
- Select the required signal range with P2.2.2.
  - Current signal 0-20 mA:
    - P2.2.2 = 0-20 mA (0)
  - Current signal 4-20 mA
    - P2.2.2 = 4-20 mA (1)
  - Other signal
    - Set P2.2.2 to „Customized (2)“
    - Set the lower limit with P2.2.3 and the upper one with P2.2.4.

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3.2.5 AI… Signal Invert

- „AI… Signal Invert“ = Not Inverted (0):
  - lowest reference = lowest speed
  - highest reference = highest speed
- „AI… Signal Invert“ = Inverted (1):
  - lowest reference = highest speed
  - highest reference = lowest speed

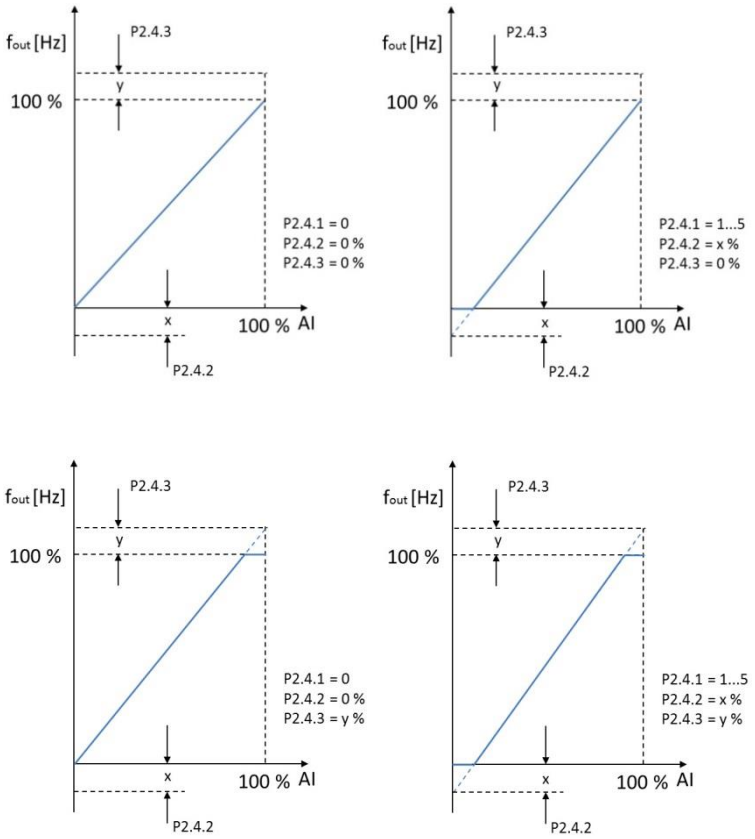
3.2.6 Fine Adjust

In some cases it is necessary to adapt the input to an external signal. Mostly it is the case, when the minimum level of the external signal is not zero or the maximum value cannot be reached, e.g. due to a voltage drop on the analog wires. The adaptation is done with P2.4.1 … P2.4.3.

P2.4.1 „Fine Tuning Input“
This parameter determines, which input is fine adjusted. Alternatively these can be all analog inputs as well as the fieldbus reference. P2.4.1 = „Not Used“ → No Fine Adjust

P2.4.2 „Fine Tuning Min“
This parameter defines a percentage, which is subtracted from the minimum reference. See diagram below.

P2.4.3 „Fine Tuning Max”
This parameter defines a percentage, which is added to the maximum reference. See diagram below



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3.2.7 Parameter list

		Parameter	Name	Range	Default
all		P2.1.1	AI Ref Scale Min Value	0.00 Hz ≤ P2.1.1 < P2.1.2	0.00 Hz
		P2.1.2	AI Ref Scale Max Value	P2.1.1 < P2.1.2 ≤ 400.00 Hz	0.00 Hz
		P2.4.1	Fine Tuning Input	Not Used (0) AI1 (1) AI2 (2) Slot A: AI1 (3) Slot B: AI1 (4) Fieldbus (5)	Not Used (0)
		P2.4.2	Fine Tuning Min	0…100 %	0.0 %
		P2.4.3	Fine Tuning Max	0…100 %	0.0 %
Grundgerät DG1	AI1	P2.2.1	AI1 Mode	0 – 20 mA (0) 0 – 10 V (1)	0-10 V (1)
		P2.2.2	AI1 Signal Range	0 - 100 % / 0 - 20 mA / 0 - 10 V (0) 20 - 100 % / 4 – 20 mA / 2 – 10 V (1) Customized (2)	0 - 100 % / 0 - 20 mA / 0 - 10 V (0)
		P2.2.3	AI1 Custom Min	0.00 % … AI1 Custom Max	0.00 %
		P2.2.4	AI1 Custom Max	AI1 Custom Min … 100.00 %	100.00 %
		P2.2.6	AI1 Signal Invert	Not Inverted (0) Inverted (1)	Not Inverted
	AI2	P2.3.1	AI2 Mode	0 – 20 mA (0) 0 – 10 V (1)	0-10 V (1)
		P2.3.2	AI2 Signal Range	0 - 100 % / 0 - 20 mA / 0 - 10 V (0) 20 - 100 % / 4 – 20 mA / 2 – 10 V (1) Customized (2)	0 - 100 % / 0 - 20 mA / 0 - 10 V (0)
		P2.3.3	AI2 Custom Min	0.00 % … AI2 Custom Max	0.00 %
		P2.3.4	AI2 Custom Max	A2 Custom Min … 100.00 %	100.00 %
		P2.3.6	AI2 Signal Invert	Not Inverted (0) Inverted (1)	Not Inverted
DXG-EXT-1AI2AO	AI1	BX.2.1[1)]	AI1 Mode	0 – 20 mA (0) 0 – 10 V (1)	0-10 V (1)
		BX.2.2	AI1 Signal Range	0 - 100 % / 0 - 20 mA / 0 - 10 V (0) 20 - 100 % / 4 – 20 mA / 2 – 10 V (1) Customized (2)	0 - 100 % / 0 - 20 mA / 0 - 10 V (0)
		BX.2.3	AI1 Custom Min	0.00 % … AI1 Custom Max	0.00 %
		BX.2.4	AI1 Custom Max	AI1 Custom Min … 100.00 %	100.00 %
		BX.2.6	AI1 Signal Invert	Not Inverted (0) Inverted (1)	Not Inverted

1) The letter „X“ in the parameter designation is used as a wildcard. Instead of the letter a number appears on the keypad or inside the parameter software, which depends on the slot (A or B) in which the expansion module mounted.

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3.3 Using a joystick

In some applications, e.g. cranes, a joystick is used for setpoint setting. There are special functions to ease the use of a joystick. Examples are a hysteresis to prevent a too sensitive reaction of the drive or the setting of the neutral position.

3.3.1 Configuration of the reference source

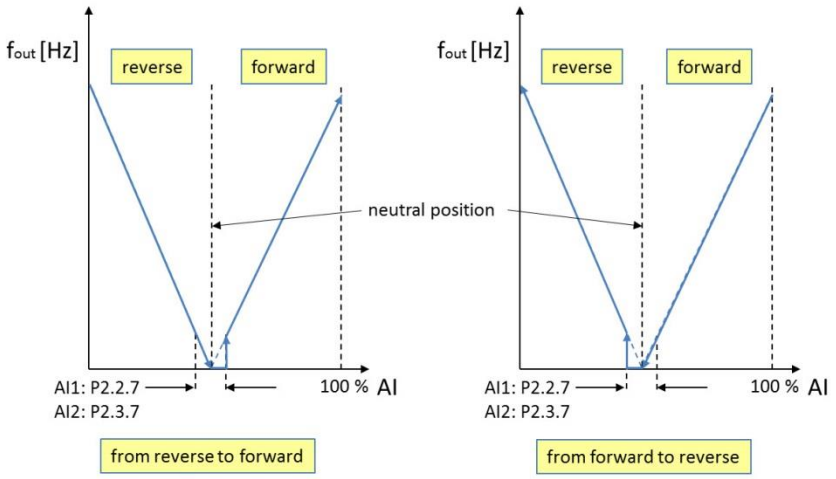
In application with a joystick the analog signal also contains the information about the required sense of rotation. The reference source must be configured accordingly. Only the selections „AI1 Joystick (4)“ and „AI2 Joystick (5)” are allowed, where the neutral position is in the middle of the range selected with “AI… Mode”. Changing the neutral position: see 3.3.4.

- Example 1: Analog signal, selected with P2.2.1 „AI1 Mode“ = 0…10 V
  - 0 V = -f-max (ccw)
  - 5 V = standstill
  - 10 V = +f-max (cw)
- Example 2: Analog signal, selected with P2.3.1 „AI2 Mode“ = -10 V - +10 V
  - -10 V = -f-max (ccw)
  - 0 V = standstill
  - +10 V = +f-max (cw)

Parameter	Name	Range	Default
P1.14	Local Reference	AI1 (0) …….. AI1 Joystick (4) AI2 Joystick (5) …….. PID2 Control Output (18)	Keypad (6)
P1.15	Remote 1 Reference	like P1.14	AI2 (1)
P7.2	Remote 2 Reference	like P1.14	Fieldbus Ref (7)

3.3.2 Setting the hysteresis

The parameters P2.2.7 „AI1 Joystick Hyst“ respectively P2.3.7 „AI2 Joystick Hyst“ determine the hysteresis of the joystick. It can be set from 0 up to 20 % around the neutral position.



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When the joystick is moved from the reverse direction to the neutral position (middle position) the output frequency is reduced linearly down to the minimum frequency and remains at this speed until the joystick is moved into the forward direction. The hysteresis determines, how much the joystick has to be moved until the output frequency starts to increase to the new reference. In case the hysteresis is zero, the acceleration starts immediately after moving the joystick into the other direction. When changing from forward to reverse, the drive behaves accordingly.

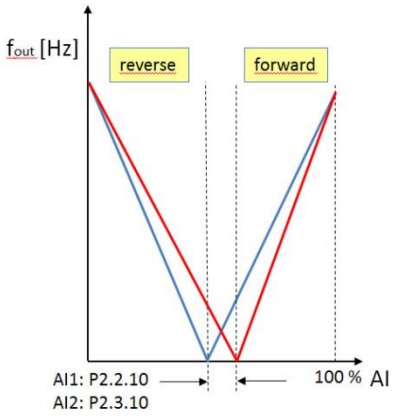
Parameter	Name	Range	Default
P2.2.7	AI1 Joystick Hyst	0.00 … 20.00 %	0.00 %
P2.3.7	AI2 Joystick Hyst	0.00 … 20.00 %	0.00 %

3.3.3 Sleep-Mode

This function is effective in joystick mode only. When the speed drops below the threshold set with P2.2.8 respectively P2.3.8 “AI… Sleep Limit”, the drive ramps to the minimum speed. It remains at this speed for the time set with P2.2.9 respectively P2.3.9 and stops afterwards. The drive restarts again when the reference increases.

Parameter	Name	Range	Default
P2.2.8	AI1 Sleep Limit	0.00 … 100.00 %	0.00 %
P2.2.9	AI1 Sleep Delay	0.00 … 320.00 s	0.00 s
P2.3.8	AI2 Sleep Limit	0.00 … 100.00 %	0.00 %
P2.3.9	AI2 Sleep Delay	0.00 … 320.00 s	0.00 s

3.3.4 Changing the neutral position



By default the neutral position is in the middle of the selected range, e.g. at 5 V when the range 0-10 V is selected. With the parameters P2.2.10 „AI1 Joystick Offset“ and P2.3.10 „AI2 Joystick Offset“ the neutral position can be moved. The move is expressed as a percentage of the maximum reference value.

Example:

- Input signal 0 … 10 V
- P2.2.10 respectively P2.3.10 = 10 %
- The neutral position is moved by 10 % of 10 V upwards, thus to 6 V.
- The reference for reverse operation is now linearly in the range from 0 to 6 V, the one for forward operation in the range from 6 V to 10 V.

Parameter	Name	Range	Default
P2.2.10	AI1 Joystick Offset	-50.00 … 50.00 %	0.00 %
P2.3.10	AI2 Joystick Offset	-50.00 … 50.00 %	0.00 %

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4 Analog outputs

4.1 Assigning functions to analog outputs

The function of the analog outputs on the basic unit and on the expansion module DXG-EXT-1AI2AO can be selected out of a comprehensive list.

Parameter	Name	Range	Default
P4.2	AO1 Function	Not Used (0) Output Frequency (1)[3)] Freq Reference (2)[3)] Motor Speed (3)[3)] Motor Current (4) Motor Torque (0-Nom) (5) Motor Power (6) Motor Voltage (7) DC-Bus Voltage (8) PID1 Setpoint (9) PID1 Feedback 1 (10) PID1 Feedback 2 (11) PID1 Control Error Value (12) PID1 Control Output (13) PID2 Setpoint (14) PID2 Feedback 1 (15) PID2 Feedback 2 (16) PID2 Control Error Value (17) PID2 Control Output (18) AI1 (19) AI2 (20) Output Freq (-2-+2N) (21)[3)] Motor Torque (-2-+2N) (22)[3)] Motor Power (-2-+2N) (23)[3)] PT100 Temperature (24) FB Process Data Input 1 (25) FB Process Data Input 2 (26) FB Process Data Input 3 (27) FB Process Data Input 4 (28) FB Process Data Input 5 (29) FB Process Data Input 6 (30) FB Process Data Input 7 (31) FB Process Data Input 8 (32) SlotA PT100 Temp Channel 1 (33)[2)] SlotA PT100 Temp Channel 2 (34)[2)] SlotA PT100 Temp Channel 3 (35)[2)] SlotB PT100 Temp Channel 1 (36)[2)] SlotB PT100 Temp Channel 2 (37)[2)] SlotB PT100 Temp Channel 3 (38)[2)] User Defined Output (39)	Output Frequency (1)
P4.9	AO2 Function	like P4.2	Motor Current (4)
BX.2.8[1)]	AO1 Function	like P4.2	Not Used (0)
BX.2.15[1)]	AO2 Funktion	like P4.2	Not Used (0)

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1) The letter „X“ in the parameter designation is used as a wildcard. Instead of the letter a number appears on the keypad or inside the parameter software, which depends on the slot (A or B) in which the expansion module mounted.
2) These temperature inputs are located on the expansion module DXG-EXT-THER1.
3) The neutral position is in the middle of the selected signal range, e.g. at 5 V or 10 mA.

4.2 Adaptation of the output signal

4.2.1 AO… Mode

Selection, if the analog signal is a voltage or a current one.

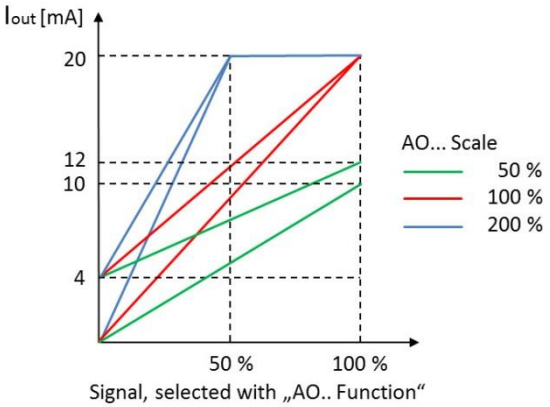
- 0 - 20 mA
  - The input signal is a current (0 - 20 mA respectively 4 - 20 mA).
- 0 – 10 V
  - The input signal is a voltage 0 – 10 V.

4.2.2 AO… Minimum

Selection of the signal range (live zero / dead zero).

- 0 V / 0 mA (0)
- 2 V / 4 mA (1)

4.2.3 AO… Scaling



Percentage between 10 and 1000 %, which is multiplied with the output signal. It has to be noted that 10 V respectively 20 mA are the maximum values in any case.

4.2.4 AO… Inversion

- „AO… Inversion“ = Not Inverted (0):
  - lowest value of the selected function = lowest output signal
  - highest value of the selected function = highest output signal
- „AO… Inversion“ = Inverted (1):
  - lowest value of the selected function = highest output signal
  - highest value of the selected function = lowest output signal

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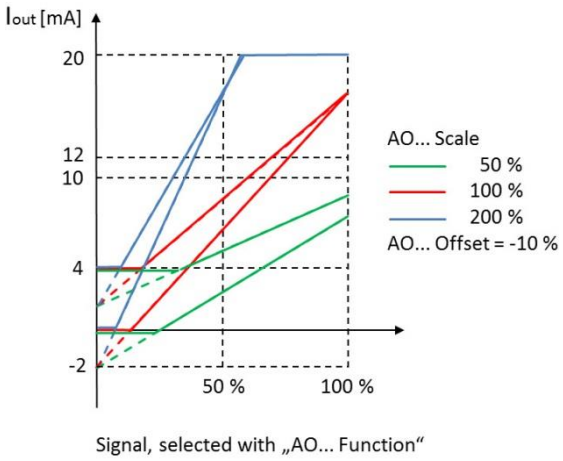
4.2.5 AO… Offset



Signal, selected with „AO... Function“

This parameter shifts the output signal by the set level upwards (+) respectively downwards (-). The percentage refers to the value of the signal selected with „AO… Mode”. The setting “-10.00 %” leads to a shift by 1 V respectively 2 mA downwards (see example on the left hand side).

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4.2.6 Parameter list

		Parameter	Name	Range	Default
Basic unit DG1	AO1	P4.1	AO1 Mode	0 – 20 mA (0) 0 – 10 V (1)	0-20 mA
		P4.3	AO1 Minimum	0 V / 0 mA (0) 2 V / 4 mA (1)	2 V / 4 mA (1)
		P4.5	AO1 Scale	10 – 1000 %	100 %
		P4.6	AO1 Inversion	Not Inverted (0) Inverted (1)	Not Inverted (0)
		P4.7	AO1 Offset	-100.00 % … +100.00 %	0.00 %
	AO2	P4.8	AO2 Mode	0 – 20 mA (0) 0 – 10 V (1)	0-20 mA
		P4.10	AO2 Minimum	0 V / 0 mA (0) 2 V / 4 mA (1)	2 V / 4 mA (1)
		P4.12	AO2 Scale	10 – 1000 %	100 %
		P4.13	AO2 Inversion	Not Inverted (0) Inverted (1)	Not Inverted (0)
		P4.14	AO2 Offset	-100.00 % … +100.00 %	0.00 %
DXG-EXT-1AI2AO	AO1	BX.2.7[1)]	AO1 Mode	0 – 20 mA (0) 0 – 10 V (1)	0-20 mA
		BX.2.9	AO1 Minimum	0 V / 0 mA (0) 2 V / 4 mA (1)	2 V / 4 mA (1)
		BX.2.11	AO1 Scale	10 – 1000 %	100 %
		BX.2.12	AO1 Inversion	Not Inverted (0) Inverted (1)	Not Inverted (0)
		BX.2.13	AO1 Offset	-100.00 % … +100.00 %	0.00 %
	AO2	BX.2.14	AO2 Mode	0 – 20 mA (0) 0 – 10 V (1)	0-20 mA
		BX.2.16	AO2 Minimum	0 V / 0 mA (0) 2 V / 4 mA (1)	2 V / 4 mA (1)
		BX.2.18	AO2 Scale	10 – 1000 %	100 %
		BX.2.19	AO2 Inversion	Not Inverted (0) Inverted (1)	Not Inverted (0)
		BX.2.20	AO2 Offset	-100.00 % … +100.00 %	0.00 %

1) The letter „X“ in the parameter designation is used as a wildcard. Instead of the letter a number appears on the keypad or inside the parameter software, which depends on the slot (A or B) in which the expansion module mounted.

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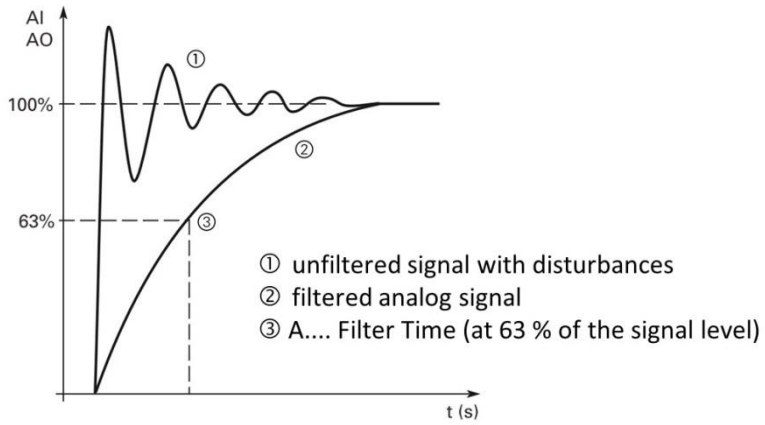
5 Filters

Analog signals are frequently affected by disturbances, which require a filtering. The time constant of the filters can be set individually for each analog input and output. On one side, a higher time constant filters the disturbances more effectively, on the other side it leads to longer reaction times.



		Parameter	Name	Range	Default
DG1	Analog input AI1	P2.2.5	AI1 Filter Time	0.00 … 10.00 s	0.10 s
	Analog input AI2	P2.3.5	AI2 Filter Time	0.00 … 10.00 s	0.10 s
	Analog output AO1	P4.4	AO1 Filter Time	0.00 … 10.00 s	1.00 s
	Analog output AO2	P4.11	AO2 Filter Time	0.00 … 10.00 s	1.00 s
DXG-	Analog input AI1	BX.2.5[1)]	AI1 Filter Time	0.00 … 10.00 s	0.10 s
	Analog output AO1	BX.2.10	AO1 Filter Time	0.00 … 10.00 s	1.00 s
	Analog output AO2	BX.2.17	AO2 Filter Time	0.00 … 10.00 s	1.00 s

1) The letter „X“ in the parameter designation is used as a wildcard. Instead of the letter a number appears on the keypad or inside the parameter software, which depends on the slot (A or B) in which the expansion module mounted.

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