HMI140 / HMI145 / HMI150

Interface modules for Bender charge controllers

Figure: Figure depending on the variant

BENDER

Table of contents

1 General information

1.1 How to use the manual

ADVICE
This manual is intended for qualified personnel working in electrical engineering and electronics! Part of the device documentation in addition to this manual is the enclosed supplement "Safety instructions for Bender products".

ADVICE
Read the operating manual before mounting, connecting and commissioning the device. Keep the manual within easy reach for future reference.

1.2 Indication of important instructions and information

DANGER
Indicates a high risk of danger that will result in death or serious injury if not avoided.

WARNING
Indicates a medium risk of danger that can lead to death or serious injury if not avoided.

CAUTION
Indicates a low-level risk that can result in minor or moderate injury or damage to property if not avoided.

ADVICE
Indicates important facts that do not result in immediate injuries. They can lead to malfunctions if the device is handled incorrectly.

Information can help to optimise the use of the product.

1.3 Service and Support

Information and contact details about customer service, repair service or field service for Bender devices are available on the following website: Fast assistance | Bender GmbH & Co. KG.

1.4 Training courses and seminars

Regular face-to-face or online seminars for customers and other interested parties:

www.bender.de > know-how > seminars.

1.5 Delivery conditions

The conditions of sale and delivery set out by Bender GmbH & Co. KG apply. These can be obtained in printed or electronic format.

1.6 Inspection, transport and storage

Check the shipping and device packaging for transport damage and scope of delivery. In the event of complaints, the company must be notified immediately, see "www.bender.de > service & support.".

When storing the devices, observe the information under Environment / EMC in the technical data.

1.7 Warranty and liability

Warranty and liability claims for personal injury and property damage are excluded in the case of:

- Improper use of the device.
- Incorrect mounting, commissioning, operation and maintenance of the device.
- Failure to observe the instructions in this operating manual regarding transport, commissioning, operation and maintenance of the device.
- Unauthorised changes to the device made by parties other than the manufacturer.
- Non-observance of technical data.
- Repairs carried out incorrectly.
- The use of accessories or spare parts that are not provided, approved or recommended by the manufacturer.
- Catastrophes caused by external influences and force majeure.
- Mounting and installation with device combinations not approved or recommended by the manufacturer.

This operating manual and the enclosed safety instructions must be observed by all persons working with the device. Furthermore, the rules and regulations that apply for accident prevention at the place of use must be observed.

1.8 Disposal of Bender devices

Abide by the national regulations and laws governing the disposal of this device.

Bender GmbH & Co. KG is registered in the waste from electrical and electronic equipment (WEEE) register under the WEEE number: DE 43 124 402. For more information on the disposal of Bender devices, refer to www.bender.de > service & support.

1.9 Safety

If the device is used outside the Federal Republic of Germany, the applicable local standards and regulations must be complied with. In Europe, the European standard EN 50110 applies.

DANGER Risk of fatal injury due to electric shock!

Touching live parts of the system carries the risk of:

- Risk of electrocution due to electric shock
- Damage to the electrical installation
- Destruction of the device

Before installing the device and before working on its connections, make sure that the installation has been de-energised. The rules for working on electrical systems must be observed.

2 Device-specific safety instructions

ADVICE
The HMI1xx complies with the relevant harmonized standards to ensure that the requirements of the Radio Equipment Directive (see chapter “Declarations of conformity”, page 20) are met. It is the responsibility of the distributor of the complete system to ensure conformity with this and any additional legal requirements.

WARNING Very bright RGB LEDs
Vision impairment!
Care must be taken to avoid looking directly into the RGB LEDs.

WARNING Electromagnetic waves and fields
Health hazards!
The device emits electromagnetic waves and fields for radio communication when in operation. Care must be taken to avoid a continuous proximity of less than 20 cm to body parts.

WARNING Buzzer sounds of up to 80 dBA at a distance of 10 cm
Hearing damage!
The buzzer can emit sounds of up to 80 dBA at a distance of 10 cm during operation. Care must be taken to maintain a corresponding distance or to cover the buzzer for test purposes.

ADVICE
The voltage on all inputs and outputs of the HMI module must not exceed the rated voltage indicated in the chapter “Tabular data”, page 17.

ADVICE
All of the cables connected to the HMI module must be routed exclusively within the enclosed charging system and must not exceed a maximum length of 1.80 m.

3 Function

3.1 Intended use

The Human Machine Interface module, hereafter referred to as the HMI module, is a separate PCB that facilitates user interaction with the charging system. The HMI module is connected to the charge controller, which is the main component of the charging system, using a USB cable. The module must only be used in combination with charge controllers* from Bender GmbH & Co. KG that support the operation of the HMI module. Any other use than that described in this manual is regarded as improper.

**The charge controllers are designed for use in electric vehicle (EV) charging stations, such as wall boxes and street light charging points.*

3.2 Device features (depending on the variant)

- Control via USB
- Power supply via USB or external DC power supply (see chapter “Commissioning”, page 16)
- RFID reader for authorization of the charging process
- 11 full-colour RGB LEDs for static or animated visualization of different operating states
- Buzzer for acoustic signalling of states or for confirming user input
- Relay output (single-pole changeover contact)
- Integrated WiFi module (front-end module)
- Two USB host outputs
- Controllable full-colour RGB LED outputs
- Digital control input
- Ambient light sensor
- Temperature sensor

3.3 Product description

The HMI module enhances the charge controller of a charging system for electric vehicles by adding actuators, sensors and communication interfaces. It facilitates a user’s interaction with the charging system. The HMI module is a passive unit that is subordinate to the control function of the charge controller. The response to sensor values can be configured in the charge controller or must be adapted there by means of software modifications.

Additional software modifications, such as custom modifications of the RGB LEDs or buzzer functions, can be requested from the device manufacturer’s customer support. A certain minimum purchase quantity applies in these cases.

3.3.1 Control and voltage supply

The control of the HMI module and the data exchange with the charge controller take place via the USB 2.0 interface (terminal B). The basic voltage supply is provided via this connection. It is dimensioned for the operation of the HMI module with RFID reader and up to 11 internal RGB LEDs. Use of further actuators and communication interfaces requires that an external DC voltage supply be connected (terminal C, see chapters “Connection”, page 13 and “Commissioning”, page 16).

3.3.2 Sensors

An integrated light sensor is provided to enable adaptation of the light intensity of the LEDs to the brightness of the surroundings. The HMI module is equipped with an integrated temperature sensor to avoid any thermal damage. The sensors are read and the corresponding reaction takes place via the charge controller that is connected.
Furthermore, the status of an external switching signal connected to the digital control input "IN" (terminal C) can be evaluated in the charge controller.

3.3.3 Actuators

RGB LEDs

The integrated RGB LEDs can be controlled independently of each other and provide a wide range of display options, such as blinking, light chasers, and colour changes. The type and manner of the visualization is determined by the respective charge controller in use and the corresponding customer configuration.

Furthermore, up to two additional series RGB LEDs can be connected (e.g. in the form of an illuminated plug socket) (terminal D, see chapter “Connection”, page 13). The same control options apply for these "external" LEDs as for the "internal" LEDs.

Provision of separate connections at terminal D enables the use of RGB LEDs with a common anode or cathode.

Buzzer

A buzzer is integrated into the HMI module to support acoustic feedback. Different charging system status messages can be signalled using different tone sequences. This can include, for example, the acknowledgement or rejection of an RFID transponder, faulty operational input, or the approval of the charging process.

Relay contact

A relay is integrated into the HMI module to allow control of external devices. The three connections of the changeover contact are provided on terminal C (see chapter “Connection”, page 13).

3.3.4 Communication interfaces

RFID reader

The HMI module has an RFID reader to support the authorization of charging processes. The registration of valid RFID transponders is stored in the backend system (charge controller).

ADVICE
No metallic materials must be used in the area of the HMI PCB to ensure that standards-compliant RFID transponders are detected reliably.
The design of the housing for the charging system must be such that the distance of the PCB to the outside of the housing is not greater than 15 mm.

WiFi module

The HMI module is equipped with an integrated WiFi module to facilitate the interaction between users and the charging system, such as for authorizing the charging process. In the absence of an Internet connection, it also serves the diagnosis and rectification of errors by customer service. Since the antenna is integrated in the module, the module is not suitable for use in enclosed metallic housings.

USB host outputs

The two USB host outputs of the HMI module are connected to a USB host output of the charge controller via an internal USB hub. They support communication or data exchange in accordance with the functional description of the charge controller in use.

3.4 Functional description

The functions depend on the charge controller in use!

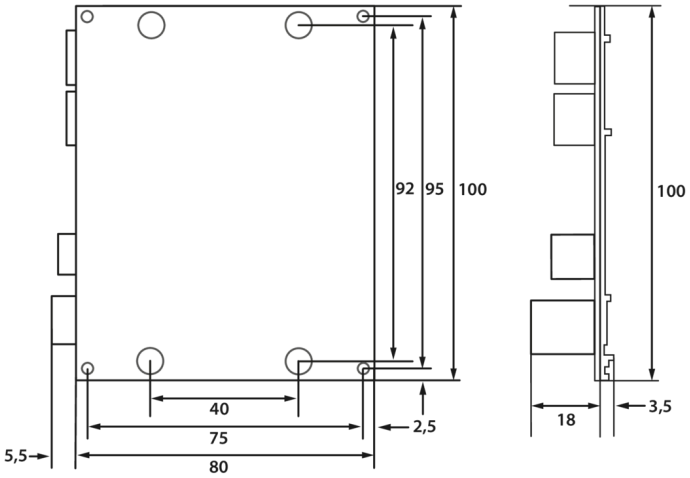
The user of the charging equipment will find different operating procedures and special display and operating options for the individual components of the HMI module.

The manual of the respective charge controller must be observed.

4 Dimensions and mounting

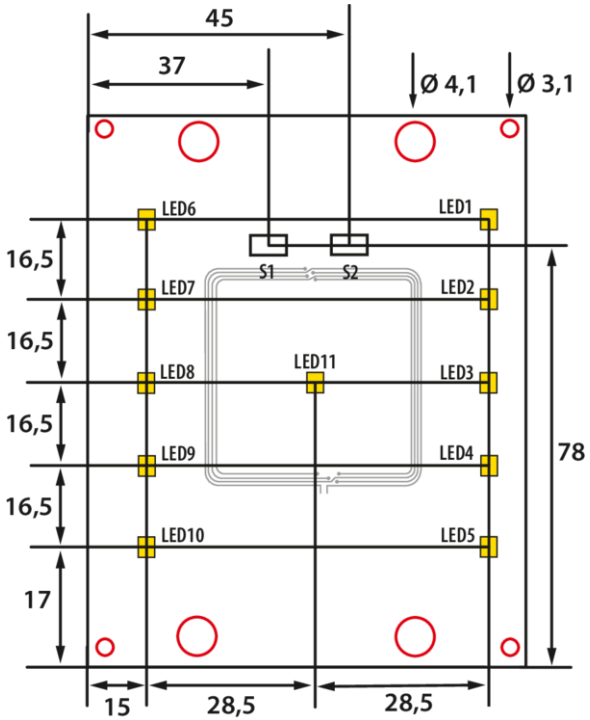
4.1 Dimensions

Dimension diagram



Dimensions in mm

4.2 Mounting



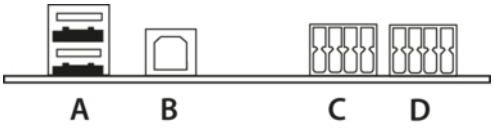
S1 Ambient light sensor
S2 Temperature sensor

Red marks: possible fastening points
Either the inner or the outer fastening holes can be used.

Fastening recommendation, Ø3.1:
- *Screws: 2.5 mm*
- *Head: max. 5 mm*
- *Extension studs: 5.1 mm*
- *Torque: 0.36 Nm*

Fastening recommendation, Ø4.1:
- *Screws: 3.5 mm*
- *Head: max. 7 mm*
- *Extension studs: max. 6 mm (plastic, max. 7 mm)*
- *Torque: 0.36 Nm*

5 Connection



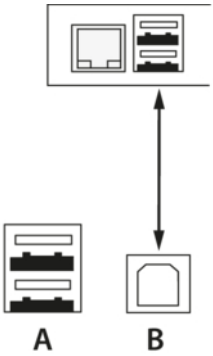
Definition of connections

Terminal	Description
A	USB type A: 2 x USB host
B	USB type B: Charge controller (controller interface, 5 V supply)
C	Phoenix Contact PCB terminal, 8-pole: Additional DC supply, FE, relay switching contacts, control input
D*	Phoenix Contact PCB terminal, 8-pole: External RGB LEDs

* LEDs can be connected without series resistors (constant current control)

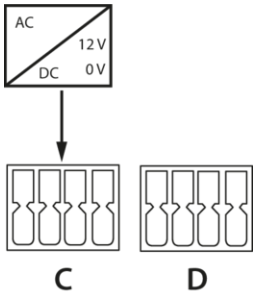
5.1 Voltage supply connection

Voltage supply connection, 5 V
from the charge controller via USB



Always required for controlling the unit

Connection of additional DC supply (e.g.
charge controller, external power supply unit)*

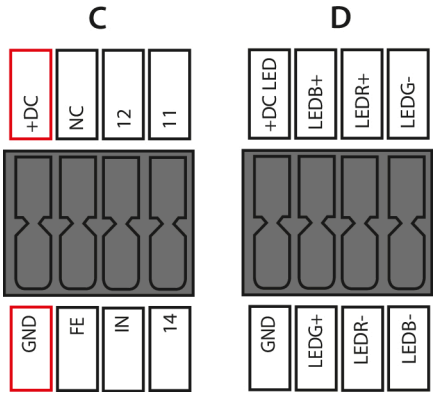


Required when using

- USB host output (type A)
- External RGB LEDs
- Relay switching output
- WiFi

* Terminal C, red marked (see chapter “Connection assignment, terminals C and D”, page 14)

5.2 Connection assignment, terminals C and D



Terminal C: Phoenix Contact DMC 1.5/ 4-G1-3.5 P26THR R44 (2x4-pole)

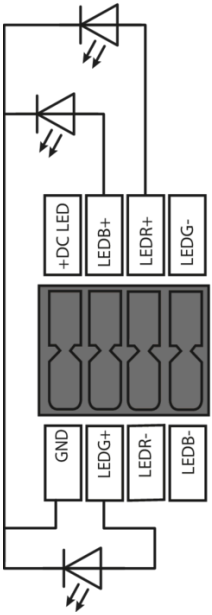
Designation	Description
+DC	DC supply voltage input
GND	Ground of the voltage supply and control signals
Functional earthing	FE input (EMC functional earthing)
12	Relay 12: GPIO NC contact
11	Relay 11: GPIO changeover contact
14	Relay 14: GPIO N/O contact
IN	Digital control input
NC	Not connected

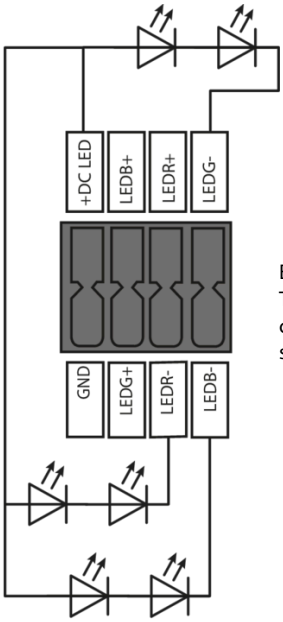
Terminal D: Phoenix Contact DMC 1.5/ 4-G1-3.5 P26THR R44 (2x4-pole)

Designation	Description
+DC LED	LED supply voltage output (shared anode)
GND	LED ground (shared cathode)
LEDR+	LED output red +
LEDR-	LED output red -
LEDG+	LED output green +
LEDG-	LED output green -
LEDB+	LED output blue +
LEDB-	LED output blue -

Examples for connecting the external RGB LED outputs

Example 1: LED with shared cathode





Example 2: Two LEDs per channel with shared anode

6 Commissioning

It is preferable to operate the HMI module with a DC supply voltage to prevent overloading of the USB supply.

ADVICE
If supply of the HMI module is possible exclusively via the USB interface, the availability of individual components will be limited:

Application scenario for power supply via USB interface only

Components	Note on scenario 5 V USB @ 500 mA
RFID	Available
LEDs	Available
Digital control input	Available
Ambient light sensor	Available
Temperature sensor	Available
Buzzer	Available
WiFi	Not available (USB overload)
USB host	Not available
External LEDs	Not available
Relay	Not available

CAUTION Connection cable
The use of unsuitable connection cables can cause inadmissible interference and voltage drops.
Care must be taken to ensure that only suitable connection cables are used (see chapter “Tabular data”, page 17).

7 Technical data

7.1 Tabular data

Insulation coordination according to IEC 60664-1 / IEC 60664-3

Rated voltage	15.8 V
Pollution degree	2
Operating altitude AMSL	≤ 2000 m

Supply voltage

External DC (terminal C: +DC / GND)	
Nominal voltage	DC 12 V
Voltage range	11.4…15.8 V
max. power consumption without USB load HMI140 / 145 / 150	3.5 / 7.5 / 9.5 W
max. power consumption with USB load HMI145 / 150	14.0 / 16.0 W

DC 5 V from charge controller (terminal B)	
Nominal voltage	DC 5 V
Nominal voltage tolerance	± 5 %
max. nominal current[1]	500 mA

[1] See table in chapter "Commissioning", page 16

Interface data

USB	
Charge controller connection	USB port type B; USB 2.0, current requirement max. 500 mA
USB host 1 (terminal A1)	USB port type A; USB 2.0, load up to max. 500 mA
USB host 2 (terminal A2)	USB port type A; USB 2.0, load up to max. 500 mA
RFID reader	
Frequency	13.56 MHz
max. field strength (distance of 10 m)	42 dBµA/m
Standard	ISO/IEC 14443 type A, MIFARE
WiFi	
Standard	IEEE 802.11b/g/n
Frequency bands	2.4 GHz
Channels 1-13	2.412 GHz - 2.472 GHz
Channel bandwidth	20 MHz

Data rates	802.11b 1, 2, 5.5, 11 Mbps 802.11g 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n MCS0-MCS7 (max. 72.2 Mbps)
max. output power	19 dBm EIRP

Inputs

Control input (terminal C: IN)	
Input voltage	DC 0…15.8 V[1]
max. Input current	1.5 mA
max. switching frequency	5 Hz
EMC functional earthing (terminal C: FE)[2]	

1 low: ≤ 1.2 V; high: ≥ 2.0 V (or not connected)
2 as needed, for connection to metallic chassis or housing parts connected to PE for improved EMC performance.

Outputs

Relay (terminal C: 11 / 12 / 14)	
Contact layout	Changeover contact (design C)
Rated operational voltage (to GND and between open contacts)	DC 15 V
Rated operational current	DC 1 A
External LED connection (terminal D)	
Rated voltage	DC 15 V
LED current per output (constant current, controlled)	0…60 mA
Voltage, shared anode (terminal D, +DC LED)	≈ external DC - 0.3 V
Voltage, shared cathode (terminal D, GND)	0 V

Environment / EMC

Operating temperature	-30…+70 °C
Classification of climatic conditions according to IEC 60721:	
stationary use (IEC 60721-3-3)	3K23 (except condensation, water and formation of ice)
Transport (IEC 60721-3-2)	2K11
Long-term storage (IEC 60721-3-1)	1K21
Classification of mechanical conditions according to IEC 60721	
stationary use (IEC 60721-3-3)	3M11
Transport (IEC 60721-3-2)	2M4
Long-term storage (IEC 60721-3-1)	1M12

EMC environmental classes	
Emitted interference	B (residential, business or commercial areas)
Interference immunity	A (industrial environment)

Connection lengths / cable types

USB host A1 and A2	
max. cable length	1.8 m
Cable type	double shielded
Charge controller connection (terminal B)	
max. cable length	1.8 m
Cable type	double shielded
recommended connection cables	hama: 00200602 Delock: 83892, 83893 Good Connection: GC2510-2TQ
External DC supply, FE, relay, control input, external LEDs (terminals C and D)[1]	
Connection data	
rigid / flexible	0.2 …1.5 mm² (AWG 24…16)
flexible with ferrule without plastic sleeve	0.25 …1.5 mm² (AWG 24…16)
flexible with ferrule with plastic sleeve	0.14 … 0.75 mm² (AWG 26…18)
Stripping length	10 mm
max. cable length	1.8 m

[1] FE connection as required with the lowest possible impedance, at the remaining connections, cables of the respective function groups in twisted pairs or equivalent

7.2 Approvals

CE UKCA

Use in the EU and other countries

The conformity with the relevant EU directives permits operation of the device exclusively in countries of the European Economic Area.

The conformity with the relevant UKCA directives permits operation of the device exclusively in the United Kingdom.

7.3 Declarations of conformity

EU Declaration of conformity

Hereby, Bender GmbH & Co. KG declares that the device covered by the Radio Directive complies with Directive 2014/53/EU. The full text of the EU Declaration of Conformity is available at the following Internet address:

https://www.bender.de/fileadmin/content/Products/CE/CEKO_HMIxxx.pdf

UK Declaration of Conformity

Hereby, Bender GmbH & Co. KG declares that this device is in compliance with Radio Equipment Regulations 2017 (S.I. 2017/1206). The full text of the UK declaration of conformity is available at the following internet address:

https://www.bender.de/fileadmin/content/Products/UKCA/UKCA_HMIxxx.pdf

7.4 Ordering information

Type	RFID reader	RGB LEDs	Digital control input	USB host connection	WiFi	RGB LED output	Relay output	Sensors (light, temperature)	Buzzer	Part No.	Manual no.
HMI150	✓	✓	✓	✓	✓	✓	✓	✓	✓	B94060150	D00481
HMI145	✓	✓	✓	✓	-	✓	✓	-	✓	B94060151	D00481
HMI140	✓	✓	✓	-	-	-	✓	-	-	B94060152	D00481

7.5 Revision history

Date	Document version	State/Modifications
11/2023	00	New
03/2025	01	Added: Chapter 5.2: Terminal assignment for DC supply marked in red Chapter 7.4: Buzzer HMI145

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