HAEHNE

Setup instructions

DMX-Series

Digital measurement amplifier with analogue output signals and the option to configure it via an app.

This operation manual is also available in German.

HAEHNE Configurator

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Product Information

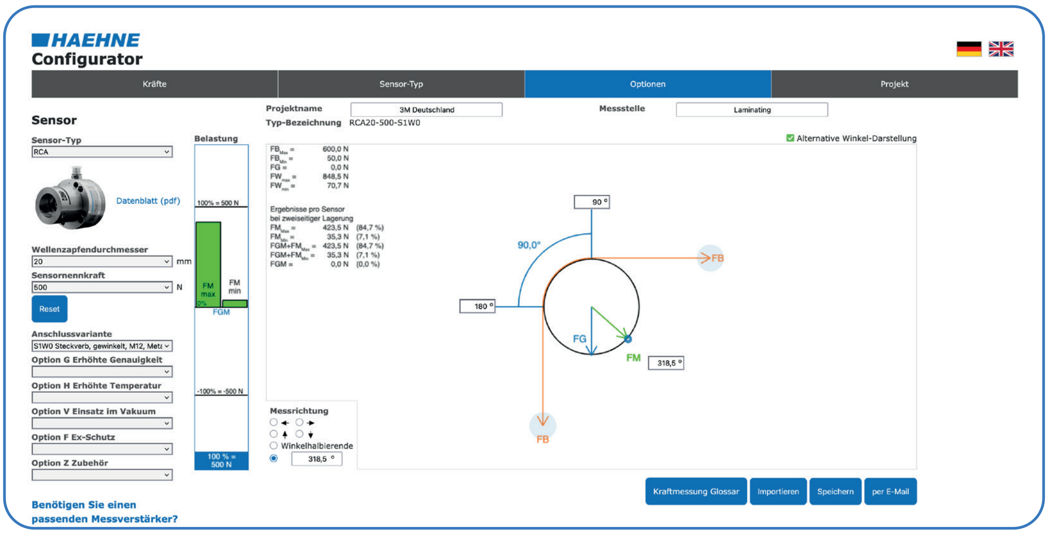
Product Description
The compact signal amplifiers in the DMX series are ideally suited for use in applications where sensors with full Wheatstone bridge (strain gauge force transducers) require fast analog signal processing. Among the most important areas of application are the measurement of web tension, wire tension and strip tension in the metal industry, as well as general force measurement in various industrial applications.

DMX amplifiers offer a wide range of applications and are compatible with virtually all force transducers based on strain gauge technology, including products from other manufacturers. The digital DMX measurement amplifier comes typically with two channels for evaluating force transducers. This makes it a versatile solution for web tension measurements as well as general force measurement applications, particularly when separate measurements are required for the right and left sides of a measuring roller, for example. It is mounted on a DIN rail inside the control cabinet.

Function Description
The DMX measurement amplifiers ensure a reliable and highly stable power supply to the strain gauge bridges. The signal generated by the load cell is converted on a mV basis into a precise, proportional electrical signal and output for each channel as a standardized current or voltage value (0/4...20 mA; 0–10 V; –10 V to +10 V).

The HAEHNE measurement principle, combined with a high resolution of 24 bits, enables extremely accurate measurements and, consequently, excellent results, even with minimal web tension and small wrap angles.

Our configurator is the perfect tool to help you choose the right force transducers.

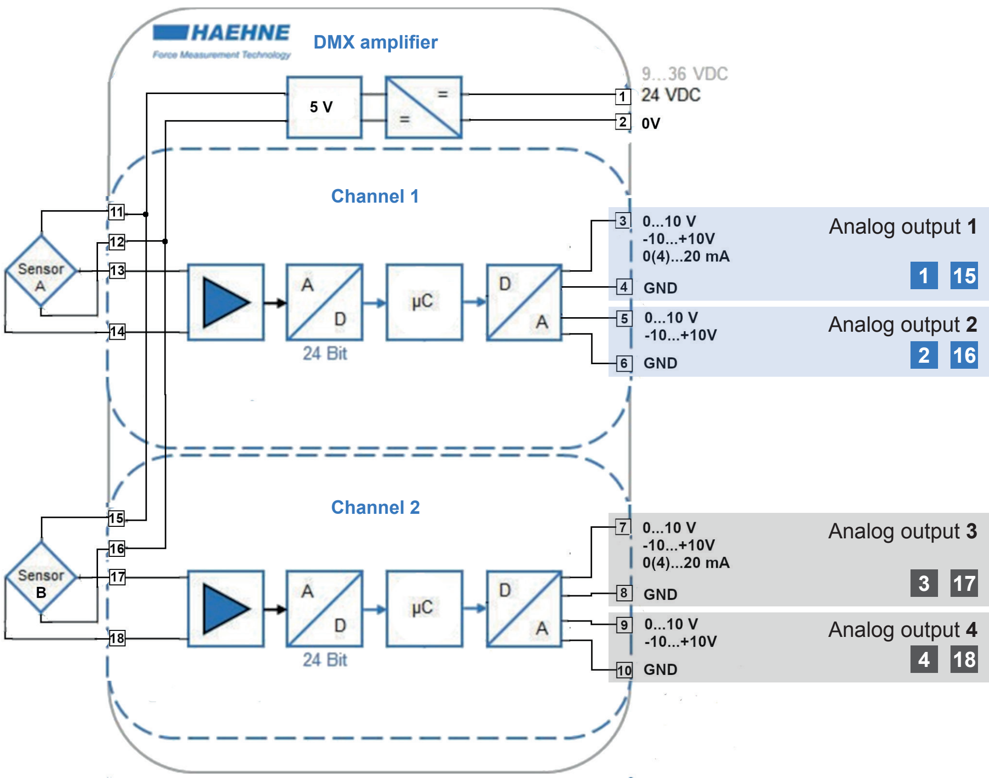


Connections and Block Diagram

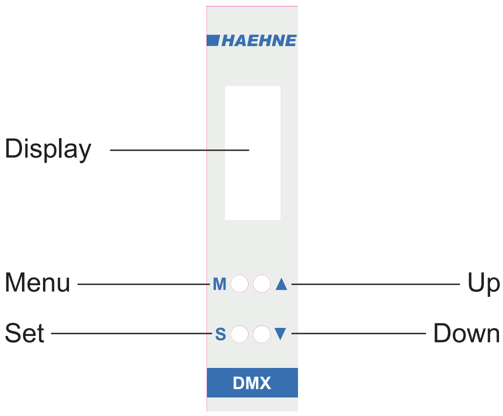
Power supply		Sensor A				Sensor B			
1	2	3	4	5	6	7	8	9	10
+24 V	0V	U, IA	GND	UA	GND	U, IB	GND	UB	GND
----- 24V -----		---------------- Signal output ----------------							

Sensor A				Sensor B			
11	12	13	14	15	16	17	18
V4+	V4-	V1+	V1-	V4+	V4-	V1+	V1-
---------- Sensor connection ----------							

- The first output (terminal 3/4) and the third output (terminal 7/8) can be used as either current or voltage outputs. The second output (terminal 5/6) and the fourth output (terminal 9/10) can only be configured as voltage outputs.
- The supply voltage for the sensor is connected to V4, while the measurement signal generated by the sensor is fed back to V1.



Operation



Operating the device:
The device can be easily operated using the keyboard. A detailed description of the menu structure can be found on page 6.

Instructions for use on the device

- If no input is made within 30 seconds, the menu will close automatically. You can also exit the menu by pressing the „M“ button repeatedly.
- When changing numerical values, the increment increases if you hold down the button for a longer period of time.
- If, during calibration with a defined load, the calculated value falls outside the permissible adjustment range, the display shows the message “Calibration weight channel x gain out of range!”
- In the standard display, a „!“ appears behind the unit for values above (-)100%. If the values exceed 160%, the message “Overflow”; if they are below -160%, “Underflow” is displayed. If no inputs are connected, for example due to interrupted sensor cables, the system displays “Open.”

Control via app:
Alternatively, quick and convenient setup can be performed using the HAEHNE Viewer app.
When using multiple DMX amplifiers, you can also assign a custom device name (e.g., unwinder) here so that the measurement point can be clearly identified within the machine.

The Bluetooth security level can be set on the amplifier between:

- Off
- Read-only
- Read and write

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The **HAEHNE Viewer** app is available in the App Store for iOS and in the Play Store for Android.

For help **setting up the Bluetooth connection** and configuring the amplifier, see pages 5–6.

App Control:
Bluetooth Connection and Settings

Set up a Bluetooth connection to the amplifier:

Open the hamburger menu in the top-left corner

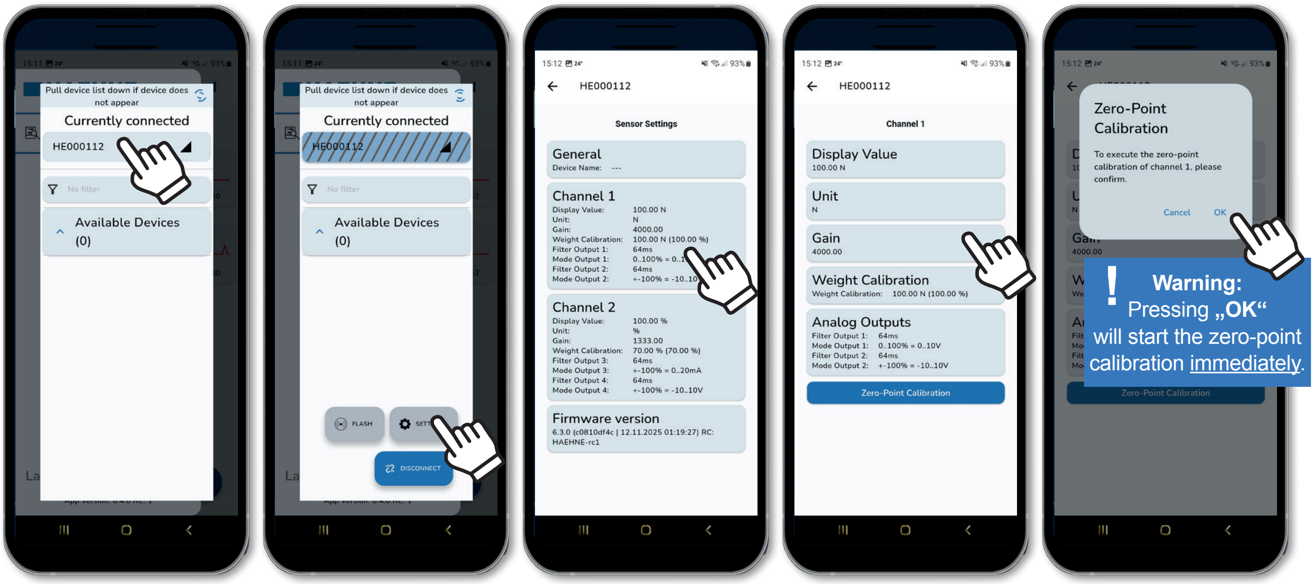
Select the „Devices“ menu item

Select the desired amplifier under „Available Devices“

Establish the connection by tapping „Connect“

Accessing device settings via the „Devices“ menu item

Adjusting the amplifier settings:



Selecting an amplifier in the upper range

Open the „Settings“ menu item

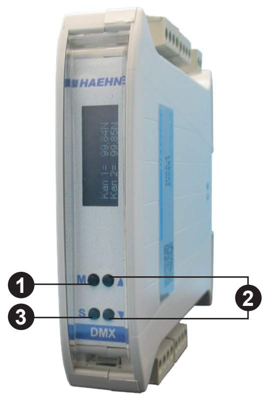
Selecting the channel to be set

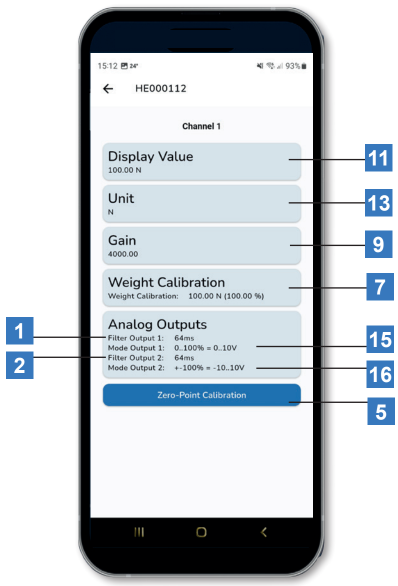
Select the parameter to change and adjust its value

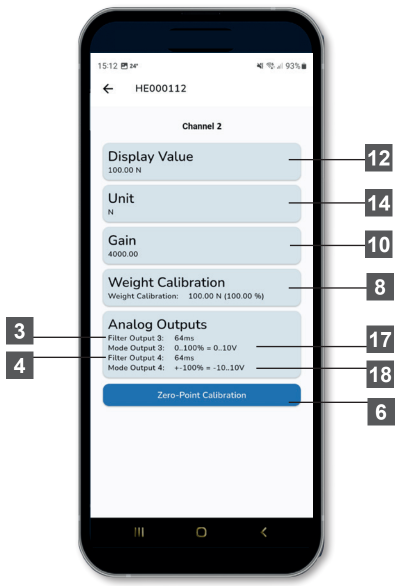
Trigger the zero-point adjustment by pressing the „Zero-point calibration“ button

Device Menu Structure

Menu item / Display	Value range / Comments		App
Default view K.1= xxx.xxyy K.2= xxx.xxyy“	xxx.xx: Value yy: Unit		
To return to the main menu, press and hold „**M**“ for about 3 seconds.			
1	2	3	
Use „**M**“ to select a menu item	Set the value using „▲▼“	Save by pressing and holding „S“ for 3 seconds	
Filter time			
Analog output 1 / Channel 1	„off“, 0,5ms, 1ms, 2ms, 4ms, 8ms, 16ms, 32ms, 64ms, 128ms, 256ms, 512ms, 1s, 2s, 4s, 8s oder 16s		1
Analog output 2 / Channel 1			2
Analog output 3 / Channel 2			3
Analog output 4 / Channel 2			4
Zero adjustment			
Channel 1	Trigger zero adjustment		5
Channel 2			6
Calibration with a defined load (reference weight)			
Channel 1	10.00% …100.00% / Note: The adjust-ment will start immediately after saving.		7
Channel 2			8
Manual gain adjustment			
Channel 1	500.00 … 8000.00 (Gain V/V)		9
Channel 2			10
Display value (100% value)			
Channel 1	1.00 … 2000.00		11
Channel 2			12
Unit (display)			
Channel 1	%, N, kN, MN, g, kg, lbs		13
Channel 2			14
Output mode			
Analog output 1 / Channel 1	+-100% = 0..10V; +-100% = -10..10V; 0..100% = 0..10V; 0..100% = -10..10V; +-100% = 0..20mA; +-100% = 4..20mA; 0..100% = 0..20mA; 0..100% = 4..20mA		15
Analog output 2 / Channel 1 (Only voltage can be selected)			16
Analog output 3 / Channel 2			17
Analog output 4 / Channel 2 (Only voltage can be selected)			18
Display orientation	Right (default), Left		
Bluetooth Mode	- Off - Read-only - Read + Write		
Serial number	xxxxxx (read-only value)		







Calibration of the measurement system

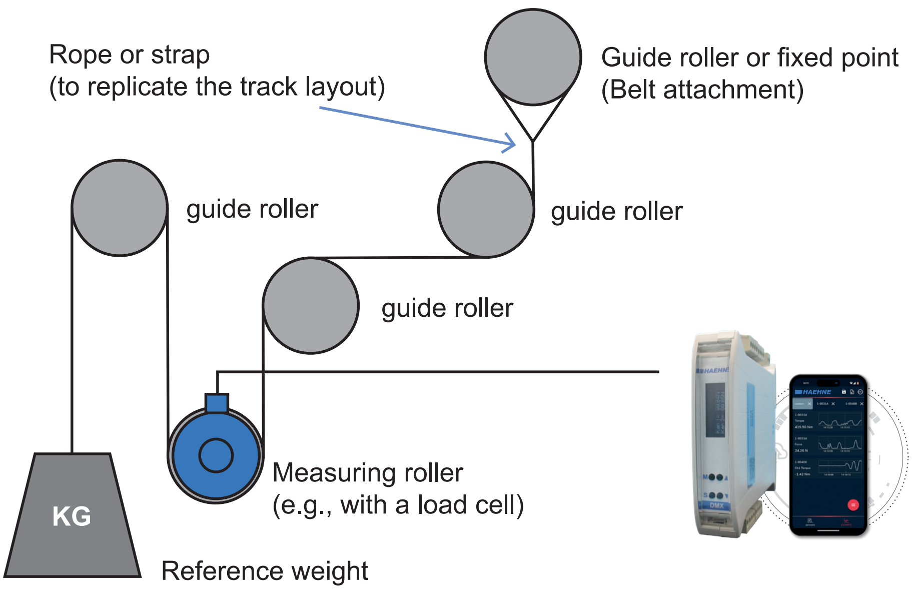
When a measurement chain consisting of sensors and amplifiers is purchased from HAEHNE, the amplifiers are preset to the sensors' rated values. This means that the amplifier's gain is set so that, at the sensor's rated force, the amplifier's output provides 10 V or 20 mA. In most cases, only the zero point needs to be adjusted.

If the desired output signal does not correspond to the rated force, the gain can either be calculated or determined automatically using a reference force.

Step-by-step instructions:

1. Wire the device according to the intended application.
2. Turn on the device and wait for it to reach operating temperature.
3. Set any parameters that differ from the default settings.
4. If the sensor signal fluctuates too much, you can use the filter setting to filter the signal.
5. Relieve the load on the sensor, but allow the preload present during normal measurement operation to remain in effect. For web tension sensors, this is the built-in measuring chain with a roller without a web, such as film, paper, etc.
6. Use the menu item (Channel x Zero Point) to adjust the zero point of both channels. After adjustment, the amplifier's output value is 0 V, 0 mA, or 4 mA.

The following settings are only necessary if the gain cannot be calculated



7. For web tension measurement, it is necessary to precisely position a non-elastic rope or strap (belt) in the center of the roller in accordance with the web path geometry. In particular, it must be ensured that the web path is maintained exactly in front of and behind the web path is maintained exactly. The rollers with the web wrapped around them in the direction of the reference weight must rotate freely and must not be driven or mounted as fixed elements.

In addition, care must be taken to ensure that no machine parts are touched, as this could lead to calculation errors. One end of the cable should be secured, while a precisely defined reference weight is attached to the other end.
(In general force measurement technology, the force can often be applied directly in a uniaxial manner.)

- Practical tip: A standard roller shutter strap is ideal because it retains its rigidity lengthways and does not damage the surface of the rollers.

8. The reference weight should, where possible, correspond to the expected maximum force to be applied, but should be at least 20% of that. It is recommended that a weight corresponding to between 70% and 100% of the intended maximum force is selected.
9. Under the menu item (Calibration Weight Ch. x), enter the percentage value of the reference weight relative to the maximum force to be used; the gain is then adjusted. This means that the amplifier calculates the gain factor so that, after adjustment, an output voltage is produced that is proportional to the percentage value entered. At 100% of the maximum force used, 10 V or 20 mA are available.
   - The HAEHNE Viewer app (iOS and Android) makes it easy to configure and calibrate the device, allowing you to enter values in various units (% , N, kN, MN, g, kg, lbs), which are automatically converted for the DMX.
10. Bleed the system and, if necessary, adjust the zero point.

Gain specification as a value (gain factor):
As an alternative to steps 7 to 9, the gain factor can be entered directly under the menu option 'Gain Ch. x', provided it is known. Below are three examples of how this factor can be calculated theoretically.

Example 1

Sensor data: Nominal sensitivity of the sensor: 1.5 mV/V
Supply voltage: 5 V
(the output signal is therefore 7.5 mV = 0.0075 V at nominal tension)

Amplifier output: 10 V at nominal web tension (web force)
0 V at zero web tension

$$\text{Gain factor} = \frac{10\ \text{V}}{0{,}0075\ \text{V}} = 1333{,}\overline{3} \approx 1333{,}33$$

Example 2

If the sensor from Example 1 is subjected to a load of less than the rated force, a higher gain is required. If, for example, the sensor is used at only up to 75% of its maximum capacity, the output signal is reduced accordingly:

$$7{,}5\ \text{mV}\ \frac{75\ \%}{100\%} = 5{,}625\ \text{mV}$$

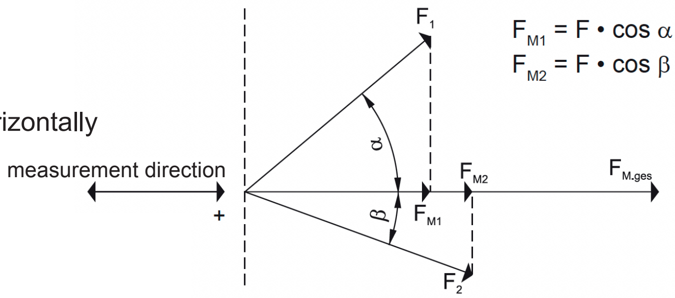
It follows that:

$$\text{Gain factor} = \frac{10\ \text{V}}{0{,}005625\ \text{V}} = 1777{,}\overline{7} \approx 1777{,}78$$

Example 3

HAEHNE web tension sensors are specifically designed for a defined measurement direction, which is indicated by a corresponding mark. Forces acting in the direction of the mark produce positive readings. If loads do not act exactly in the measurement direction, the sensors therefore record a correspondingly reduced value in accordance with trigonometric functions. The machine design determines the angles for the strip inlet and strip outlet; Consequently, the direction of the two force vectors F1 and F2 is determined. Assuming that the roller is neither driven nor braked and that bearing friction can be neglected, the specified maximum value of the operating web tension is applied to the magnitudes of the vectors. Using trigonometric functions and the respective installation position, the web tension components in the direction of measurement are then calculated. The combined effect of these two components acts on the roller, with half of the resulting force being transmitted to each sensor.

Web tension F = 1000 N
Inlet angle α = 40°
Run-out angle β = 20°
Measurement direction M = horizontally



$$F_{M1} = F \cdot \cos\alpha$$
$$F_{M2} = F \cdot \cos\beta$$

Force per sensor:

$$F_M = \frac{1}{2}\left(F_{M1} + F_{M2}\right)$$

$$F_M = \frac{F}{2}\left(\cos\alpha + \cos\beta\right)$$

$$= \frac{1000\ \text{N}}{2}\left(0{,}766 + 0{,}94\right) \qquad F_M = 853\ \text{N}$$

In this example, a web tension of 1000 N exerts a force of 853 N on each sensor. With the amplifier properly calibrated, a web tension of 1000 N produces an output signal of 10 V.

Note: Instead of calculating the force component manually, you can also use the Configurator (https://haehne-configurator.de/index.html) to determine it. When using sensors with a rated force of 1000 N and a rated sensitivity of 1.5 mV/V, the calculation is as follows.

$$7{,}5\ \text{mV} \cdot \frac{853\ \text{N}}{1000\ \text{N}} = 6{,}3975\ \text{mV}$$

$$\text{Gain} = \frac{10\ \text{V}}{0{,}0063975\ \text{V}} = 1563{,}11$$

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