CIRCUTOR

Indicator for process signals, temperature and resistance

DHB-402 DHB-424

INSTRUCTION MANUAL

(M045B01-03-16A)

C E

SAFETY PRECAUTIONS

Follow the warnings described in this manual with the symbols shown below.

	DANGER Warns of a risk, which could result in personal injury or material damage.

	ATTENTION Indicates that special attention should be paid to a specific point.

If you must handle the unit for its installation, start-up or maintenance, the following should be taken into consideration:

	Incorrect handling or installation of the unit may result in injury to personnel as well as damage to the unit. In particular, handling with voltages applied may result in electric shock, which may cause death or serious injury to personnel. Defective installation or maintenance may also lead to the risk of fire. Read the manual carefully prior to connecting the unit. Follow all installation and maintenance instructions throughout the unit's working life. Pay special attention to the installation standards of the National Electrical Code.

	Refer to the instruction manual before using the unit In this manual, if the instructions marked with this symbol are not respected or carried out correctly, it can result in injury or damage to the unit and /or installations.

CIRCUTOR, SA reserves the right to modify features or the product manual without prior notification.

DISCLAIMER

CIRCUTOR, SA reserves the right to make modifications to the device or the unit specifications set out in this instruction manual without prior notice.

CIRCUTOR, SA on its web site, supplies its customers with the latest versions of the device specifications and the most updated manuals.

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REVISION LOG

Table 1: Revision log.

Date	Revision	Description
09/14	M045B01-03-14A	Initial version
08/15	M045B01-03-15A	Global revision
02/16	M045B01-03-16A	Changes in the following sections: 3.3.1. - 3.3.2. - 4.6. - 5.

Note: The images of the units are solely for the purpose of illustration and may differ from the original unit.

1.- VERIFICATION UPON RECEPTION

Check the following points when you receive the unit:

a) The unit meets the specifications described in your order.
b) The unit has not suffered any damage during transport.
c) Perform an external visual inspection of the unit prior to switching it on.
d) Check that it has been delivered with the following:
- An installation guide,
- Four retainers for rear attachment of the unit,
- 2 connection terminals.
- Labels with the measuring units.

⚠️ If any problem is noticed upon reception, immediately contact the transport company and/or **CIRCUTOR's** after-sales service.

2.- PRODUCT DESCRIPTION

The **DHB-4xx** is a programmable panel unit that measures: standard analogue signals sent by sensors, temperature (RTD and Thermocouple), resistance, and current time.
There are 2 versions of the unit depending on the number of alarms and whether the unit has communications.

✓ **DHB-402,** with 2 alarm relays.
✓ **DHB-424,** with 4 alarm relays, 2 analogue outputs and communications RS-485.

The unit features:

- **4 buttons** that allow you to browse between the various screens and program the unit.
- **Inputs** to measure analogue voltage, current and temperature signals.
- **LCD Display**, which displays all the parameters.
- **2 alarm relays**, fully programmable (**DHB-402** model).
- **2 analogue outputs**, fully programmable. (**DHB-424** model).
- **4 alarm relays**, fully programmable (**DHB-424** model).
- **RS-485** communications, MODBUS RTU©. (**DHB-424** model).
- **1 open collector output**, NPN (**DHB-424** model).

3.- UNIT INSTALLATION

3.1.- PRELIMINARY RECOMMENDATIONS

⚠️	In order to use the unit safely, it is critical that individuals who handle it follow the safety measures set out in the standards of the country where it is being used, use the personal protective equipment necessary, and pay attention to the various warnings indicated in this instruction manual.

The **DHB-4xx** unit must be installed by authorised and qualified staff.

The power supply plug must be disconnected and measuring systems switched off before handling, altering the connections or replacing the unit. It is dangerous to handle the unit while it is powered.

Also, it is critical to keep the cables in perfect condition to avoid accidents, personal injury and damage to installations.

The manufacturer of the unit is not responsible for any damage resulting from failure by the user or installer to heed the warnings and/or recommendations set out in this manual, nor for damage resulting from the use of products or accessories that did not come with the unit or that were made by other manufacturers.

If an anomaly or malfunction is detected in the unit, do not use the unit to take any measurements.

Inspect the work area before taking any measurements. Do not take measurements in dangerous areas or where there is a risk of explosion.

⚠️	Disconnect the unit from the power supply (unit and measuring system power supply) before maintaining, repairing or handling the unit's connections. Please contact the after-sales service if you suspect that there is an operational fault in the unit.

3.2.- INSTALLATION

The unit is installed on a panel. The thickness should not exceed 6 mm. Drill panel at $92^{+0.6}$ x $45^{+0.6}$ mm.

⚠️	Terminals, opening roofs or removing elements can expose parts that are hazardous to the touch while the unit is powered. Do not use the unit until it is fully installed.

All the connections are located inside the electric panel. The unit must be installed on the panel from the front. Attach the unit with the 4 brackets to the panel (**Figure 1**)

Cable cross-section for connections up to: 2.5 mm^2.

The unit must be connected to a power circuit protected by a circuit breaker switch or equivalent device located close to unit, marked accordingly, and easily accessed by the operator.
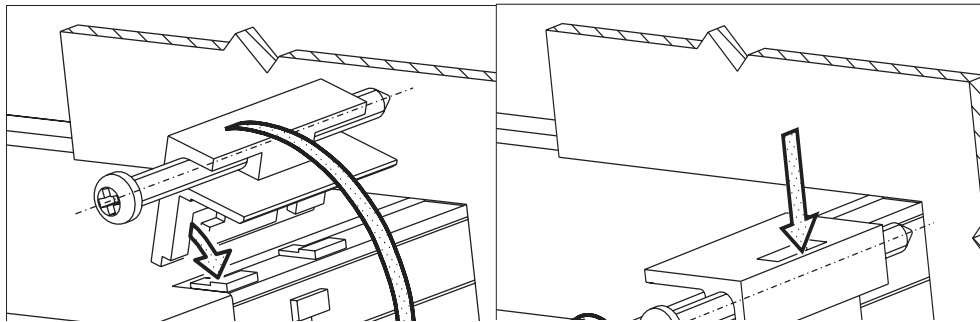

Figure 1: Unit installation and attachment

3.3.- UNIT TERMINALS

3.3.1.- List of terminals, DHB-402 model

Table 2:List of terminals on the DHB-402.

Unit terminals	
1 :10V +, Voltage input	**9: AL1**, Alarm 1 relay output (NO)
2: GND -, Ground voltage and current input	**10: AL1**, Alarm 1 relay output (Common)
3: 20mA +, Current input	**11: AL2,** Alarm 2 relay output (NO)
4: 60mV +, Thermocouple input	**12: AL2**, Alarm 2 relay output (Common)
5: 60mV -, Thermocouple input	**13, 14:** Not used.
6,7,8: Resistance-RTD probes	**15, 16:** Auxiliary power supply.

DHB-402

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

Figure 2:Terminals of the DHB-402

Note: The input, output and power supply lines are galvanically separated from each other.

3.3.2.- List of terminals, DHB-424 models

Table 3:List of terminals on the DHB-424

Unit terminals	
1 :10V +, Voltage input	**22: GND**, for RS-485
2: GND -, Ground voltage and current input	**23: 10V+**, Analogue voltage output
3: 20mA +, Current input	**24: 10V** , Analogue voltage output
4: 60mV +, Thermocouple input	**25: 20mA+**, Analogue current output
5: 60mV -, Thermocouple input	**26: 20mA**, Analogue current output
6,7,8: Resistance-RTD probes	**27: OC+,** Open collector output (NPN)
9: AL1, Alarm 1 relay output (NO)	**28: OC,** Open collector output (NPN).
10: AL1, Alarm 1 relay output (Common)	**29, 30 :** Not used
11: AL2, Alarm 2 relay output (NO)	**31: AL3**, Alarm 3 relay output (Common)
12: AL2, Alarm 2 relay output (Common)	**32: AL3**, Alarm 3 relay output (NC)
13, 14: Not used.	**33: AL3**, Alarm 3 relay output (NO)
15, 16: Auxiliary power supply.	**34: AL4**, Alarm 4 relay output (Common)
20: **B**, RS-485	**35: AL4**, Alarm 4 relay output (NC)
21: A, RS-485	**36: AL4**, Alarm 4 relay output (NO)

```
20 21 22 23 24 25 26 27 28   29 30 31 32 33 34 35 36
```

DHB-402 / DHB-424
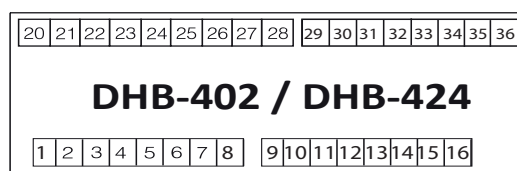
```
1  2  3  4  5  6  7  8    9 10 11 12 13 14 15 16
```

Figure 3: Terminals of the DHB-424

Note: The input, output, power supply and RS-485 communications lines are galvanically separated from each other.

3.4.- CONNECTION DIAGRAM

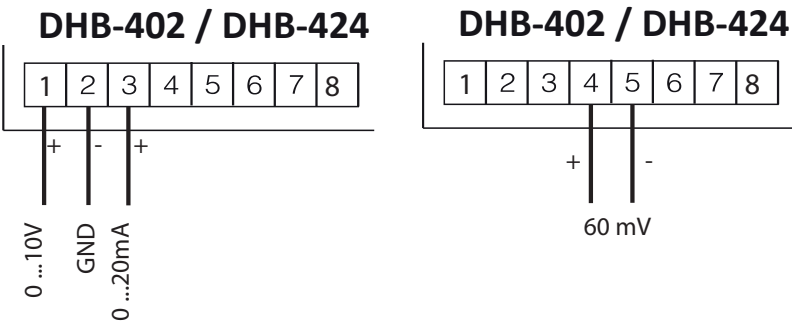### 3.4.1.- Connection of the standard analogue signals

DHB-402 / DHB-424

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

+   -   +

0 ...10V   GND   0 ...20mA

DHB-402 / DHB-424

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

+   -

60 mV

Figure 4: Connection of the standard signals, DHB-402 and DHB-424 models.

3.4.2.- Connection for measuring temperature

Thermocouple

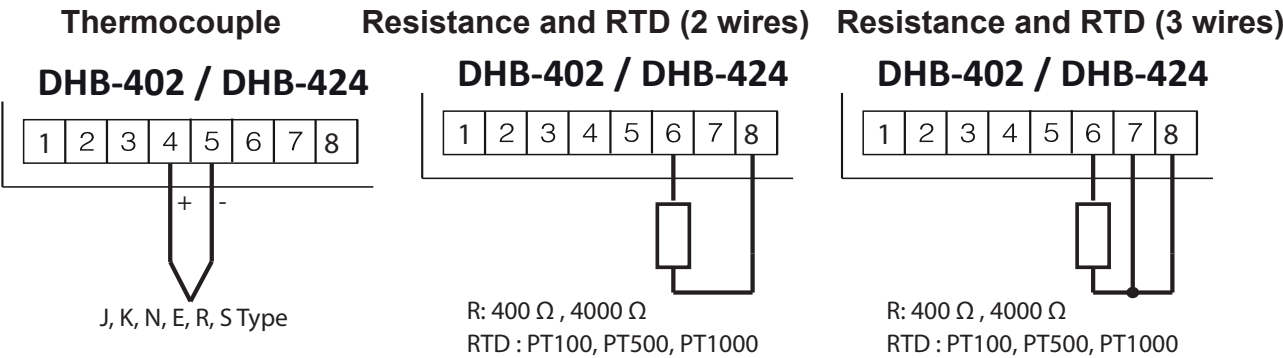**DHB-402 / DHB-424**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

+   -

J, K, N, E, R, S Type

Resistance and RTD (2 wires)

DHB-402 / DHB-424

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

R: 400 Ω , 4000 Ω
RTD : PT100, PT500, PT1000

Resistance and RTD (3 wires)

DHB-402 / DHB-424

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

R: 400 Ω , 4000 Ω
RTD : PT100, PT500, PT1000

Figure 5: Connection for measuring temperature, DHB-402 and DHB-424 models.

4.- OPERATION

4.1.- MEASURING PARAMETERS

The unit measures or calculates all the parameters in **Table 4**:

Table 4:Measurement parameters

Parameter		Display range	Maximum display range
Voltage	*Range:* 10 V⎓	-10 ...10 V	-13 ...13 V
	Range: 60 mV⎓	0 ... 60 mV	-10 ... 63 mV
Current		-20...20 mA	-24...24 mA
Temperature: Type J thermocouple		- 100 ... 1200 ºC	- 200 ... 1200 ºC
Temperature: Type K thermocouple		- 100...1370 ºC	- 200 ... 1370 ºC
Temperature: Type N thermocouple		- 100 ... 1300 ºC	- 200 ... 1300 ºC
Temperature: Type E thermocouple		- 100 ... 1000 ºC	- 200 ... 1000 ºC
Temperature: Type R thermocouple		- 50 ... 1760 ºC	- 50 ... 1768 ºC
Temperature: Type S thermocouple		- 50 ... 1760 ºC	- 50 ... 1765 ºC
Temperature: Type PT100 RTD		- 200 ... 850 ºC	- 205 ... 855 ºC
Temperature: Type PT500 RTD		- 200 ... 850 ºC	- 205 ... 855 ºC
Temperature: Type PT1000 RTD		- 200 ... 850 ºC	- 205 ... 855 ºC
Resistance	Range: 400 Ω	0 ... 400 Ω	0 ... 410 Ω
	Range: 4000 Ω	0 ... 4000 Ω	0 ... 4010 Ω
Current time		0.00 ... 23.59	0.00 ... 23.59

4.2.- DISPLAY

The display is divided into 2 areas:
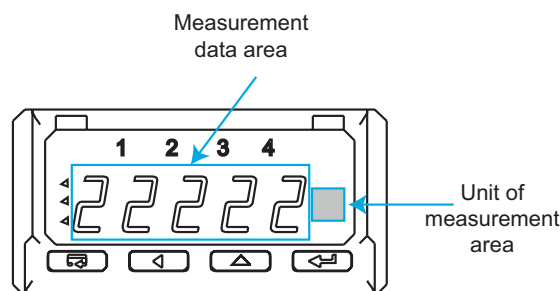
Figure 6: Areas of the DHB-4xx display

✓**Measurement data area,** for viewing the value of the parameter measured or calculated by the unit.

✓ **Unit of measurement area**, where you can see the unit for the parameter you are viewing. To do so, select the label with the unit of measurement you wish to use and stick it in its space. Then activate the corresponding LED (see section *"4.7.9.4. DISPLAYING THE UNIT OF MEASUREMENT"*) .

and there are 5 LEDs, **Figure 7**:
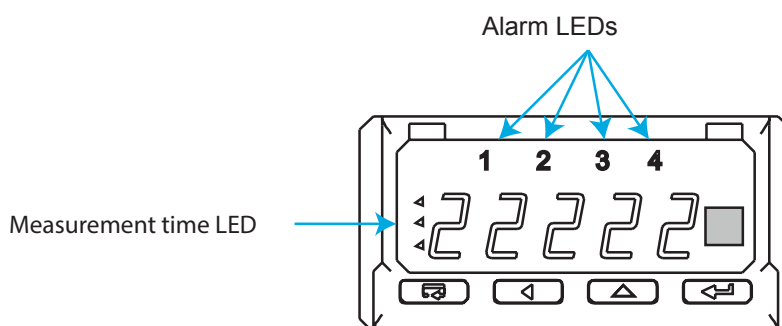
Figure 7:LEDs of the DHB-4xx

✓4 **alarm LEDs,** indicating the active alarm.

✓ 1 **measurement time LED,** indicating that the calculation time has not ended.

The unit has a three-colour LED display: red, green and orange.

The unit can automatically change the colour of the display based on the programmable parameters in the display menu (**lower colour limit**, **upper colour limit**, **lower colour**, **middle colour** and **upper colour**).

Example: In a temperature measurement you can program the display to be green when the voltage is below 10ºC, orange when it is between 10ºC and 50ºC and red for voltages above 50ºC. See section *"4.7.3.- DISPLAY."*

4.3.- BUTTON FUNCTIONS

The **DHB-4xx** has 4 buttons that allow you to browse the various screens and program the unit (**Table 5**):

Table 5: Button functions on the measurement screens.

Button	Short press	Long press (3 s)
↵	-	Enter the setup menu (editing mode)
▲	Display maximum value.	-
◄	Display minimum value.	-
⌸	-	Enter the setup menu (display mode)
⌸ ▲	Delete the maximum value	-
⌸ ◄	Delete the minimum value	-
⌸ ↵	-	Delete the alarm LED

4.4.- OPEN COLLECTOR OUTPUT, OC (**DHB-424** model)

The **DHB-424** unit has an NPN-type open collector output, terminals 27 and 28 of **Table 3**, indicating an over-range for the measurement.
See *"5.- TECHNICAL FEATURES"*

4.5.- REGRESSION OF NON-LINEAR EQUATIONS

Normally, an instrument's measurement is given by the equation for a line; in other words, there are two pairs of points that provide the measurement.
However, it may be the case that two points are not sufficient to adjust the signal's operation.
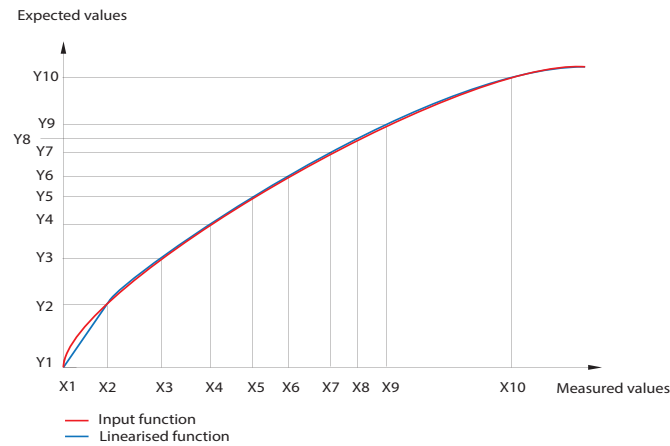For this reason, the **DHB-4xx** can work with non-linear equations with up to a maximum of 20 points (**Figure 8**)**.**

Figure 8:Regression of non-linear equations.

Once the number of points with which the function will be linearised has been selected (the number of functions is one fewer than the number of points), program the consecutive points by giving them the measured values (Xi) and the values expected to correspond to them (Yi) (0 < i < n).

While the function is being estimated, keep in mind that with non-linear functions, the more linear segments there are, the less error there will be in terms of the linearisation.

If the measured values are less than **X1**, then it will rescale, based on the first line calculated at points (X1, Y1) and (X2, Y2).
Values above Xn (where n < 22- the last measured value), will display a calculated value based on the last configured linear function.

See section "*4.7.2 REGRESSION OF NON-LINEAR EQUATIONS.*" for configurations of non-linear equations

4.6.- ALARMS

The **DHB-402** unit has:

   ✓ 2 alarm relays, **Alarm 1** and **2**, terminals 9, 10, 11, and 12 of **Table 2**, with normally open (NO) contact.

   ✓2 alarms, **Alarm 3** and **4**, fully programmable but not linked to any relay.

The **DHB-424** model has:

   ✓ 2 alarm relays, **Alarm 1** and **2**, terminals 9, 10, 11, and 12 of **Table 2**, with normally open (NO) contact.

   ✓ 2 switched alarm relays, **Alarm 3 and 4,** terminals 31, 32, 33, 34, 35, and 36 of **Table 3**.

Each of the alarms can operate in the following work modes (**Figure 9**):

✓ **n-on**: the alarm is activated when the average value exceeds the upper value **PrH** and does not deactivate until it is below the lower value **PrL**.

✓ **n-off:** the alarm is deactivated when the average value exceeds the upper value **PrH** and does not activate until it is below the lower value **PrL**.

✓ **on**: the alarm is activated when the average value exceeds the lower value **PrL** and does not deactivate until it is above the upper value **PrH**.

✓ **off:** the alarm is deactivated when the average value exceeds the lower value **PrL** and does not activate until it is above the upper value **PrH**.

✓ **h-on**: This option is always enabled for manual simulation.

✓ **h-off**: This option is always disabled for manual simulation.
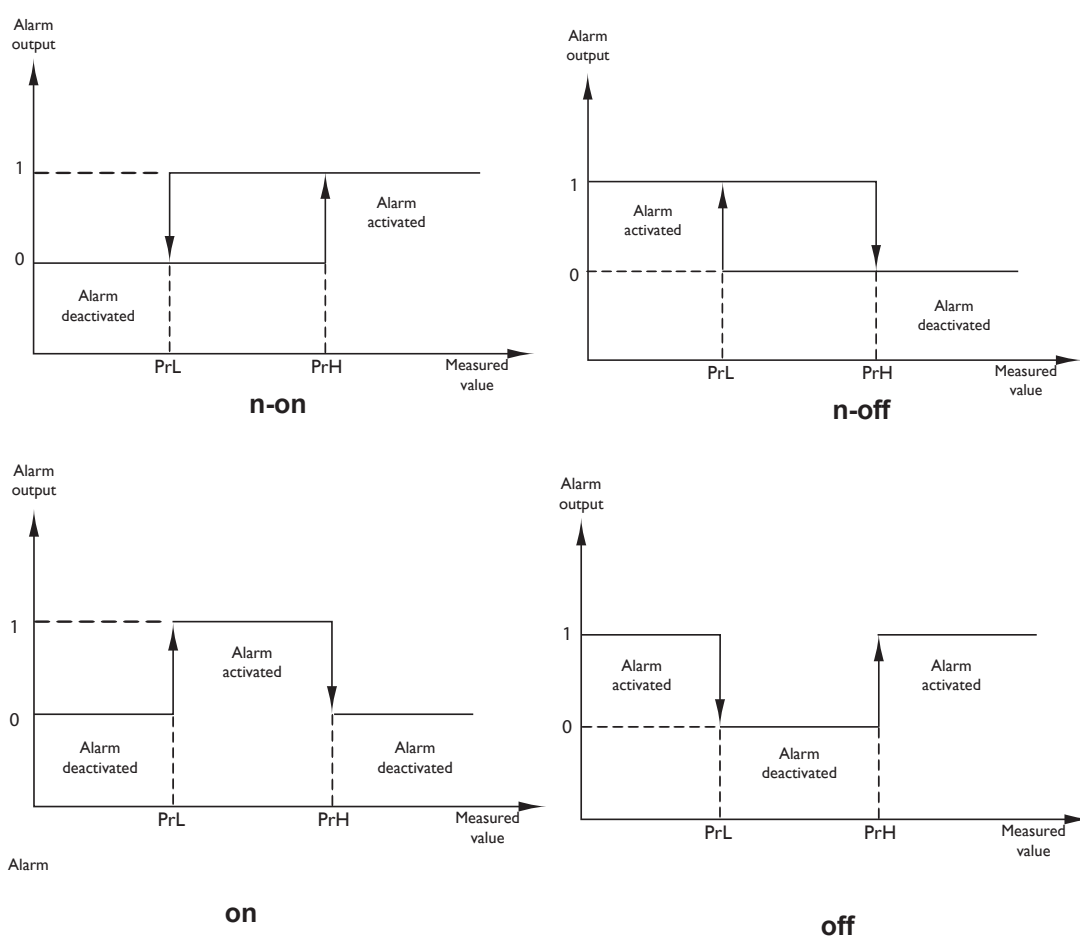
Figure 9: Alarm working modes.

4.7.- CONFIGURATION

The unit has various setup menus where you can configure:

- ✓ The input parameter.
- ✓ Regression of non-linear equations.
- ✓ The display.
- ✓ The alarms.
- ✓ The outputs (**DHB-424** model).
- ✓ The service parameters.
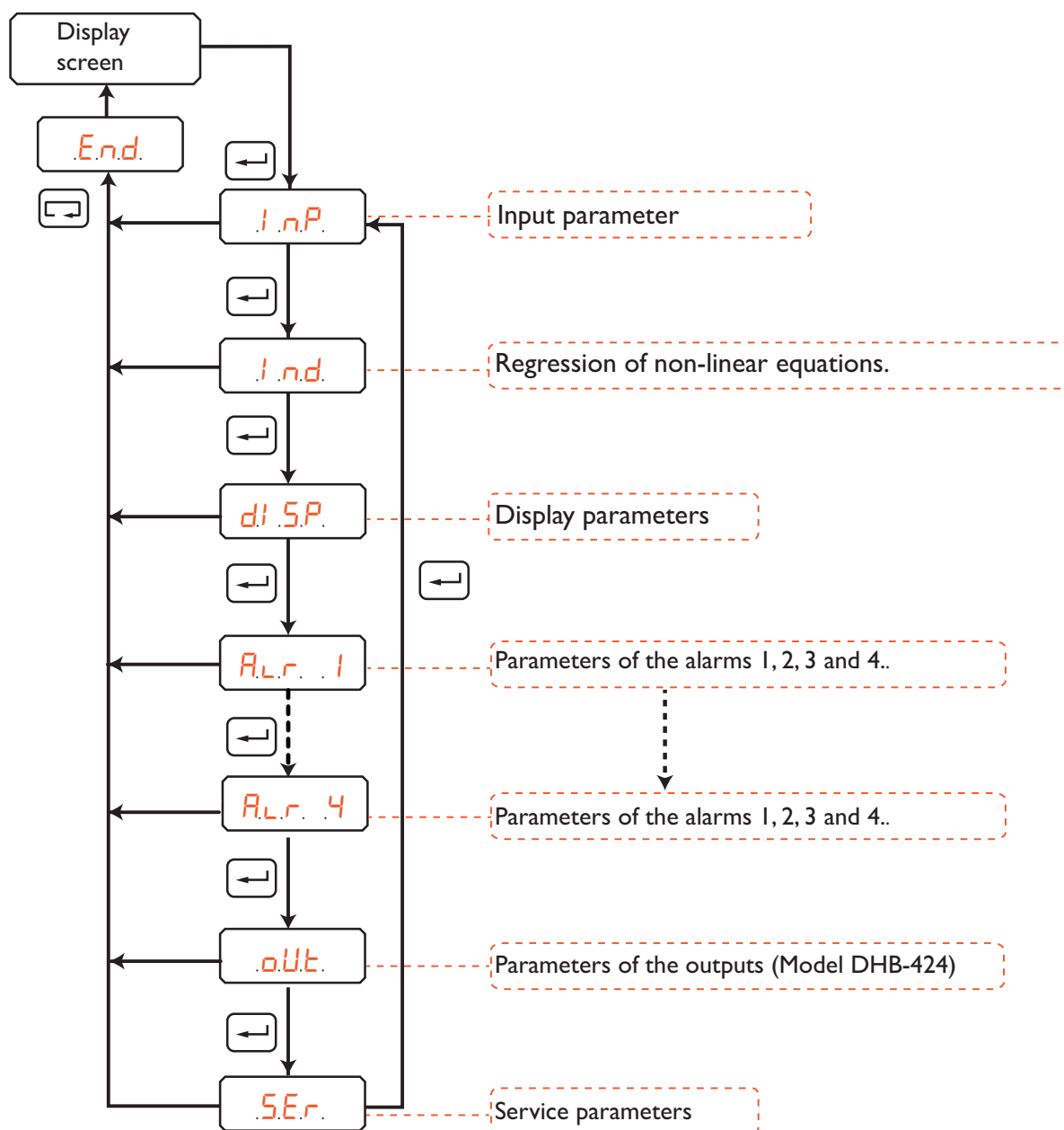
Figure 10: Accessing the setup menus

The **DHB-4xx** does not record programming changes until the configuration is complete. If the unit is reset before finishing the configuration or if no button is pressed for 30 seconds, the configuration will not be stored in the memory.

To enter the setup menu press the ↵ button for 3 seconds.

If the setup menu is password-locked the display will read 𝖲𝖤𝖢 along with a flashing 𝟢 value:

Figure 11:Password screen

To modify the password, press the ↵ button.

To modify the value of the selected digit, press the ▲ button repeatedly.

To jump to the next digit, press the ◀ button.

Once at the desired value, validate by pressing the ↵ button.

If the password is incorrect or no password has been entered, the screen in **Figure 12** will appear and the unit will go to the display screen.

Figure 12:Incorrect password screen.

If the password is correct, the unit will display the parameters screen **Figure 13.**

To permanently unlock the unit, see *"4.7.9.2. PASSWORD"*

Note: *By default, the unit comes without a password.*

4.7.1.- INPUT PARAMETERS

This menu is used to configure the input parameters.
Press the ▲ button to access the first configuration parameter.

Figure 13:Input parameters menu main screen.

4.7.1.1.- TYPE OF INPUT

This screen is used to select the type of input that has been connected to the unit.
The screen flashes between the symbol and the configured value. (**Figure 14**)

Figure 14: Parameter to display screen.

To edit the parameter, press the ↵ button.

The parameters that can be displayed are:

	RTD sensor: Pt 100		RTD sensor: Pt 500
	RTD sensor: Pt 1000		Resistance measurement up to 400 Ω
	Measuring resistance up to 4000 Ω		Type J thermocouple
	Type H thermocouple.		Type N thermocouple
	Type E thermocouple		Type R thermocouple
	Type S thermocouple		Voltage input 0...10 V

 Current input 0...20 mA

 Voltage input 0...60 mV

 Current time

To move from one option to another, press the ▲ button repeatedly.

When you see the option you want, validate by pressing the ↵ button.
The unit goes back to the screen shown in **Figure 14.**

To move to the next parameter on the menu, press the ▲ button.

When the ⯐ button is pressed, the unit goes to the main screen of the input parameters menu (**Figure 13**).

Default value: Pt 100 (Pt 1).

4.7.1.2.- COMPENSATION VALUE

Note: Parameter applicable to temperature (RTD and Thermocouple) and resistance measurement inputs.

This configuration screen is used to select the compensation value.
For the RTD sensors this value is defined by the cable that joins the RTD sensor to the unit.
For the thermocouples it is defined by the *cold junction*.
The screen flashes between the symbol and the configured value. (**Figure 15**).

Figure 15: Compensation value screen.

To edit the parameter, press the ↵ button.
To modify the value of the selected digit, press the ▲ button repeatedly.

To jump to the next digit, press the ◄ button.
Once at the desired value, validate by pressing the ↵ button.

You can now select the position of the decimal point, which will be flashing.

To select the position of the decimal point, press the ◄ button.
Validate by pressing the ↵ button. The unit goes back to the screen shown in **Figure 15**

To move to the next parameter on the menu, press the ▲ button.

When the ⌨ button is pressed, the unit goes to the main screen of the input parameters menu (**Figure 13**).

Range: **RTD temperature or resistance measurement input** : 0 ... 20 Ω.
                 Thermocouple temperature input : 0 ... 60ºC.

Note: If a value is programmed that is out of range, the unit will activate automatic compensation.

Default value: 0.

4.7.1.3.- MEASUREMENT TIME

This screen lets you configure the measurement time for the input signal in seconds.
The screen flashes between the symbol and the configured value (**Figure 16**).

Figure 16:Measurement time display screen.

To edit the parameter, press the ↵ button.
To modify the value of the selected digit, press the ▲ button repeatedly.

To jump to the next digit, press the ◄ button

Once at the desired value, validate by pressing the ↵ button.

Validate by pressing the ↵ button. The unit goes back to the screen shown in **Figure 16**.

To move to the next parameter on the menu, press the ▲ button.

When the ⌨ button is pressed, the unit goes to the main screen of the input parameters menu (**Figure 13**).

Range: 1 ... 3600 s.
Default value: 1

4.7.1.4.- EXITING THE MENU

At the end of the menu the screen shown in **Figure 17** appears**.**
Press the ↵ button to go back to the main screen of the input parameters menu **Figure 13**.
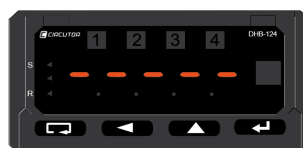

Figure 17:Exit menu screen.

4.7.2.- REGRESSION OF NON-LINEAR EQUATIONS

This menu is used to configure the parameters to carry out regressions of non-linear equations
 (see section "**4.5.- REGRESSION OF NON-LINEAR EQUATIONS"**).
Press the ▲ button to access the first configuration parameter.

Figure 18:Regression of non-linear equations menu.

4.7.2.1.- NUMBER OF POINTS

This screen is used to select the number of points to be configured for regressions of non-linear equations.
The screen flashes between the symbol and the configured value (**Figure 19**).

Figure 19:Number of points screens.

To edit the parameter, press the ← button.
To modify the value of the selected digit, press the ▲ button repeatedly.

To jump to the next digit, press the ◄ button.

Once at the desired value, validate by pressing the ← button.

To move to the next parameter on the menu, press the ▲ button.
When the ⌑ button is pressed, the unit goes to the main screen of the regression of non-linear equations menu (**Figure 18**).

Range: 1 ... 21 or No.
Default value: No

Note: *If a* value of less than 2 *is programmed, regressions of non-linear equations will be disabled (Menus* ***4.7.2.2 MEASURED VALUES (X)*** *and* ***4.7.2.3 EXPECTED VALUES (Yi)*** *will no longer be accessible.)*

4.7.2.2.- MEASURED VALUES (Xi)

This screen is used to configure the value X1 (measured value) corresponding to the first point in the equation.
The screen flashes between the symbol and the configured value (**Figure 20**).

Figure 20:Measured values configuration screens

To edit the parameter, press the ↵ button.
To modify the value of the selected digit, press the ▲ button repeatedly.

To jump to the next digit, press the ◄ button.
Once at the desired value, validate by pressing the ↵ button.

You can now select the position of the decimal point, which will be flashing.

To select the position of the decimal point, press the ◄ button.
Validate by pressing the ↵ button. The unit goes back to the screen shown in **Figure 20**.

To move to the next parameter on the menu, press the ▲ button.

When the ⬓ button is pressed, the unit goes to the main screen of the regression of non-linear equations menu (**Figure 18**).

Range: -19999 ... 99999
Default value: 0

4.7.2.3.- EXPECTED VALUES (Yi)

This screen is used to configure the value Y1 (expected value) corresponding to the first point in the equation.
The screen flashes between the symbol and the configured value (**Figure 21**).

Figure 21:Expected values configuration screens.

To edit the parameter, press the ↵ button.
To modify the value of the selected digit, press the ▲ button repeatedly.

To jump to the next digit, press the ◄ button.
Once at the desired value, validate by pressing the ↵ button.

You can now select the position of the decimal point, which will be flashing.

To select the position of the decimal point, press the ◄ button.

Validate by pressing the ↵ button. The unit will go back to the screen shown in **Figure 21** .

To move to the next parameter on the menu, press the ▲ button.

When the ⬚ button is pressed, the unit goes to the main screen of the regression of non-linear equations menu (**Figure 18**).

Range: -19999 ... 99999
Default value: 0

Note: The configuration screens "4.7.2.2 MEASURED VALUES (X)" and "4.7.2.3.- EXPECTED VALUES (Yi)"must be repeated once for each number of points programmed.

Note: All the measured points (Xi) must be in sequence such that X1 < X2 < ... < Xi. If this is not the case, regressions of non-linear equations will be disabled and an indicator established in the log.

4.7.2.4.- EXITING THE MENU

At the end of the menu the screen shown in **Figure 22** appears**.**
Press the ↵ button to go back to the regressions of non-linear equations main screen **Figure 18.**
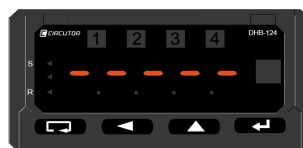

Figure 22:End of menu screen.

4.7.3.- DISPLAY.

This menu is used to configure the display features.
Press the ▲ button to access the first configuration parameter.

Figure 23:Display setup menu

4.7.3.1.- MINIMUM POSITION OF THE DECIMAL PLACE IN THE DISPLAY VALUE

This screen can be used to assign a minimum position to the decimal point being displayed.
The screen flashes between the symbol and the configured value (**Figure 24**).

Figure 24: Configuration screens for the display decimal point.

To edit the parameter, press the ↵ button.
To move from one position of the decimal point to another, press the ▲ button repeatedly.

When you see the option you want, validate by pressing the ↵ button.
The unit goes back to the screen shown in **Figure 24**.

To move to the next parameter on the menu, press the ▲ button.
When the ☐ button is pressed, the unit goes to the main screen of the display menu (**Figure 23**).

Default value: 0000.0

4.7.3.2.- LOWER COLOUR.

This screen is used to configure the lower colour of the display. In other words, this is the display colour when the measured value is below the **lower colour limit** (see section "*4.7.3.5. LOWER COLOUR LIMIT*.").
The screen flashes between the symbol and the configured value (**Figure 25**).

Figure 25:Middle colour screens.

To modify the options, press the ⏎ button.

The colour options are:

 Green.   Orange.

 Red.

To move from one option to another, press the ▲ button repeatedly.

When you see the option you want, validate by pressing the ⏎ button.
The unit goes back to the screen shown in **Figure 25**.

To move to the next parameter on the menu, press the ▲ button.

When the ⏏ button is pressed, the unit goes to the main screen of the display menu (**Figure 23**).

Default value: *Green*.

4.7.3.3. MIDDLE COLOUR

This screen is used to configure the middle colour of the display. In other words, this is the display colour when the measured value is between the **lower colour limit** (see section "*4.7.3.5. LOWER COLOUR LIMIT*.") and the **upper colour limit** (see section *"4.7.3.6. UPPER COLOUR LIMIT"*).
The screen flashes between the symbol and the configured value (**Figure 26**).

Figure 26:Middle colour screens.

To modify the options, press the ⏎ button.
The colour options are:

 Green.   Orange.

 Red.

To move from one option to another, press the ▲ button repeatedly.

When you see the option you want, validate by pressing the ⏎ button.
The unit goes back to the screen shown in **Figure 26**.

To move to the next parameter on the menu, press the ▲ button.

When the 🖵 button is pressed, the unit goes to the main screen of the display menu (**Figure 23**).

Default value: *Orange*.

4.7.3.4. UPPER COLOUR

This screen is used to configure the upper colour of the display. In other words, this is the display colour when the measured value is above the **upper colour limit** (see section *"4.7.3.6. UPPER COLOUR LIMIT"*).
The screen flashes between the symbol and the configured value (**Figure 27**)

Figure 27:Upper colour screens.

To modify the options, press the ⏎ button.
The colour options are:

  Green.   Orange.

  Red.

To move from one option to another, press the ▲ button repeatedly.

When you see the option you want, validate by pressing the ⏎ button.
The unit goes back to the screen shown in **Figure 27**.

To move to the next parameter on the menu, press the ▲ button.

When the 🖵 button is pressed, the unit goes to the main screen of the display menu (**Figure 23**).

Default value: *red*.

4.7.3.5. LOWER COLOUR LIMIT

This screen is used to configure the value of the lower colour limit.
The screen flashes between the symbol and the configured value (**Figure 28**).

Figure 28:Lower colour limit screens.

To edit the parameter, press the [↵] button.
To modify the value of the selected digit, press the [▲] button repeatedly.

To jump to the next digit, press the [◄] button.
Once at the desired value, validate by pressing the [↵] button.

You can now select the position of the decimal point, which will be flashing.

To select the position of the decimal point, press the [◄] button.
Validate by pressing the [↵] button. The unit goes back to the screen shown in **Figure 28**.

To move to the next parameter on the menu, press the [▲] button.

When the [⟲] button is pressed, the unit goes to the main screen of the display menu (**Figure 23**).

Range: -19999 ... 99999.
Default value: 50.000.

4.7.3.6. UPPER COLOUR LIMIT

This screen is used to configure the value of the upper colour limit.
The screen flashes between the symbol and the configured value (**Figure 29**).

Figure 29:Upper colour limit screens.

To edit the parameter, press the [↵] button.
To modify the value of the selected digit, press the [▲] button repeatedly.

To jump to the next digit, press the [◄] button.
Once at the desired value, validate by pressing the [↵] button.

You can now select the position of the decimal point, which will be flashing.

To select the position of the decimal point, press the [◄] button.
Validate by pressing the [↵] button. The unit goes back to the screen shown in **Figure 29**.

To move to the next parameter on the menu, press the [▲] button.

When the [▭] button is pressed, the unit goes to the main screen of the display menu (**Figure 23**).

Range: -19999 ... 99999.
Default value: 80.000.

4.7.3.7. UNDERFLOW.

This screen is used to configure the value under which underflow signals will be shown on the display [-----] .
The screen flashes between the symbol and the configured value (**Figure 30**)

Figure 30:Underflow screens.

To edit the parameter, press the [↵] button.

To modify the value of the selected digit, press the [▲] button repeatedly.

To jump to the next digit, press the [◄] button.

Once at the desired value, validate by pressing the [↵] button.
You can now select the position of the decimal point, which will be flashing.

To select the position of the decimal point, press the [◄] button.
Validate by pressing the [↵] button. The unit goes back to the screen shown in **Figure 30**.

To move to the next parameter on the menu, press the [▲] button.

When the [▭] button is pressed, the unit goes to the main screen of the display menu (**Figure 23**).

Range: -19999 ... 99999.
Default value: -19999.

4.7.3.8. OVERFLOW

This screen is used to configure the value above which overflow signals will be shown on the display ![display] .

The screen flashes between the symbol and the configured value (**Figure 31**)

Figure 31:Overflow screens.

To edit the parameter, press the ![enter] button.
To modify the value of the selected digit, press the ![up] button repeatedly.

To jump to the next digit, press the ![left] button.
Once at the desired value, validate by pressing the ![enter] button.

You can now select the position of the decimal point, which will be flashing.

To select the position of the decimal point, press the ![left] button.
Validate by pressing the ![enter] button. The unit goes back to the screen shown in **Figure 31.**

To move to the next parameter on the menu, press the ![up] button.

When the ![menu] button is pressed, the unit goes to the main screen of the display menu (**Figure 23**).

Range: -19999 ... 99999.
Default value: 99999

4.7.3.9. EXITING THE MENU

At the end of the menu the screen shown in **Figure 32** appears**.**
Press the ![enter] button to go back to the main screen of the display menu (**Figure 23**).
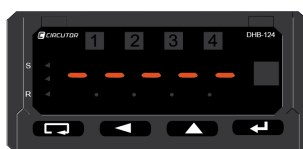

Figure 32:End of menu screen.

4.7.4. ALARM 1

This menu is used to configure the parameters of alarm 1.
Press the ▲ button to access the first configuration parameter.

Figure 33:Alarm relay 1 configuration screen.

4.7.4.1. PARAMETER

This screen is used to select the parameter for which the alarm is to be applied
The screen flashes between the symbol and the configured value. (**Figure 34**).

Figure 34:Alarm parameter configuration screens.

To edit the parameter, press the ↵ button.
The parameters are:

 Type of input that has been connected to the unit.

 Current time

To move from one option to another, press the ▲ button repeatedly.

When you see the option you want, validate by pressing the ↵ button.
The unit goes back to the screen shown in **Figure 34**.

To move to the next parameter on the menu, press the ▲ button.
When the ▢ button is pressed, the unit goes to the main screen of the alarms menu (**Figure 33**).

Default value: Type of input that has been connected to the unit (**InP**).

4.7.4.2. ALARM TYPE

This screen is used to select the alarm functionality (see section **"4.6.- ALARMS"**).
The screen flashes between the symbol and the configured value (**Figure 35**)

Figure 35:Alarm types screens.

To edit the parameter, press the ⏎ button.
The options are:

 n-on   n-off

 on   off

 Manual activation of the alarm relay.   Manual deactivation of the alarm relay.

To move from one option to another, press the ▲ button repeatedly.

When you see the option you want, validate by pressing the ⏎ button.
The unit goes back to the screen shown in **Figure 35**.

To move to the next parameter on the menu, press the ▲ button.

When the ⟳ button is pressed, the unit goes to the main screen of the alarms menu (**Figure 33**).

Default value: Manual deactivation of the alarm relay (**H-off**).

4.7.4.3. ALARM LOW VALUE

This screen is used to configure the low value of the alarm, **PrL**.
The screen flashes between the symbol and the configured value (**Figure 36**).

Figure 36:Alarm low value screen.

To edit the parameter, press the ⏎ button.
To modify the value of the selected digit, press the ▲ button repeatedly.

To jump to the next digit, press the ◄ button
Once at the desired value, validate by pressing the ⏎ button.

You can now select the position of the decimal point, which will be flashing.

To select the position of the decimal point, press the ◄ button.
Validate by pressing the ⏎ button. The unit will go back to the screen shown in **Figure 36**.
To move to the next parameter on the menu, press the ▲ button.

When the ⟱ button is pressed, the unit goes to the main screen of the alarms menu (**Figure 33**).

Range: -19999 ... 99999.
Default value: 100.00

Note: **PrL**> **PrH** *will cause the alarm to be disabled.*

4.7.4.4. ALARM HIGH VALUE

This screen is used to configure the high value of the alarm, **PrH**.
The screen flashes between the symbol and the configured value, (**Figure 37**).

Figure 37:Alarm high value screens.

To edit the parameter, press the ⏎ button.
To modify the value of the selected digit, press the ▲ button repeatedly.

To jump to the next digit, press the ◄ button
Once at the desired value, validate by pressing the ⏎ button.

You can now select the position of the decimal point, which will be flashing.

To select the position of the decimal point, press the ◄ button.
Validate by pressing the ⏎ button. The unit goes back to the screen shown in **Figure 37**.
To move to the next parameter on the menu, press the ▲ button.

When the ⟱ button is pressed, the unit goes to the main screen of the alarms menu (**Figure 33**).

Range: -19999 ... 99999.
Default value: 200.00
Note: **PrL**> **PrH** *will cause the alarm to be disabled.*

4.7.4.5. CONNECTION AND DISCONNECTION DELAY

This screen is used to configure the connection and disconnection delay for the alarm.
The screen flashes between the symbol and the configured value (**Figure 38**).

Figure 38:Connection/disconnection delay screens.

To edit the parameter, press the ⏎ button.
To modify the value of the selected digit, press the ▲ button repeatedly.

To jump to the next digit, press the ◄ button

Once at the desired value, validate by pressing the ⏎ button.

To move to the next parameter on the menu, press the ▲ button.

When the ⟳ button is pressed, the unit goes to the main screen of the alarms menu (**Figure 33**).

Range: 0 ... 32400 seconds.
Default value: 0

4.7.4.6. LEDs

These screens are used to activate the interlocking of the display LEDs that indicate whether an alarm has been activated or not.
The screen flashes between the symbol and the configured value (**Figure 39**).

Figure 39:LED configuration screen.

To edit the parameter, press the ⏎ button.
The options are:

 When the alarm condition is no longer met, the corresponding LED will switch off.

When the alarm condition is no longer met, the corresponding LED stays on.

You must press the combination of buttons ⊡ ↵ to switch it off.

To move from one option to another, press the ▲ button repeatedly.

When you see the option you want, validate by pressing the ↵ button.
The unit goes back to the screen shown in **Figure 39.**

To move to the next parameter on the menu, press the ▲ button.

When the ⊡ button is pressed, the unit goes to the main screen of the alarms menu (**Figure 33**).

Default value: Alarm LEDs not interlocked (OFF).

4.7.4.7. EXITING THE MENU.

At the end of the menu the screen shown in **Figure 40** appears.
Press the ↵ button to go back to the main screen of the display menu **Figure 33.**
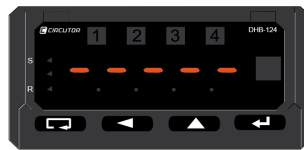
Figure 40:End of menu screen.

4.7.5. ALARM 2

This menu is used to configure the parameters of alarm 2.
See section *"4.7.4. ALARM 1"*

4.7.6. ALARM 3

This menu is used to configure the parameters of alarm 3.
This alarm is not linked to a relay in the **DHB-402** model.
See section *"4.7.4. ALARM 1"*

4.7.7. ALARM 4

This menu is used to configure the parameters of alarm 4.
This alarm is not linked to a relay in the **DHB-402** model.
See section *"4.7.4. ALARM 1"*

4.7.8. OUTPUTS (DHB-424 model)

This menu is used to configure the unit's outputs.
Press the ▲ button to access the first configuration parameter.

Figure 41:Output configuration screen.

4.7.8.1. ANALOGUE OUTPUT: PARAMETER (**DHB-424** model)

This screen is used to select the parameter to which the analogue output is to be applied.
The screen flashes between the symbol and the configured value. (**Figure 42**)

Figure 42:Analogue output configuration screen: meter.

To edit the parameter, press the ↵ button.

  Type of input that has been connected to the unit.

  Current time.

To move from one option to another, press the ▲ button repeatedly.
When you see the option you want, validate by pressing the ↵ button.
The unit goes back to the screen shown in **Figure 42**.
To move to the next parameter on the menu, press the ▲ button.

When the 🖵 button is pressed, the unit goes to the main screen of the outputs menu (**Figure 41**).

Default value: Type of input that has been connected to the unit (**InP**).

4.7.8.2. ANALOGUE OUTPUT: TYPE (**DHB-424** model)

This screen is used to select the type of analogue output.
The screen flashes between the symbol and the configured value (**Figure 43**).

Figure 43:Analogue output configuration screen: type.

To edit the parameter, press the ⏎ button.
The following types can be selected:

 Voltage 0 ... 10 V.

 Current 0 ... 20 mA.

 Current 4 ... 20 mA.

To move from one option to another, press the ▲ button repeatedly.
When you see the option you want, validate by pressing the ⏎ button.
The unit goes back to the screen shown in **Figure 43**.

To move to the next parameter on the menu, press the ▲ button.
When the ⟵ button is pressed, the unit goes to the main screen of the outputs menu (**Figure 41)**.

Default value: Voltage 0 ... 10 V

4.7.8.3. ANALOGUE OUTPUT: ZERO VALUE (**DHB-424** model)

This screen is used to configure the display value you wish to have at the beginning of the analogue output (*0 V*, *0 mA* or *4 mA*, depending on the type of output selected).
The screen flashes between the symbol and the configured value (**Figure 44**).
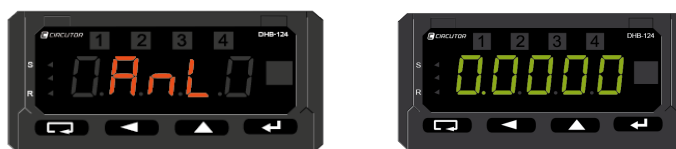
Figure 44:Analogue output configuration screen: zero value.

To edit the parameter, press the ⏎ button.
To modify the value of the selected digit, press the ▲ button repeatedly.
To jump to the next digit, press the ◄ button

Once at the desired value, validate by pressing the ⏎ button.
You can now select the position of the decimal point, which will be flashing.
To select the position of the decimal point, press the ◄ button.

Validate by pressing the ⏎ button. The unit goes back to the screen shown in **Figure 44**.
To move to the next parameter on the menu, press the ▲ button.

When the ⟵ button is pressed, the unit goes to the main screen of the outputs menu (**Figure 41**).
Range: -19999 ... 99999.
Default value: 0.0000

4.7.8.4. ANALOGUE OUTPUT: FULL-SCALE VALUE (**DHB-424** model)

This screen is used to configure the display value you wish to have at the end of the analogue output (***10 V*** or ***20 mA***, depending on the type of output selected).
The screen flashes between the symbol and the configured value (**Figure 45**).
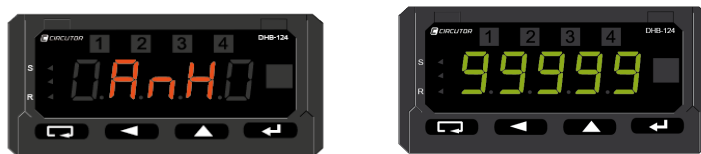
Figure 45:Analogue output configuration screen: full-scale value.

To edit the parameter, press the ⏎ button.

To modify the value of the selected digit, press the ▲ button repeatedly.
To jump to the next digit, press the ◄ button

Once at the desired value, validate by pressing the ⏎ button.

You can now select the position of the decimal point, which will be flashing.

To select the position of the decimal point, press the ◄ button.
Validate by pressing the ⏎ button. The unit goes back to the screen shown in **Figure 45**.

To move to the next parameter on the menu, press the ▲ button.

When the ⊡ button is pressed, the unit goes to the main screen of the outputs menu (**Figure 41**).

Range: -19999 ... 99999.
Default value: 99999

4.7.8.5. MODBUS COMMUNICATIONS: BAUD RATE (**DHB-424** model)

Screen used to configure the baud rate of the RS-485 port.
The screen flashes between the symbol and the configured value (**Figure 46**).

Figure 46:Modbus communications configuration screens: Transmission speed.

To edit the parameter, press the ⏎ button.
The options available are:

 4800 bauds.

 9600 bauds.

 19200 bauds.

 38400 bauds.

 57600 bauds.

 115200 bauds.

To move from one option to another, press the ▲ button repeatedly.
When you see the option you want, validate by pressing the ↵ button.
The unit goes back to the screen shown in **Figure 46**.

To move to the next parameter on the menu, press the ▲ button.

When the ⌨ button is pressed, the unit goes to the main screen of the outputs menu (**Figure 41**).

Default value: 19200 bps

4.7.8.6. MODBUS COMMUNICATIONS: TRANSMISSION PROTOCOL (**DHB-424** model)

Screen used to configure the type of transmission protocol for the RS-485 port
The screen flashes between the symbol and the configured value (**Figure 47**).

Figure 47:Modbus communications configuration screens: Transmission protocol.

To edit the parameter, press the ↵ button.

The options available are:

 8 data bits - no parity - 2 stop bits

 8 data bits - even parity - 1 stop bit

 8 data bits - odd parity - 1 stop bit

 8 data bits - no parity - 1 stop bit

To move from one option to another, press the ▲ button repeatedly.
When you see the option you want, validate by pressing the ↵ button.
The unit goes back to the screen shown in **Figure 47**.

To move to the next parameter on the menu, press the ▲ button.
When the ⟲ button is pressed, the unit goes to the main screen of the outputs menu (**Figure 41**).

Default value: 8 data bits - no parity - 1 stop bit (**r8n1**)

4.7.8.7. MODBUS COMMUNICATIONS: ADDRESS (**DHB-424** model)

Screen to configure the unit's address on the Modbus network.
The screen flashes between the symbol and the configured value (**Figure 48**)**.**

Figure 48: Modbus communications configuration screens: Modbus address.

To edit the parameter, press the ↵ button.
To modify the value of the selected digit, press the ▲ button repeatedly.

To jump to the next digit, press the ◄ button
Once at the desired value, validate by pressing the ↵ button. The unit will go back to the screen shown in **Figure 48.**

To move to the next parameter on the menu, press the ▲ button.

When the ⟲ button is pressed, the unit goes to the main screen of the outputs menu (**Figure 41**)
Range: 0 ... 247.
Default value: 1
*Note: If the value given to the address is **0**, communications will be disabled.*

4.7.8.8. EXITING THE MENU

At the end of the menu the screen shown in **Figure 49** appears.
Press the ↵ button to go back to the main screen of the outputs menu **Figure 41**.
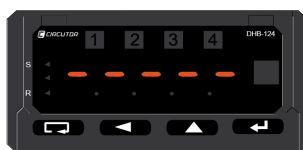
Figure 49:End of menu screen.

4.7.9. SERVICE

This menu is used to configure the unit's service parameters.
Press the ▲ button to access the first configuration parameter.

Figure 50:Services screen

4.7.9.1. DEFAULT CONFIGURATION

Screen used to reset the unit to its default configuration.
The screen flashes between the symbol and the configured value (**Figure 51**).

Figure 51:Default configuration screens.

To edit the parameter, press the ↵ button.
The options are:

  Restore the original factory parameters.

  No changes made.

To move from one option to another, press the ▲ button repeatedly.
When you see the option you want, validate by pressing the ↵ button.

If you have selected to restore the original parameters, YES, the unit will restore them and go to the screen shown in **Figure 51**, showing the default option again, no.

To move to the next parameter on the menu, press the ▲ button.
When the ▭ button is pressed, the unit goes to the main screen of the services menu (**Figure 50)**.

Default value: No changes made (**no**).

4.7.9.2. PASSWORD

This screen is used to enter a password to access the unit's setup menus.
The screen flashes between the symbol and the configured value (**Figure 52**)

Figure 52:Password screens.

To edit the parameter, press the ⏎ button.
To modify the value of the selected digit, press the ▲ button repeatedly.

To jump to the next digit, press the ◄ button
Once at the desired value, validate by pressing the ⏎ button. The unit will go back to the screen shown in **Figure 52**.

To move to the next parameter on the menu, press the ▲ button.

When the ⟲ button is pressed, the unit goes to the main screen of the services menu (**Figure 50**)

Range: 0 ... 60000.
Default value: 0

*Note: If the programmed value is **0**, the menus will not be password-protected.*

4.7.9.3. CURRENT TIME

Screen to set the unit's clock to the current time.
The screen flashes between the symbol and the configured value (**Figure 53**).

Figure 53: Current time adjustment screens.

To edit the parameter, press the ⏎ button.
To modify the value of the selected digit, press the ▲ button repeatedly.
To jump to the next digit, press the ◄ button

Once at the desired value, validate by pressing the ⏎ button. The unit will go back to the screen shown in **Figure 53.**

To move to the next parameter on the menu, press the ▲ button.

When the ⌨ button is pressed, the unit goes to the main screen of the services menu (**Figure 50**)

Range: 0.00 ... 23.59.

4.7.9.4. DISPLAYING THE UNIT OF MEASUREMENT

Screen used to light up the LED that indicates the units measured if the label is attached to the unit. *See* section *"4.2.- DISPLAY"*
The screen flashes between the symbol and the configured value. (**Figure 54**)

Figure 54:Unit of measurement display configuration screen.

To edit the parameter, press the ↵ button.
The parameters that can be displayed are:

    Unit of measurement LED off.

    Unit of measurement LED on.

To move from one option to another, press the ▲ button repeatedly.

When you see the option you want, validate by pressing the ↵ button.
The unit goes back to the screen shown in **Figure 54**.

To move to the next parameter on the menu, press the ▲ button.
When the ⌨ button is pressed, the unit goes to the main screen of the services menu (**Figure 50**).

Default value: Unit of measurement LED switched off (**Off**)

4.7.9.5. DISPLAY TEST

The test screen consists of all the segments of the screen lighting up in a sequence, allowing you to verify the correct operation of all the indicator lights.
The screen flashes between the symbol and the configured value. (**Figure 55**)

Figure 55:Display test screen.

To edit the parameter, press the ⏎ button.
The options are:

Do not perform the test

Start the display test. To stop, press the ⌨ button. When the test stops, the unit will go back to showing the ⌐□ option by default.

To move from one option to another, press the ▲ button repeatedly.

When you see the option you want, validate by pressing the ⏎ button.
The unit goes back to the screen shown in **Figure 55**.

To move to the next parameter on the menu, press the ▲ button.

When the ⌨ button is pressed, the unit goes to the main screen of the services menu (**Figure 50**).

Default value: do not perform the test.

4.7.9.6. EXITING THE MENU.

At the end of the menu the screen shown in **Figure 56** appears.
Press the ⏎ button to go back to the main screen of the services menu **Figure 50.**
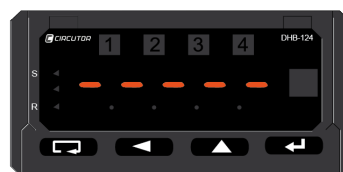
Figure 56:Exiting the menu screen.

4.8.- COMMUNICATIONS (**DHB-424** model)

The **DHB-424** units have an RS-485 serial communication output with the **MODBUS RTU**® communications protocol

4.8.1.- CONNECTIONS

The RS-485 standard enables direct communications of 32 units with a single 1200 m long serial link (speed of 9600 bauds).
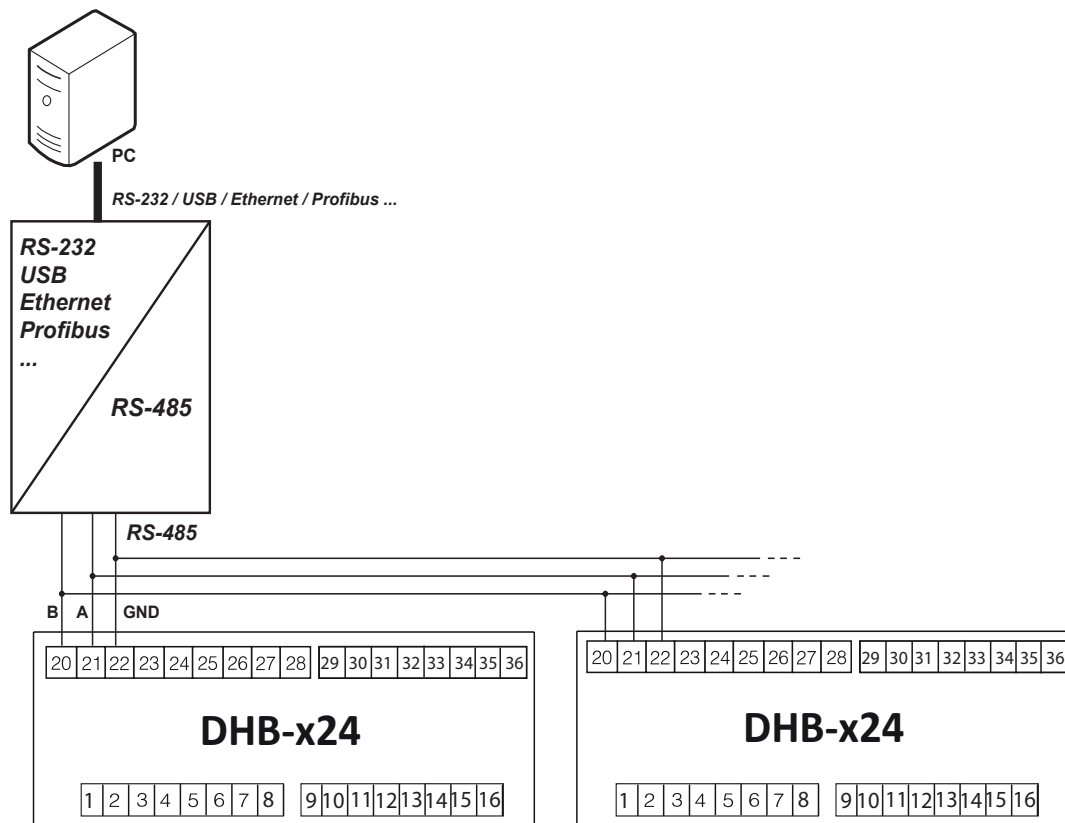
Figure 57:RS-485 port connection

The RS-485 cable must be twisted pair with shielding (minimum of 3 wires).

For interface configuration, see the configuration section *"4.7.8. Outputs (DHB-424 model)."*

4.8.2.- MODBUS PROTOCOL.

The **DHB-424** uses the RTU mode (Remote Terminal Unit) with its Modbus protocol.

The Modbus functions implemented in the unit are as follows:

Function 03 for reading multiple records.
Function 04 for reading input records.
Function 06 for writing one record.
Function 16 for writing multiple records
Function 17 for identifying the slave unit.

The maximum response time is 100 milliseconds.

4.8.3.- MODBUS MEMORY MAP.

Modbus addresses are in decimal format.

Table 6:Type of values in the Modbus memory MAP.

Address	Type of value	Description
4000-4049	integer (16 bits)	Value given in a 16-bit record.
7000-7039	float (32 bits)	Value given in two consecutive 16-bit records. The records include the same data as the 32-bit records in the 7500 area. Records valid for read function only.
7200-7326	float (32 bits)	Value given in two consecutive 16-bit records. The records include the same data as the 32-bit records in the 7600 area. The read and write functions are valid for the records.
7500-7519	float (32 bits)	Value given in a 32-bit record. Records valid for read function only.
7600-7663	float (32 bits)	Value given in a 32-bit record. The read and write functions are valid for the records.

4.8.3.1- Configuration: Input parameters menu

The Modbus address is in decimal format.
The read and write functions are enabled for all of these variables.

Table 7: Modbus memory MAP (Table 1)

INPUT PARAMETERS			
Address		**Symbol**	**Description**
4000		$tYP1$	Type of input

Type of input detail:

Value	Description
0	RTD sensor: Pt 100
1	RTD sensor: Pt 500
2	RTD sensor: Pt 1000
3	Resistance measurement up to 400 Ω
4	Resistance measurement up to 4000 Ω
5	Type J thermocouple
6	Type K thermocouple
7	Type N thermocouple
8	Type E thermocouple
9	Type R thermocouple
10	Type S thermocouple
11	Voltage input 0...10 V
12	Current input 0...20 mA
13	Voltage input 0...60 mV
14	Current time

Address 1[1]	Address 2[2]	Symbol	Description
7228-7229	7614	Con	Compensation value -19999 ... 99999
4003		Cnt	Measurement time 1 ... 3600 s

[1] *Value in two consecutive 16-bit records.*
[2] *Value in one 32-bit record.*

4.8.3.2- Configuration: Regression of non-linear equations parameters.

The Modbus address is in decimal format.
The read and write functions are enabled for all of these variables.

Table 8:Modbus memory map (Table 2)

REGRESSION OF NON-LINEAR EQUATIONS			
Address		**Symbol**	**Description**
4008		$IndCP$	Number of points on the non-linear equation regression. 1 ... 21.
Address 1[1]	**Address 2[2]**	$H1$	Measured value for point no. 1 -19999 ... 99999
7244-7245	7622		
Address 1[1]	**Address 2[2]**	$Y1$	Expected value for point no. 1 -19999 ... 99999
7246-7247	7623		
Address 1[1]	**Address 2[2]**	$H2$	Measured value for point no. 2 -19999 ... 99999
7248-7249	7624		
Address 1[1]	**Address 2[2]**	$Y2$	Expected value for point no. 2 -19999 ... 99999
7250-7251	7625		
Address 1[1]	**Address 2[2]**	$H3$	Measured value for point no. 3 -19999 ... 99999
7252-7253	7626		

REGRESSION OF NON-LINEAR EQUATIONS			
Address		Symbol	Description
Address 1[1]	Address 2[2]	$y3$	Expected value for point no. 3 -19999 ... 99999
7254-7255	7627		
Address 1[1]	Address 2[2]	$H4$	Measured value for point no. 4 -19999 ... 99999
7256-7257	7628		
Address 1[1]	Address 2[2]	$y4$	Expected value for point no. 4 -19999 ... 99999
7258-7259	7629		
Address 1[1]	Address 2[2]	$H5$	Measured value for point no. 5 -19999 ... 99999
7260-7261	7630		
Address 1[1]	Address 2[2]	$y5$	Expected value for point no. 5 -19999 ... 99999
7262-7263	7631		
Address 1[1]	Address 2[2]	$H6$	Measured value for point no. 6 -19999 ... 99999
7264-7265	7632		
Address 1[1]	Address 2[2]	$y6$	Expected value for point no. 6 -19999 ... 99999
7266-7267	7633		
Address 1[1]	Address 2[2]	$H7$	Measured value for point no. 7 -19999 ... 99999
7268-7269	7634		
Address 1[1]	Address 2[2]	$y7$	Expected value for point no. 7 -19999 ... 99999
7270-7271	7635		
Address 1[1]	Address 2[2]	$H8$	Measured value for point no. 8 -19999 ... 99999
7272-7273	7636		
Address 1[1]	Address 2[2]	$y8$	Expected value for point no. 8 -19999 ... 99999
7274-7275	7637		
Address 1[1]	Address 2[2]	$H9$	Measured value for point no. 9 -19999 ... 99999
7276-7277	7638		
Address 1[1]	Address 2[2]	$y9$	Expected value for point no. 9 -19999 ... 99999
7278-7279	7639		
Address 1[1]	Address 2[2]	$H10$	Measured value for point no. 10 -19999 ... 99999
7280-7281	7640		
Address 1[1]	Address 2[2]	$y10$	Expected value for point no. 10 -19999 ... 99999
7282-7283	7641		
Address 1[1]	Address 2[2]	$H11$	Measured value for point no. 11 -19999 ... 99999
7284-7285	7642		
Address 1[1]	Address 2[2]	$y11$	Expected value for point no. 11 -19999 ... 99999
7286-7287	7643		
Address 1[1]	Address 2[2]	$H12$	Measured value for point no. 12 -19999 ... 99999
7288-7289	7644		
Address 1[1]	Address 2[2]	$y12$	Expected value for point no. 12 -19999 ... 99999
7290-7291	7645		
Address 1[1]	Address 2[2]	$H13$	Measured value for point no. 13 -19999 ... 99999
7292-7293	7646		
Address 1[1]	Address 2[2]	$y13$	Expected value for point no. 13 -19999 ... 99999
7294-7295	7647		
Address 1[1]	Address 2[2]	$H14$	Measured value for point no. 14 -19999 ... 99999
7296-7297	7648		

REGRESSION OF NON-LINEAR EQUATIONS			
Address		**Symbol**	**Description**
Address 1[1]	**Address 2**[2]		
7298-7299	7649	Y 14	Expected value for point no. 14 -19999 ... 99999
Address 1[1]	**Address 2**[2]		
7300-7301	7650	H 15	Measured value for point no. 15 -19999 ... 99999
Address 1[1]	**Address 2**[2]		
7302-7303	7651	Y 15	Expected value for point no. 15 -19999 ... 99999
Address 1[1]	**Address 2**[2]		
7304-7305	7652	H 16	Measured value for point no. 16 -19999 ... 99999
Address 1[1]	**Address 2**[2]		
7306-7307	7653	Y 16	Expected value for point no. 16 -19999 ... 99999
Address 1[1]	**Address 2**[2]		
7308-7309	7654	H 17	Measured value for point no. 17 -19999 ... 99999
Address 1[1]	**Address 2**[2]		
7310-7311	7655	Y 17	Expected value for point no. 17 -19999 ... 99999
Address 1[1]	**Address 2**[2]		
7312-7313	7656	H 18	Measured value for point no. 18 -19999 ... 99999
Address 1[1]	**Address 2**[2]		
7314-7315	7657	Y 18	Expected value for point no. 18 -19999 ... 99999
Address 1[1]	**Address 2**[2]		
7316-7317	7658	H 19	Measured value for point no. 19 -19999 ... 99999
Address 1[1]	**Address 2**[2]		
7318-7319	7659	Y 19	Expected value for point no. 19 -19999 ... 99999
Address 1[1]	**Address 2**[2]		
7320-7321	7660	H20	Measured value for point no. 20 -19999 ... 99999
Address 1[1]	**Address 2**[2]		
7322-7323	7661	Y20	Expected value for point no. 20 -19999 ... 99999
Address 1[1]	**Address 2**[2]		
7324-7325	7662	H21	Measured value for point no. 21 -19999 ... 99999
Address 1[1]	**Address 2**[2]		
7326-7327	7663	Y21	Expected value for point no. 21 -19999 ... 99999

[1] *Value in two consecutive 16-bit records.*

[2] *Value in one 32-bit record.*

4.8.3.3- Configuration: Display parameters.

The Modbus address is in decimal format.
The read and write functions are enabled for all of these variables.

Table 9: Modbus memory map (Table 3)

DISPLAY		
Address	**Symbol**	**Description**
4009	*d_P*	Minimum position of the decimal place in the display value.
		Value **Description**
		0 *0.0000*
		1 *00.000*
		2 *000.00*
		3 *0000.0*
		4 *00000*
4010	*CoLdo*	Lower colour
		Value **Description**
		0 *rEd*
		1 *grEEn*
		2 *orAn9E*
4011	*CoLbE*	Middle colour
		Value **Description**
		0 *rEd*
		1 *grEEn*
		2 *orAn9E*
4012	*CoLUP*	Upper colour
		Value **Description**
		0 *rEd*
		1 *grEEn*
		2 *orAn9E*

Address 1[1]	**Address 2**[2]	**Symbol**	**Description**
7200-7201	7600	*CoLLo*	Lower colour change limit. -19999 ... 99999
7202-7203	7601	*CoLHI*	Upper colour change limit. -19999 ... 99999
7204-7205	7602	*ourLo*	Underflow. -19999 ... 99999
7206-7207	7603	*ourHI*	Overflow. -19999 ... 99999

[1] *Value in two consecutive 16-bit records.*
[2] *Value in one 32-bit record.*

4.8.3.4- Configuration: Alarm parameters.

The Modbus address is in decimal format.
The read and write functions are enabled for all of these variables.

Table 10:Modbus memory map (Table 4).

ALARMS				
Address		**Symbol**	**Description**	
4013		P_A1	Parameter (Alarm 1)	
			Value	**Description**
			0	Input connected to the unit
			1	Current time
4014		tYP1	Type of alarm (Alarm 1)	
			Value	**Description**
			0	n-on
			1	n-off
			2	on
			3	off
			4	h-on
			5	h-off
4015		dLY1	Connection and disconnection delay (Alarm 1) 0 ...32400 s	
4016		LEd1	Alarm 1 LED	
			Value	**Description**
			0	Interlocking of the alarm LED disabled
			1	Interlocking of the alarm LED enabled
Address 1[1]	**Address 2**[2]	PrL1	Alarm 1 low value -19999 ... 99999	
7208-7209	7604			
Address 1[1]	**Address 2**[2]	PrH1	Alarm 1 high value -19999 ... 99999	
7210-7211	7605			
4017		P_A2	Parameter (Alarm 2)	
			Value	**Description**
			0	Input connected to the unit
			1	Current time
4018		tYP2	Type of alarm (Alarm 2)	
			Value	**Description**
			0	n-on
			1	n-off
			2	on
			3	off
			4	h-on
			5	h-off
4019		dLY2	Connection and disconnection delay (Alarm 2) 0 ...32400 s	
4020		LEd2	Alarm 2 LED	
			Value	**Description**
			0	Interlocking of the alarm LED disabled
			1	Interlocking of the alarm LED enabled

ALARMS					
Address		**Symbol**	**Description**		
Address 1[1]	**Address 2**[2]	PrL2	Alarm 2 low value -19999 ... 99999		
7212-7213	7606				
Address 1[1]	**Address 2**[2]	PrH2	Alarm 2 high value -19999 ... 99999		
7214-7215	7607				
4021		P_A3	Parameter (Alarm 3)		
			Value	**Description**	
			0	Input connected to the unit	
			1	Current time	
4022		tYP3	Type of alarm (Alarm 3)		
			Value	**Description**	
			0	n-on	
			1	n-off	
			2	on	
			3	off	
			4	h-on	
			5	h-off	
4023		dLY3	Connection and disconnection delay (Alarm 3) 0 ...32400 s		
4024		LEd3	Alarm 3 LED		
			Value	**Description**	
			0	Interlocking of the alarm LED disabled	
			1	Interlocking of the alarm LED enabled	
Address 1[1]	**Address 2**[2]	PrL3	Alarm 3 low value -19999 ... 99999		
7216-7217	7608				
Address 1[1]	**Address 2**[2]	PrH3	Alarm 3 high value -19999 ... 99999		
7218-7219	7609				
4025		P_A4	Parameter (Alarm 4)		
			Value	**Description**	
			0	Input connected to the unit	
			1	Current time	
4026		tYP4	Type of alarm (Alarm 4)		
			Value	**Description**	
			0	n-on	
			1	n-off	
			2	on	
			3	off	
			4	h-on	
			5	h-off	
4027		dLY4	Connection and disconnection delay (Alarm 4) 0 ...32400 s		
4028		LEd4	Alarm 4 LED		
			Value	**Description**	
			0	Interlocking of the alarm LED disabled	
			1	Interlocking of the alarm LED enabled	
Address 1[1]	**Address 2**[2]	PrL4	Alarm 4 low value -19999 ... 99999		
7220-7221	7610				

ALARMS			
Address		**Symbol**	**Description**
Address 1[1]	**Address 2**[2]	PrH4	Alarm 4 high value -19999 ... 99999
7222-7223	7611		

[1] *Value in two consecutive 16-bit records.*
[2] *Value in one 32-bit record.*

4.8.3.5- Configuration: Output menu parameters (DHB-424 model).

The Modbus address is in decimal format.
The read and write functions are enabled for all of these variables.

Table 11:Modbus memory map (Table 5).

OUTPUTS (DHB-424)			
Address		**Symbol**	**Description**
4029		P_An	Analogue output parameter
			Value	**Description**
			0	Input connected to the unit
			1	Current time
4030		tYPA	Type of analogue output
			Value	**Description**
			0	Voltage output 0...10 V
			1	Current output 0...20 mA
			2	Current output 4...20 mA
4031		bAUdS	Modbus Communications: Baud rate
			Value	**Description**
			0	4800 bauds
			1	9600 bauds
			2	19200 bauds
			3	38400 bauds
			4	57600 bauds
			5	115200 bauds
4032		Prot	Modbus Communications: Transmission protocol
			Value	**Description**
			0	8 data bits - no parity - 2 stop bits
			1	8 data bits - even parity - 1 stop bit
			2	8 data bits - odd parity - 1 stop bit
			3	8 data bits - no parity - 1 stop bit
4033		Addr	Modbus address. 0 ... 247
4034		SAuE	Apply the changes entered in the RS-485 interface
			Value	**Description**
			0	Do not save changes
			1	Save changes
Address 1[1]	**Address 2**[2]	AnL	Zero value of the analogue output -19999 ... 99999
7224-7225	7612		
Address 1[1]	**Address 2**[2]	AnH	Full-scale value of the analogue output -19999 ... 99999
7226-7227	7613		

[1] *Value in two consecutive 16-bit records.*
[2] *Value in one 32-bit record.*

4.8.3.6- Configuration: Service menu parameters.

The Modbus address is in decimal format.
The read and write functions are enabled for all of these variables.

Table 12:Modbus memory map (Table 6).

SERVICES		
Address	**Symbol**	**Description**
4035	5Et	Default configuration
		Value / **Description**
		0 / No changes made
		1 / Change to the default parameters
4036	5Ec	Password
		Value / **Description**
		0 / No password
		1 ... 60000 / Password range
4037	t iiE	Current time ***Format: hh.mm*** hh: hours (0 ... 23) mm: minutes (0...59)
4038	Un it	Displaying the unit of measurement
		Value / **Description**
		0 / Unit of measurement LED off
		1 / Unit of measurement LED on
4039	L I_0	Reset the maximum and minimum values
		Value / **Description**
		0 / Reset not performed
		1 / Reset performed

4.8.3.7- Status record

The Modbus address is in decimal format.
The read and write functions are valid for these variables.

Table 13:Modbus memory map (Table 7).

STATUS OF THE UNIT		
Address	**Symbol**	**Description**
4048	STATUS 1	Unit status. Describes the current status of the unit. Events may only be deleted.

Position	Description
Bit15	Power supply cut
Bit14	RTC clock. Loss of configuration
Bit13	Not used
Bit12	Memory communication error
Bit11	Incorrect configuration
Bit10	The default configuration has been installed
Bit9	Memory data measurement error
Bit8	Not used
Bit7	Output board detected
Bit6	Output board calibration error
Bit5	Not used
Bit4	Not used
Bit3	Regression of non-linear equations configuration error
Bit2	Not used
Bit1	Not used
Bit0	Measurement period has not finished

Address	Symbol	Description
4049	STATUS2	Unit status. Describes the current status of the unit. Events may only be deleted

Position	Description
Bit15	Not used
Bit14	Not used
Bit13	Not used
Bit12	Not used
Bit11	Not used
Bit10	Not used
Bit9	Not used
Bit8	Not used
Bit7	LED4- Alarm 4 signal
Bit6	LED3- Alarm 3 signal
Bit5	LED2- Alarm 2 signal
Bit4	LED1- Alarm 1 signal
Bit3	Status of alarm relay 4
Bit2	Status of alarm relay 3
Bit1	Status of alarm relay 2
Bit0	Status of alarm relay 1

4.8.3.8- Unit information parameters.

The Modbus address is in decimal format.
The read function is valid for these variables.

Table 14:Modbus memory map (Table 8)

UNIT INFORMATION				
Address 1[1]	Address 2[2]	Name	Description	Unit
7000-7001	7500	Identifier	Unit identifier. The value 183: **DHB-4xx**	**-**
7002-7003	7501	Status	Record of the current status of the unit.	-
7004-7005	7502	Control	Control record for the analogue output	%
7006-7007	7503	Minimum	Minimum value of the value currently being displayed	-
7008-7009	7504	Maximum	Maximum value of the value currently being displayed	-
7010-7011	7505	Displayed value	Value currently being shown on the display	-
7012-7013	7506	current time	Current time	-
7014-7015	7507	Wire resistance	Cable resistance	Ω
7016-7017	7508	ADC	ADC	
7018-7019	7509	Terminal temperature	Temperature of the terminals. The measurement is only taken during the temperature measurement via the thermocouple sensors or during the measurement time.	ºC
7020-7021	7510	Measured value	Value measured without performing the non-linear equation regression.	-
7022-7023	7511	EMF	EMF measurement at the unit's terminals, when the temperature is measured via thermocouples.	µV
7024-7025	7512	Resistance	Resistance measurement of the line when the temperature measurement is taken via RTD.	Ω

[1] *Value in two consecutive 16-bit records.*

[2] *Value in one 32-bit record.*

5.- TECHNICAL FEATURES

Model: DHB-402	
Code	Auxiliary power supply
M22027	85 ... 253 V ~ / 85 ... 253 V ⎓
M220270020000	20 ... 40 V ~ / 20 ... 60 V ⎓

Model: DHB-424	
Code	Auxiliary power supply
M22028	85 ... 253 V ~ / 85 ... 253 V ⎓
M220280020000	20 ... 40 V ~ / 20 ... 60 V ⎓

AC Power supply		
Rated voltage	*M22027 or M22028*	*M220270020000 or M220280020000*
	85 ... 253 V~	20 ... 40 V~
Frequency	40 ... 400 Hz	
Consumption	2.1...9.5 VA	
Installation category	CAT III 300 V	

DC Power supply		
Rated voltage	*M22027 or M22028*	*M220270020000 or M220280020000*
	85 ...253 V ⎓	20 ...60 V ⎓
Consumption	2.1 ... 5.5 W	
Installation category	CAT III 300 V	

Input signal		
	Range	Accuracy [1]
Voltage input 0 ... 10 V⎓	-10 ... 10 V	0.1
Current input 0 ... 20 mA	-20...20 mA	0.1
Voltage input 60 mV	0 ... 60 mV	0.1
Thermocouple: type J	-100 ... 1200ºC	0.1
Thermocouple: type K	-100 ... 1370ºC	0.1
Thermocouple: type N	-100 ... 1300ºC	0.1
Thermocouple: type E	-100 ... 1000ºC	0.1
Thermocouple: type R	-50 ... 1760ºC	0.1
Thermocouple: type S	-50 ... 1760ºC	0.1
RTD: PT100	-200 ... 850ºC	0.1
RTD: PT500	-200 ... 850ºC	0.1
RTD: PT1000	-200 ... 850ºC	0.1
Resistance: 400 Ω	0 ... 400 Ω	0.1
Resistance: 4000 Ω	0 ... 4000 Ω	0.1
Current time	00.00 ... 23.59	0.5 s. / 24 hours

[1] Maximum error of measure = (Accuracy /100) x Full scale.

Automatic compensation	
Thermocouple	1 ºC
RTD	0.5 ºC
Resistance	0.2 W

Analogue outputs		
	Current	Voltage
Nominal output range	0-20 mA or 4-20 mA	0 ...10 V ⎓
Minimum load resistance	≤ 500 Ω	≥ 500 Ω

Relay outputs		
Number of relays:	**DHB-402**	**DHB-424**
	2	4
Maximum voltage, open contacts	250 V ~	
Maximum current	0.5 A	
Maximum switching power	1500 W or 1250 VA	
Electrical working life (250 VAC / 5 A)	1×10^5 cycles	
Mechanical working life	1×10^6 cycles	

Open collector output (DHB-424 model)	
Type	NPN
Voltage / Current	30 V ⎓ / 30 mA

Communications (DHB-424 model)	
Field bus	RS-485
Communications protocol	Modbus RTU
Baud rate	4800-9600 - 19200-38400-57600-115200
Stop bits	1 - 2
Parity	none - even - odd

User interface	
Display	LED 5 digits
Buttons	4 buttons
LED	5 LEDs

Environmental features	
Operating temperature	-25ºC... +55ºC
Storage temperature	-30ºC... +70ºC
Relative humidity (with no condensation)	25 ... 95%
Maximum altitude	2,000 m
Protection degree	Back: IP10/ Front panel: IP65

Mechanical features	
Dimensions (**Figure 58**)	96×48×93 mm
Weight	< 0.2 Kg
Enclosure	Self-extinguishing V0 plastic

| Standards	
Electromagnetic compatibility (CEM). Part 6-2: Generic standards. Immunity for industrial environments.	UNE EN 61000-6-2 :2006
Electromagnetic compatibility (CEM). Part 6-4: Generic standards. Emissions standard for industrial environments.	UNE EN 61000-6-4:2007
Safety requirements for electrical units for measurement, control and laboratory use. Part 1: General requirements	UNE EN 61010-1:2011
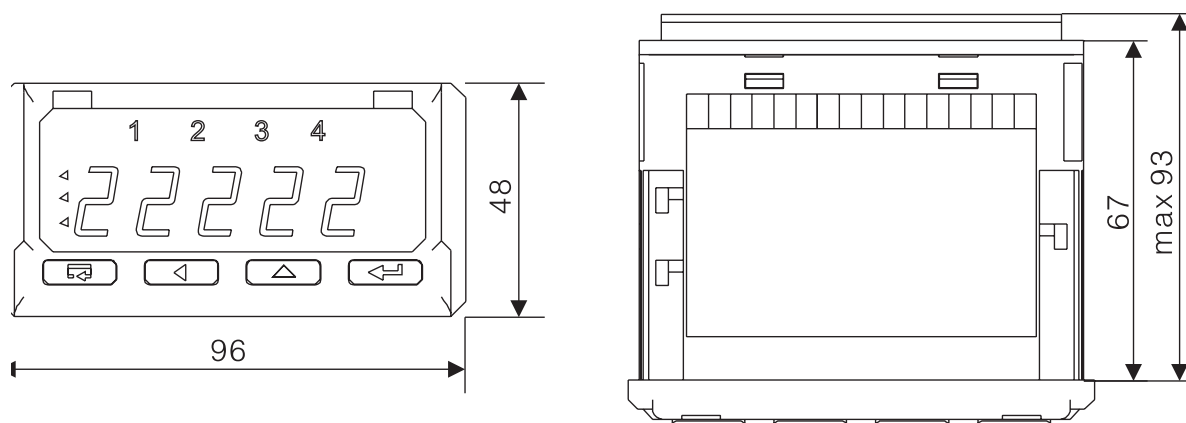
Figure 58: Dimensions of the DHB-4xx.

6.- MAINTENANCE AND TECHNICAL SERVICE

In the case of any query in relation to unit operation or malfunction, please contact the **CIRCUTOR, SA** Technical Support Service.

Technical Assistance Service
Vial Sant Jordi, s/n, 08232 - Viladecavalls (Barcelona)
Tel: 902 449 459 (España) / +34 937 452 919 (outside of Spain)
email: sat@circutor.es

7.- WARRANTY

CIRCUTOR guarantees its products against any manufacturing defect for two years after the delivery of the units.

CIRCUTOR will repair or replace any defective factory product returned during the guarantee period.

⚠️	• No returns will be accepted and no unit will be repaired or replaced if it is not accompanied by a report indicating the defect detected or the reason for the return. •The guarantee will be void if the units has been improperly used or the storage, installation and maintenance instructions listed in this manual have not been followed. "Improper usage" is defined as any operating or storage condition contrary to the national electrical code or that surpasses the limits indicated in the technical and environmental features of this manual. • **CIRCUTOR** accepts no liability due to the possible damage to the unit or other parts of the installation, nor will it cover any possible sanctions derived from a possible failure, improper installation or "improper usage" of the unit. Consequently, this guarantee does not apply to failures occurring in the following cases: - Overvoltages and/or electrical disturbances in the supply; - Water, if the product does not have the appropriate IP classification; - Poor ventilation and/or excessive temperatures; - Improper installation and/or lack of maintenance; - Buyer repairs or modifications without the manufacturer's authorisation.

8.- CE CERTIFICATE

CIRCUTOR

DECLARACIÓN DE CONFORMIDAD CE
CE DECLARATION OF CONFORMITY
DECLARATION DE CONFORMITE CE

Por la presente   **CIRCUTOR, S.A.**
We hereby
Par le présent

Con dirección en: **Vial Sant Jordi, s/n**
With address in: **08232 VILADECAVALLS (Barcelona)**
Avec adresse à: **ESPAÑA**

Declaramos bajo nuestra responsabilidad que el producto:
We declare under our responsibility that the product:
Nous déclarons sous notre responsabilité que le produit:

Instrumentación digital   **Serie:** **DHB-102, DHB-124, DHB-202, DHB-224, DHB-302,**
Digital intrumetation   **DHB-324, DHB-402, DHB-424**
Instruments digitaux

Marca CIRCUTOR
Brand
Marque

Siempre que sea instalado, mantenido y usado en la aplicación para la que ha sido fabricado, de acuerdo con las normas de instalación aplicables y las instrucciones del fabricante,
Provided that it is installed, maintained and used in application for which it was made, in accordance with relevant installation standards and manufacturer's instructions,
Toujours qu'il soit installé, maintenu et utilisé pour l'application par lequelle il a été fabriqué, d'accord avec les normes d'installation applicables et suivant les instructions du fabricant,

Cumple con las prescripciones de la(s) Directiva(s):
Complies with the provisions of Directive(s):
Accomplie avec les prescriptions de la (les) Directive(s):

2006/95/CE
2004/108/CE
2011/65/CE

Está en conformidad con la(s) siguiente(s) norma(s) u otro(s) documento(s) normativo(s) :
It is in conformity with the following standard(s) or other normative document(s) :
Il est en conformité avec la (les) norme(s) suivante(s) ou autre(s) document(s) normatif (ves) :

IEC 61010-1:2010
IEC 61000-6-2:2005
IEC 61000-6-4:2011

Año de marcado "CE": 2015
Year of affixing "CE" marking:
An de mise en application du marquage "CE":

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Revisado en Viladecavalls
Fecha: 16/12/2015   **Nombre y Firma:**   **Ferran Gil Torné**   **Sello**
Date: *Name and signature :*   *General Manager*   *Stamp*
Date :   *Nom et signature :*   *Directeur Général*   *Tampon*

CIRCUTOR, SA – Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcelona) Spain – Tel.(+34) 937 452 900 - central@circutor.es
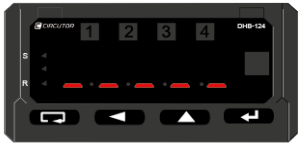
APPENDIX A: DISPLAY MESSAGES

The error screens shown in **Table 15** may appear after the unit is switched on or while it is measuring**.**

Table 15:Error messages

Error messages	
	Overflow of the measured value above its range. This message may also indicate a break in the sensor circuit (Thermocouple or RTD)
	Underflow of the measured value below its range. This message may also indicate a short-circuit in the sensor circuit (Thermocouple or RTD)
	Communication error with the data memory. Contact Customer Service.
	Parameter error. Error in configuration data. The default configuration will be loaded as soon as any button is pressed.
	The default parameters have been loaded. To continue with the job, press any button
	Error storing the values measured by the unit (measured value, maximum value, minimum value). Press any button to go back to the unit's measuring job. After pressing it, the screen *ErdEF* will be displayed for 1 second.
	Error calibrating the analogue output. Press any button to go back to the unit's measuring job. The analogue outputs are not in service. Contact Customer Service.
	The calibration values have been lost. Contact Customer Service.