Original instructions

HD5-B

Three position enabling device with safe AS-i slave

Read and understand this document

Please read and understand this document before using the products. Please consult your ABB Electrification Sweden AB representative if you have any questions or comments.

Suitability for use

ABB Electrification Sweden AB shall not be responsible for conformity with any standards, codes, or regulations that apply to the

combination of products in the customer's application or use of the product. At the customer's request, ABB Electrification Sweden AB will provide applicable third-party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not enough for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

• Outdoor use uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.

• Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, and installations subject to separate industry or government regulations.

• Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE ABB Electrification Sweden AB IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Table of contents

1. INTRODUCTION

Purpose

The purpose of this operating manual is to describe the HD5-B-xxx three position enabling device and to provide the information necessary for planning, assembly, maintenance, and operation.

Target group

This document is aimed at planners, as well as specialist staff working in assembly and maintenance. In addition, this operating manual is aimed at users who have received training and authorization, from the operator of the facility, in relation to these devices, how to handle them, and the hazards they pose.

Prerequisites

It is assumed that the reader of this document has the following knowledge:

- Basic knowledge of ABB Electrification Sweden AB products
- Knowledge of the AS-i Bus system
- Knowledge of safety products
- Knowledge of safety control devices with functions relevant to safety
- Knowledge of related facilities

Special instructions

Please pay attention to the following special instructions in this document:

	**Attention!**	**Danger of personal injury!** Failure to follow instructions or work sequences properly may result in personal injury.
	**Caution**	**Risk of damage to the equipment!** Failure to follow instructions or work sequences properly may result in damage to the equipment.
	**Note**	Notes are used to provide important or explanatory information.

2. SAFETY

Intended use

HD5-B-xxx is a three-position enabling device with integrated AS-i technology, according to the AS-i specification V 3.0, it is operated in the standard addressing mode. (see chapter "AS-i data")

The device is intended for connection to an AS-i safety bus and connected to a suitable safety controller. Additionally, the machinery or the equipment causing the potential danger needs to be put in jog position or otherwise restricted in movement, speed, temperature, etc.

The operator pushes the large black button to a middle position in order to allow a movement. In case of danger, the operator will either release the button or squeeze it to its bottom position and the machine will stop. Some models offer additional top and front buttons to control a non-safe signal, e.g. move forward and/or backward.

Correct use

The protective function of the safety device is only safe if the safety controller is correctly connected and configured.

Obey the following conditions to prevent misuse and cause danger:

- Make sure that these instructions are included together with the documentation of the system to which the protective device is attached to.
- Make sure that these instructions always are available for the operators.
- The three-position device must only be used after it has been selected refereed to related instructions, relevant standards, rules and regulations for labor protection and safety at work, and when installation, connection, check and start-up are done by an approved person.
- The three-position device must be connected and started according to its specifications, for example the technical data.
- The three-position device must be connected so that its safety related capacity meets or exceed the performance level (PL) or safety integrity level (SIL) that has been estimated in the risk analysis.
- The three-position device must not be modified. If the design or the functions are changed the protective function can be damaged and the warranty of the three-position device is not applicable.
- Repair and exchange of parts of the three-position device is not permitted.
- The three-position device must be tested regularly by an approved person.
- The three-position device must be exchanged within a mission time 20 years, due to requirement in EN ISO 13849-1. Depending on the use (calculation of T_{10D}, se 6. Performance Level (PL) Calculation), the three-position device might have to be exchanged within a shorter time than 20 years.

Foreseeable misuse

- Other use than defined as correct use and foreseeable misuse, or which is beyond that use, is considered as incorrect use.
- The three-position device is not by itself a complete protective device.
- The three-position device is not intended for use in explosive or easily flammable adjacent air.

Approved person

- An approved person must have ...
- A suitable technical education.
- Knowledge about rules and regulations for occupational safety, safety at work, safety technology and how to estimate the safety of the machine.
- Received instructions from the person that is responsible for the installation and operation of the three-position device and the device/machine which it is connected to.
- See Chapter Intended use and Chapter Correct use for further information

Safety precautions

The following safety precautions must be followed during installation, operation, maintenance and troubleshooting.

General safety information

 **Attention!**

- Carefully read through this entire manual before using the product.
- Always respect the documented minimum or maximum values of the product.
- For installation and prescribed use of the product, the special notes in these instructions must be carefully observed and the technical standards relevant to this product must be considered.
- This product must be installed by a trained electrician following applicable safety regulations, standards and the machine directive.
- Failure to comply with these instructions, operation that is not in accordance with the use prescribed in these instructions, improper installation or handling of the device can affect the safety of people and the plant.
- In case of failure to comply with these instructions or the applicable standards, especially when tampering with and/or modifying the product, liability is excluded.
- The safety functions of the product must be tested before the system is put in operation.
- The safety functions of the product must be tested after installation or replacement of components or cables.
- The safety functions and the mechanics of the product must be tested regularly to confirm that all the safety functions are working properly.
- In case of breakdown or damage to the product, contact ABB Electrification Sweden AB. Do not try to repair the product. It might accidentally cause permanent damage, impairing the safety of the product and in turn lead to serious personnel injuries.

Caution!

Please note, if you in non-compliance with the specifications and restrictions of these operating instructions (e.g. duty cycle, temperature, etc.) can lead to the functionality of the enabling device failing and unintended machine stop.
After a shutdown in according to this, the function of the 3-position enabling device will be restored, if the values below the limits. But a probable damage to the electronics and a reduction of service life can´t be ruled out.

Disposal

The three-position device shall be disposed in accordance with WEEE directive, 2012/19/EU.

3. PRODUCT DESCRIPTION

HD5-B-xxx

HD5 is a three-position device designed for use in hazardous areas where alternative protective devices are not possible or practical.

The “HD5-B-xxx” enabling device is designed to be connected to a Safety controller via AS-i Safety-Bus. Additionally, the machinery or the equipment causing the potential danger needs to be put in jog position or otherwise restricted in movement, speed, temperature, etc.

The operator pushes the larger black button to a middle position in order to allow a movement. In case of danger, the operator will either release the button or squeeze it to its bottom position and the machine will stop. Some models offer additional top and front buttons to control a non-safe signal, e.g. move forward and/or backward.

The signals from the three-position enabling switches and the emergency stop button (if the device is equipped with this) are detected by the integrated electronics and transmitted to the AS-i safety monitor via the safe slave.
Signals used to provide haptic or visual feedback are transmitted from additional integrated command buttons and sensors to the AS-i logic and from the AS-i logic to the enabling device via a third, unsafe slave.

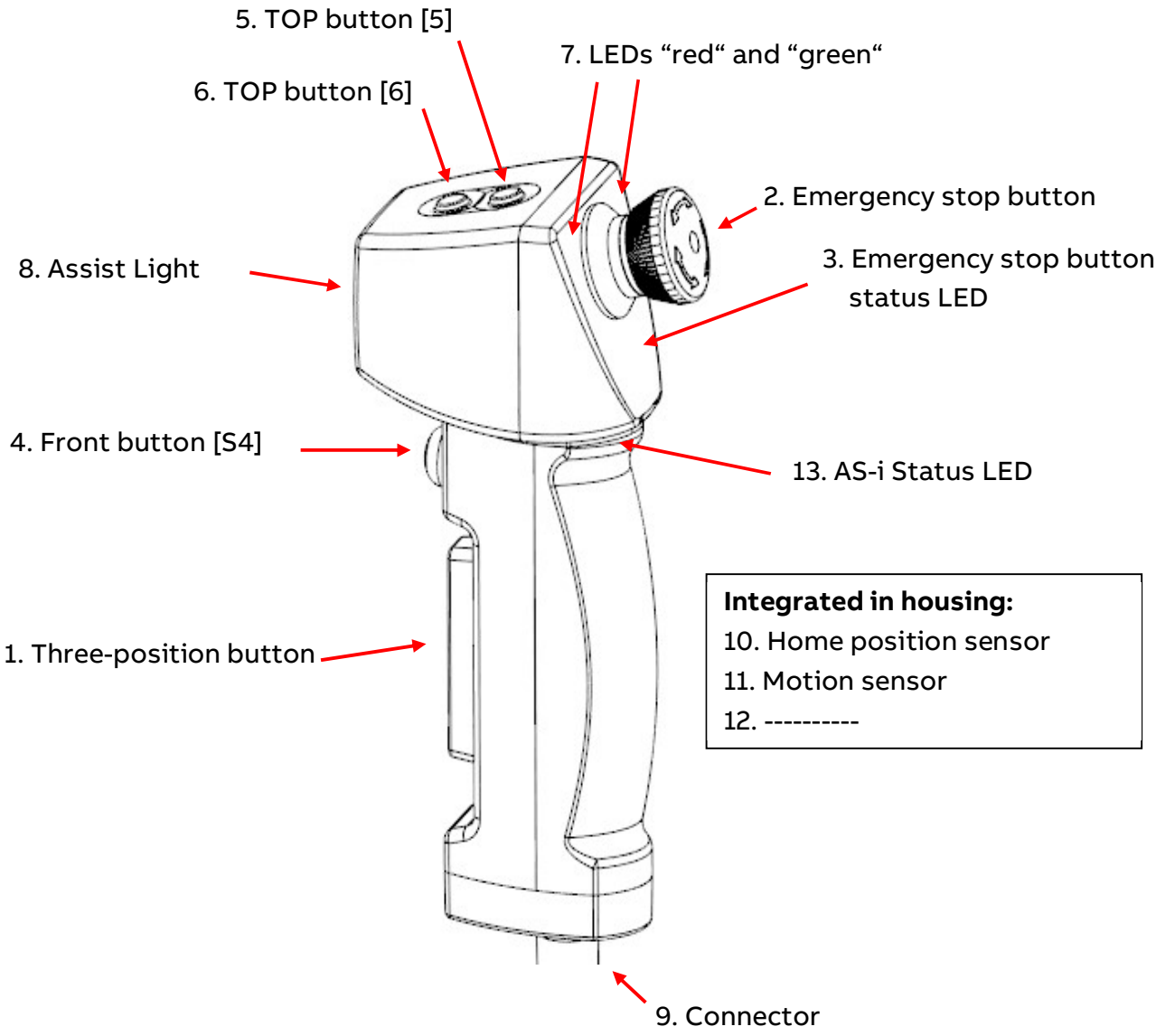
The enabling device is connected to the AS-i Bus in the usual way using a fixed spiral-cable or via a M12 connector built into the device.

Product range

The HD5-B product range includes the following models.

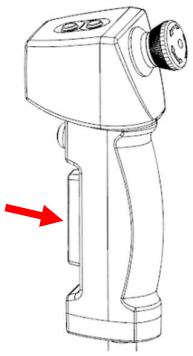
	Function	**HD5-B-101**	**HD5-B-102**	
1	Three-position button	Yes	Yes	
2	Emergency stop button	Yes	No	
3	Emergency stop button status LED	Yes	No	
4	Front button [S4]	Yes	Yes	
5	Top button [S5]	Yes	Yes	
6	Top button [S6]	Yes	Yes	
7	LEDs red and green	Yes	Yes	
8	Assist Light	Yes	Yes	
9	Connector	M12- 5 pin	M12- 5 pin	
10	Home position sensor	Yes	Yes	
11	Motion sensor	No	No	
12	----------	----------	----------	
13	AS-I Status LED	Yes	Yes	

* position-no., regarding to the picture on next side


5. TOP button [5]
7. LEDs “red“ and “green“
6. TOP button [6]
2. Emergency stop button
8. Assist Light
3. Emergency stop button status LED
4. Front button [S4]
13. AS-i Status LED
1. Three-position button
Integrated in housing:
10. Home position sensor
11. Motion sensor
12. ----------
9. Connector

4. FUNCTION DESCRIPTIONS

Three-position button



The three-position button provides signals, which:

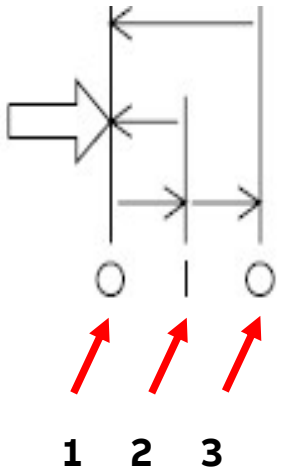
- When activated, allow the machine or equipment to be activated using a separate start control signal.
- When deactivated, initiate a stop function which prevents the machine or equipment from starting.

Two three-position switches are used and controlled simultaneously to create a two-channel architecture.

An important feature of the three-position button is that when it is released from position 3, the ON position is never reached, i.e. the contacts remain open. The three-position button always go back to position 1 when released.

The three-positions functionality:

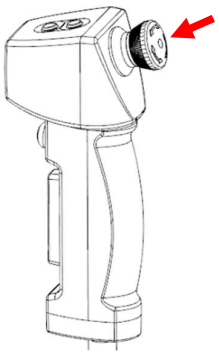
Position 1 (O):	OFF mode	the button is not pressed, contacts are open.
Position 2 (I):	ON mode	the button is pressed in the middle position, contacts are closed
Position 3 (O):	OFF mode	the button is fully pressed to bottom position, contacts are open.



Note on operation

To ensure a correct and safe operation, the three-position button must be pressed to the middle position with two or three fingers.

Emergency stop button



The built-in emergency stop button has two force guided normally closed contacts.

The emergency stop button shall initiate an emergency stop function, thereby removing energy to the hazardous functions in the event of emergency.

The holders developed for this three-position device allow for the emergency stop button to be pressed when the three-position device is placed in the holder.

LEDs integrated in the housing indicate the status of the emergency stop button.

Note on safe actuation

To allow for the emergency stop button to operate safely, we recommend using the holders designed for this three-position device. See the accessories section.

Attention!

Caution should be exercised in relation to three-position devices that are connected, as standard, using a connector. Be aware of the following items:

- The correct function of the emergency stop must be check monthly!
- The emergency stop function must always be functional and should have priority over all other functions and operations in all operating modes of the machine without affecting any system intended to release trapped persons.
- No start command (whether intentional, unintentional or unexpected) should be able to affect working processes that were stopped by initiating the emergency stop function until the emergency stop function has been reset manually.
- If it is possible to remove emergency stop buttons (e.g. portable programming devices) or shut down sections of a machine, it must be ensured that operational and non-operational emergency stop buttons are not mixed.

Emergency stop LED

A row of LEDs is integrated in the housing, below the emergency stop button.

Red LED row (controlled via AS-i Bus)	
Green LED row (is is possible to activate and controlled according the following table)	

LED row red controlled via AS-I Bus	function LED green controlled via AS-I Bus	LED row green
Off	not activated	Off
On	not activated	Off
Off	activated	On
On	activated	Off

Attention!

The controls for the feedback LED are independent from the emergency stop button function.
The programmer is solely responsible for their signaling function.
ABB Electrification Sweden AB does not accept any liability for damages of any kind caused by signaling that is not logical, and the resulting misjudgements and errors by users.

Front button

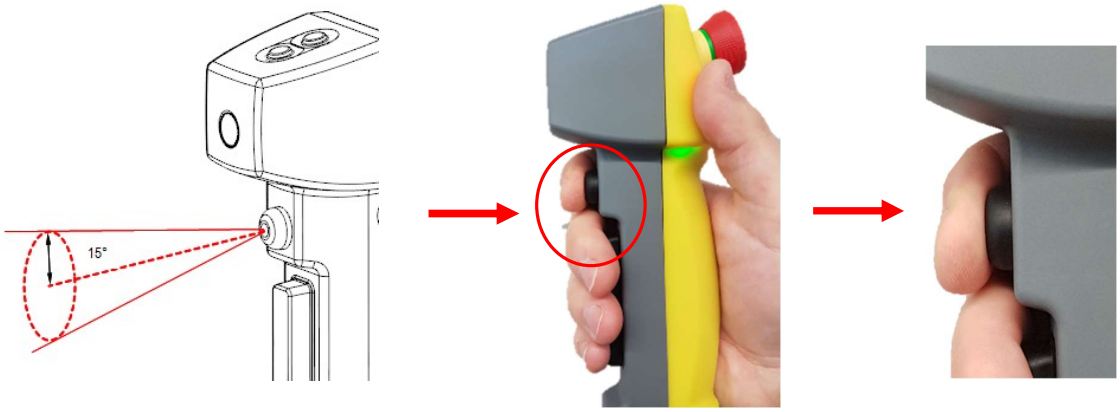
The front button is located above the three-position button.
The button is user-defined and can be controlled via wiring.

Attention!

This signal is not failsafe and must not be used for a safety function.

Note on activation of front button

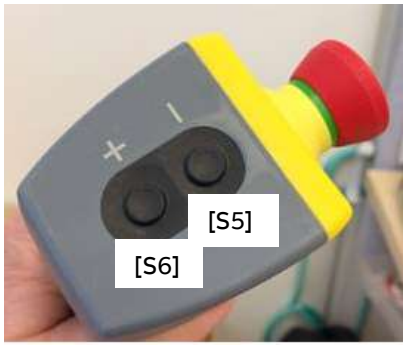
The button must be pressed down vertically. If the angle exceeds 15° when actuating the switch, the switch contact may be damaged, reducing it lifetime (number of switching cycles).



Top buttons

The two top buttons are located at the top part of the HD5.
The buttons are user-defined and can be controlled via wiring.

Button [S5] is marked -
Button [S6] is marked +



Attention!

This signal is not failsafe and must not be used for a safety function.

Signal LED

A green and a red LED are integrated in the housing, above the emergency stop button. The LEDs are user-defined and can be controlled in via AS-I Bus.

Home position sensor

This function provides information as to whether the three-position device is in its holder.

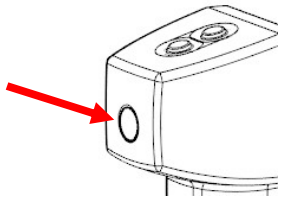
The home position sensor delivers a signal, transmitted via AS-I Bus when HD5 is in place in the active holder (HD5-M-001). The holder is available as an accessory.

Attention!

This signal is not failsafe and must not be used for a safety function.

Assist Light

The assist Light is in the front of the HD5 and can be used for short periods when the ambient light is insufficient.
Controll of the function via AS-I Bus.



Note on duty cycle

- For ambient temperatures ≤ 35°C, the flashlight should never be used longer than 15 min at a time and max 60% on-time
- For ambient temperatures over 35°C, the flashlight should never be user more than 10 min at a time and max 40% on-time

On-time percentage = [on time/ (on time + off time)] x 100

Caution

The increased heat can damage the device. Make sure to comply to the above requirements.

If the device had stopped working because of temperature rise, it will work again once the values have dropped below the limits. However, there may still be damage to the electronics and a reduction in product lifetime.

Attention! Hazards arising from glare

Avoid looking directly into the lens of the assist light. Looking directly into the lens, and the glare effect which may result from it, can sometimes impair vision, cause irritation, and result in accidents.

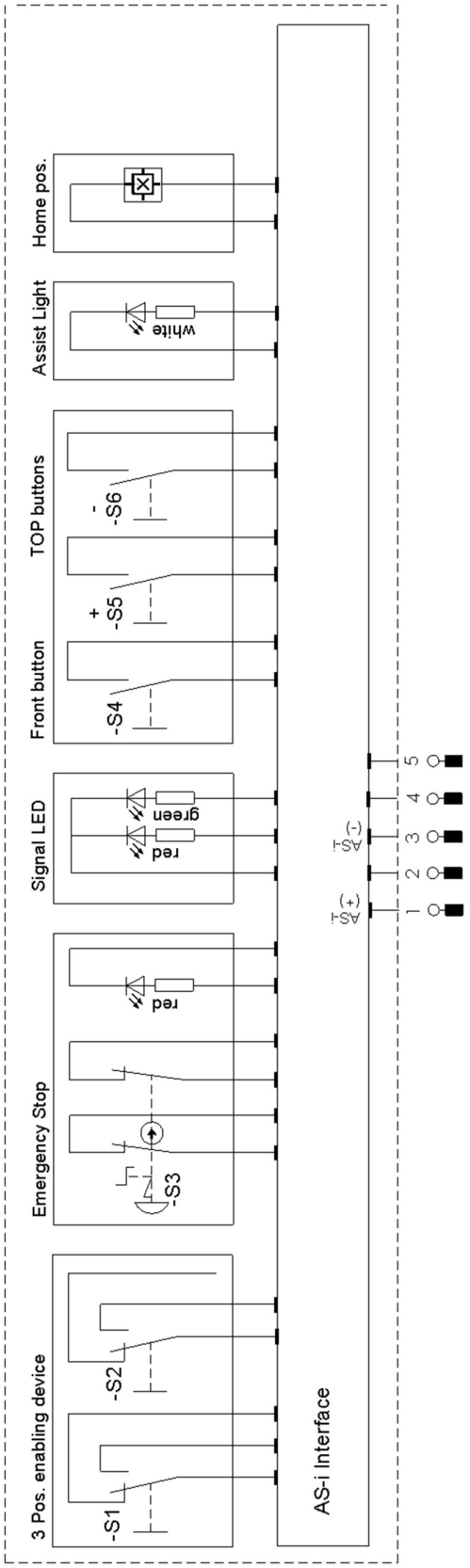
Status LED for AS-i Bus

One green and one red LED will inform you, about the status of the slave on the AS-i Bus.
The LEDs are positioned in a way that means they are not directly visible when the enabling device is placed in the holder intended for this purpose.
The reason of the positioning is to avoid confusing the user with too many visual signals

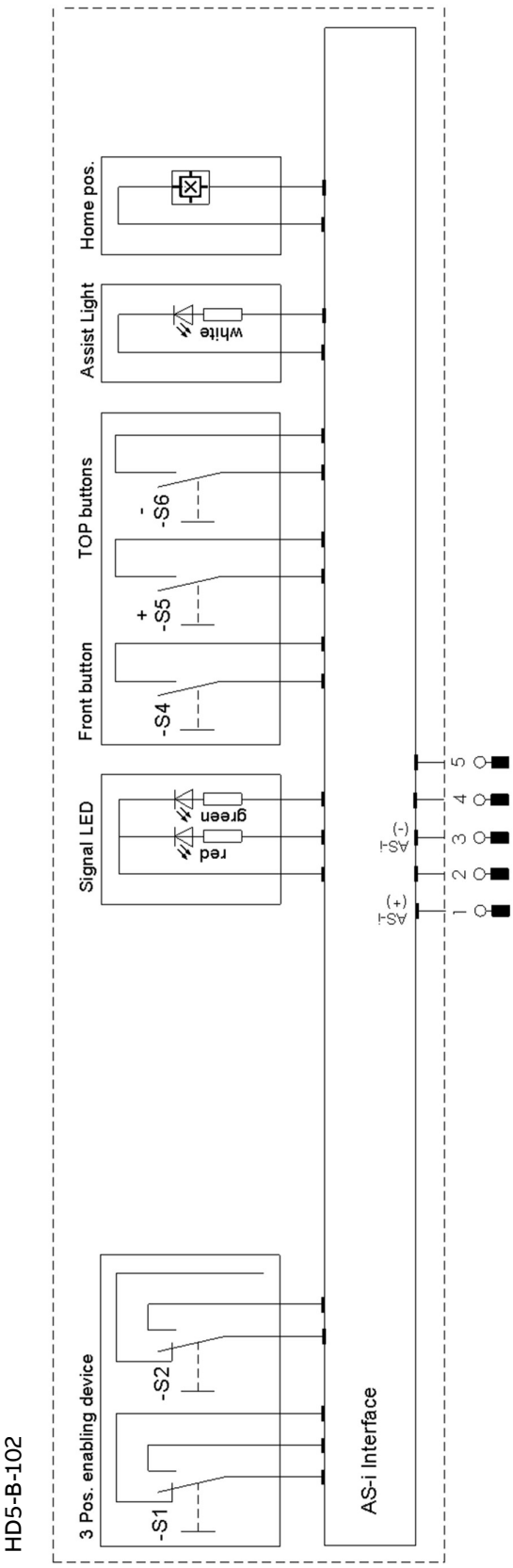
AS-i (green)	Fault (red)	Description
Off	Off	No power supply to AS-i
ON	Off	Normal operation
Off	ON	AS-i communication disrupted
Flashing	ON	No data exchange because address = 0
alternating flashing	alternating flashing	Peripheral error
Off	flashing	Recognizes double addresses (ABB version only)

5. CONNECTIONS HD5-B-xxx

HD5-B-101



HD5-B-102



6. INSTALLATION

This chapter contains information about the installation procedures for the three-position device.

- Connect the cable to the control device and connect the HD5 to the cable.
- Mount the holder
- Make sure that the three-position device is completely in the holder.
- Make sure that the connection cable is an original cable from ABB and protected from mechanical damage to ensure highest safety and reliability.
- Make sure that the cable carrying the control signals from the three-position device is physically separated from cables that carry power.

Attention!

Installation shall be done by an approved person (see Chapter Approved person) with knowledge on AS-i Bus Systems.

- The position should be selected in view of ergonomic and safety relevant aspects.
- Other protective measures must be taken in order to protect other people in the same or in adjacent hazardous areas.
- The safety functions of the product must be tested before the system is put in operation.
- The safety functions of the product must be tested after installation or replacement of components or cables.
- The safety functions and the mechanics of the product must be tested regularly to confirm that all the safety functions are working properly.

Attention!

in accordance to the national electrical codes, cables that carry power (mains power lines, power circuits with a high di/dt, switch-mode converters, power-regulation control devices) and cables that carry control signals must be physically separated.

The connection cable of this device carries control signals and must be laid in the cable area for control signals.

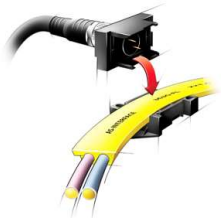
Otherwise, a risk of material damage or personal injury cannot be ruled out

Note on the connection on AS-I Bus

When using enabling devices with connectors, always use cables without additional shielding for reasons of interference immunity.
Cables for harmless use can be found in the accessories chapter or on request.

If the enabling device is connected by spiral cable, the maximum line length must be reduced by 12m per enabling device when an AS-i line is occupied by more than three type HD5-B-xxx enabling devices.

A recommended method for connection is the type shown in the picture on the right using an M12 connector.
The M12 connector is assigned to pin 1 (AS-i +) and pin 3 (AS-i -) as standard.



7. MAINTENANCE

The three-position device itself does not require any maintenance in addition to regular functional testing and cleaning.

The emergency stop safety function must be checked monthly. All safety functions and mechanisms must be tested regularly, at least once a year, to confirm that all the safety functions are working as they should. Depending on the application, machine manufacturers may stipulate requirements for shorter maintenance intervals. If this is the case, such requirements should be given priority. As a rule, it is recommended to document all maintenance work.

To ensure that command buttons continue to function in the long term, it is advisable to regularly wash them with a soft cloth and a standard (soap-based) multi-purpose cleaner.

The connection cable must be inspected regularly and replaced in case of damage. Make sure that the cable is an original cable from ABB to ensure highest safety and reliability.

Caution

The degree of protection of the three-position device specified in the data sheet must be met during cleaning.

The operating surfaces are made of soft, elastic and very thin material designed to be hard wearing. Using abrasive cleaning agents or sharp-edged tools can weaken or penetrate the surface, which results in the protection class being lost in a relatively short space of time. (Dirt and moisture may penetrate the housing) The use of cleaning agents containing solvents should be avoided. This is not only to protect the surfaces, but also to protect the health of employees.

Attention!

If the device is not working or is damaged, the device must immediately be put out of service. Please contact your regular contact for maintenance work or your nearest ABB customer service or dealer. Do not attempt to repair the product yourself. Any attempt to interfere with the device will result in a loss of warranty. A damaged product can affect the function and the safety and how it functions, which may lead to serious injury.

8. MODEL OVERVIEW, ACCESSORIES

HD5-B-xxx

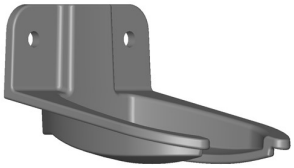
Type	Article number	Description
HD5-B-101	2TLA920502R0003	3-pos button, 1 front button, 2 top buttons, Emergency stop, flashlight, home position sensor
HD5-B-102	2TLA920502R0004	3-pos button, 1 front button, 2 top buttons, flashlight, home position sensor

HD5-B-101

HD5-B-102

HD5 accessories

Type	Article number	Description	Suitable for
HD5-M-001	2TLA920509R0001	Active holder	HD5-B-xxx
HD5-M-002	2TLA920509R0002	Passive holder	HD5-B-xxx
M12-C51-AS-i	2TLA910093R0000	Cable 5m/ 5 pin	HD5-B-xxx
M12-C51S-AS-i	2TLA930051R0000	Cable 10m/ 12 pin	HD5-B-xxx



HD5-M-00x

M12-C51-AS-i

M12-C51S-AS-i

Note „HD5-M-00X“

To guarantee all safety functions of HD5 when it is in holder, it is urgent to ensure that the holder is securely fastened.

Note „TKx-xxx“

When screwing or loosening the plug connection, to ensure, that twisting the installed plug connector is excluded. If necessary, suitable measures must be taken to prevent rotation.

9. TECHNICAL DATA

Manufacturer	
Address	ABB Electrification Sweden AB SE-721 61 Västerås, Sweden
Power supply	
Operational voltage	30 VDC, AS-i Bus, tolerance 26 - 31,6 VDC
Overall power consumption	<150 mA
General	
Protection class	IP65
Ambient temperature for during operation	-10°C (no buildup of ice) up to +55°C (no direct sunlight)
Ambient temperature for storage	-20°C (no buildup of ice) up to +70°C (no direct sunlight)
Dimensions	See drawing in section 12 “dimensions”
Weight	approx. 200 g without connection cable
Material	Housing: Fiberglass reinforced plastic, PPH G30 Operating buttons: TPE
Actuating force enabling button	approx. 20 N, 1 ➔ 2 approx. 45 N, 2 ➔ 3
Actuating force additional buttons	approx. 3 N, additional buttons 1 and 2 approx. 7 N, additional buttons 3 and 4
Mechanical /electrical durability of enabling button	1×10^6 switching cycles, position 1 ➔ position 2 1×10^5 switching cycles, position 2 ➔ position 3
Mechanical reliability B_{10D}, enabling button	B_{10D} : 2×10^6, position 1 ➔ position 2 ➔ position 1 B_{10D} : 968,000, position 1 ➔ position 3 ➔ position 1
Mechanical /electrical durability of emergency stop button	5×10^4 switching cycles
Mechanical reliability B_{10d}, emergency stop button	B_{10D} : 250,000
Mechanical durability of additional button 1	2×10^6 switching cycles
Mechanical durability of additional buttons 2/3/4	5×10^4 switching cycles
Connection	M12 connector 5 pin, A coded

Information for use in USA/Canada (UL)	
Ambient temperature for operation	-10°C (no buildup of ice) up to +50°C (no direct sunlight)
Enclosure	Type 1
Electrical supply	The device shall be supplied from an isolating transformer having a secondary overcurrent protective device that complies with UL 248 to be installed in the field rated max 4 Ampere. a) Max. 5 A for voltages 0-20 V (0-28.3 V peak), or b) 100/Vp for voltages of 20-30 V (28.3-42.4 V peak).
Supply Voltage HD5-B-xxx	26.0 to 31.6 VDC, supplied from Class 2 or LVLC
Overall Current consumption	< 150mA
For devices with field wiring leads smaller than AWG 26 following statement shall be provided on a separate sheet or on the device packaging:	Field wiring leads smaller than AWG 26 need to be terminated in a terminal block or similar connection device or shall be prepared by a wire termination.
Response time on the AS-i bus	
HD5-B-xxx	The enabling device meets the requirements of AS-Interface Safety-at-Work in all respects. An additional extension of the response time in the transition to the safe state is not carried out by this.
ABB AS-i logic unit Pluto *Response time on the AS-i bus* transistor output relay output *Response time on AS-i bus in case of error* transistor output relay output	 < 16,5 ms + programme-execution time < 20,5 ms + programme-execution time < 29 ms (with setting „Short stop time“) < 39 ms (with setting „Disturbance immunity“) < 33 ms (with setting „Short stop time“) < 43 ms (with setting „Disturbance immunity“)
 The response times refer exclusively to the AS-i monitor Pluto from the manufacturer ABB. When using an AS-i monitor from another manufacturer, the response times may differ.	
Further information on the profile and addressing, see chapter "AS-i configuration"	

Safety / Harmonized Standards	
2006/42/EC – Machines, 2014/30/EU – EMC, 2011/65/EU – RoHS2, 2015/863-RoHS3 EN ISO 12100-1:2010, EN ISO 13849-2:2012, IEC 62061:2015, EN 60204-1:2006+A1:2009 EN 61000-6-2:2005, EN 61000-6-3:2007	
SILCL 3	PL e, category 4
UL/CSA 60947-5-1	
UL/CSA 60947-5-5	only for variants with an E-Stop is included
Certificates	
TÜV Süd	cULus
AS-International Assoziation	

AS-i data

The enabling device with integrated AS-i technology contains up to three slaves, depending on the configuration.
The following bit description relates to functions that are generally possible and is set out in detail in the data sheet enclosed with the product (or available from ABB), depending on the configuration.

ABB versions HD5-B-xxx

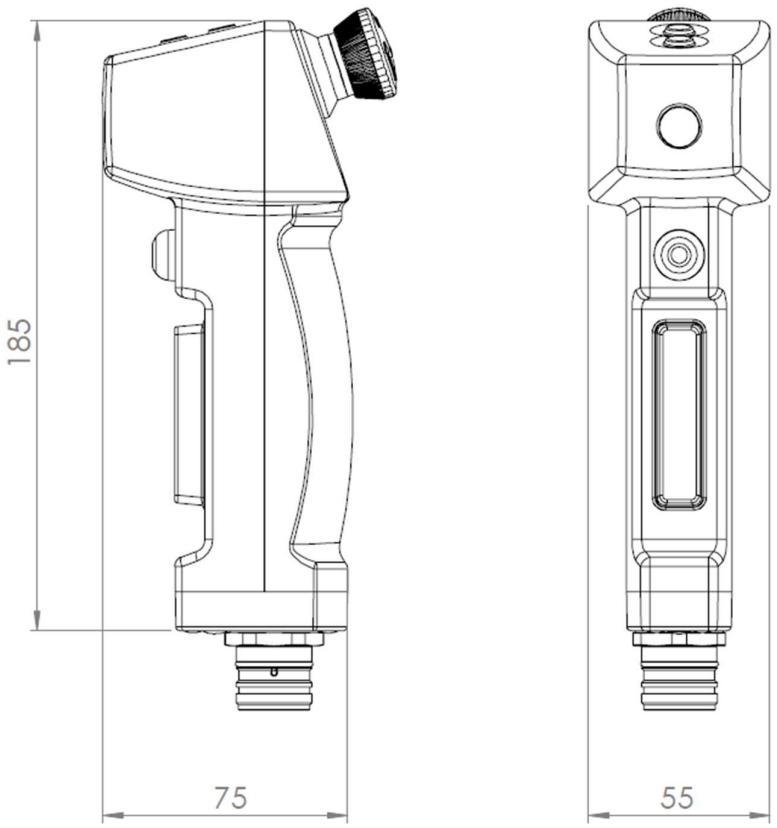
(up to 12 enabling devices may be used on one AS-i string)

Slave	I/O type	Bit	Value	Description
S-7.B.1.E Address 29 upon delivery	Safe code1	D 0		emergency stop button
	Safe code1	D 1		
	Safe code2	D 2		
	Safe code2	D 3		
	Output Non safe	DO 0	0	red feedback LED in emergency stop button or below, OFF
			1	red feedback LED in emergency stop button or below, ON
		DO1	0	green feedback LED, *not* activated
			1	green feedback LED, activated
S-0.B.2.E Address 30 upon delivery	Safe code1	D 0		enabling button
	Safe code1	D 1		
	Safe code2	D 2		
	Safe code2	D 3		
S-7.A.7.7 Address 31 upon delivery	Input Non safe	DI 0	0	additional button 1, *not* actuated
			1	additional button 1, actuated
		DI 1	0	home position sensor, enabling device *not* hung up in holder
			1	home position sensor, enabling device hung up in holder
		DI 2	0	additional button 3, *not* actuated
			1	additional button 3, actuated
		DI 3	0	additional button 4, *not* actuated
			1	additional button 4, actuated
	Output Non safe	DO 0	0	green signal LED, OFF
			1	green signal LED, ON
		DO 1	0	red signal LED, OFF
			1	red signal LED, ON
		DO 2	0	assist light (flashlight), OFF
			1	assist light (flashlight), ON

10. DIMENSIONS

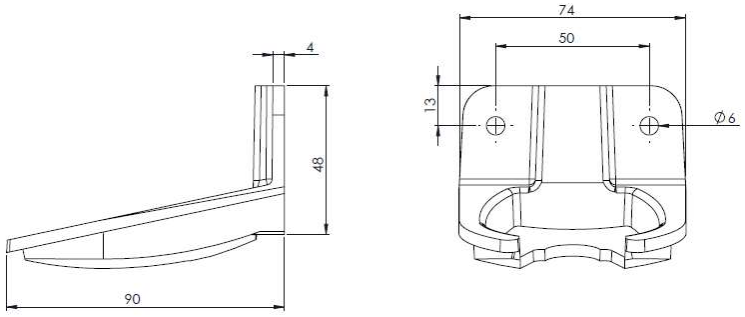
Three position device HD5-S-xxx

All dimensions are in millimeters (mm)



Holder HD5-M-00x

All dimensions are in millimeters (mm)



11. EC DECLARATION OF CONFORMITY

EC Declaration of conformity

(according to 2006/42/EC, Annex 2A)

We	ABB Electrification Sweden AB SE-721 61 Västerås Sweden	declare that the safety components of ABB Electrification AB manufacture with type designations and safety functions as listed below, are in conformity with the Directives 2006/42/EC – Machinery 2014/30/EU – EMC 2011/65/EU – RoHS2 + 2015/863
Authorised to compile the technical file		ABB Electrification Sweden AB SE-721 61 Västerås Sweden
Product Three position device, HD5-B-xxxxxx		**EC-Type ExaminationCertificate** M6A 049833 0028 Rev.00
Notified Body		TÜV Süd Ridlerstrasse 65 80339 Munich Germany Notified Body No 0123
Used harmonized standards		EN ISO 12100-1:2010, EN ISO 13849-1:2015, EN ISO 13849-2:2012, EN 62061:2015, EN 60204-1:2006+A1:2009, EN 61000-6-2:2005, EN 61000-6-3:2007

Viktoria Sakar
R&D team lead Electronics and Software
Västerås 220816

abb.com/lowvoltage

Original

ABB Electrification Sweden AB
SE-721 61 Västerås
abb.com/lowvoltage

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