

1 HR 550FS Handwheel

1.1 Handwheels

The standard iTNC 530 HSCI supports the use of electronic handwheels. They are connected to X23 of the machine operating panel.

The following handwheels can be installed:

- One HR 550FS portable handwheel with wireless transmission
- One HR 520 portable handwheel with connecting cable, or
- One HR 410 portable handwheel with connecting cable, or
- One HR 130 panel-mounted handwheel

HR 550FS handwheel with wireless transmission

Portable electronic handwheel with wireless transmission:

- Graphic display, Resolution: 128 x 64 pixels, 6-line display
- 6 NC keys
- 6 PLC keys with LEDs that are controlled through the PLC
- 2 override potentiometers (feed rate and spindle speed)
- 2 permissive buttons
- Exchangeable snap-on keys for PLC functions and maintenance
- Integrated emergency stop button
- Vibration alarm when leaving the radio range
- Battery warning
- Display of radio field strength
- Weight: Approx. 1 kg

Without mechanical detent:

ID 598 515-xx

With mechanical detent:

ID 606 622-xx

Accessories (1 x included with the HR 550FS):

Handwheel batteries (battery pack, 4-tray)
ID 623166-02



HRA 551FS

Handwheel holder (docking tray)
with integrated charger for
handwheel batteries

ID 731 928-xx



1.1.1 HR 550 wireless handwheel

The HR 550FS wireless handwheel must always be used together with the HRA 551FS handwheel adapter. The handwheel and the handwheel adapter communicate with each other via radio transmission. The handwheel adapter is connected to X23 of the machine operating panel via the connecting cable.

If the handwheel is located in the HRA, communication takes place through serial data transmission via contacts on the HRA and on the rear side of the HR instead of through radio transmission. The function of the HR 550FS remains the same, regardless of whether it communicates via radio transmission or via the handwheel adapter.

The HRA handwheel adapter features an integrated charger for the handwheel batteries. In addition, the safety-related signals (Emergency Stop, permissive buttons) are translated into relay contacts through the HRA. They must be used to connect the Emergency Stop button and the permissive buttons of the handwheel to the control and the associated safety circuits.



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If more than one control with a portable HR 550 handwheel is located in a factory hall, a room or a working area, then the handwheels must be identified by unique color markings. The color marking must be applied to the handwheel **and** the associated machine tool at a clearly visible location. The marking on the handwheel and the machine tool must enable the machine operator to see clearly which handwheel belongs to which machine tool. The color marking must ensure that no confusion occurs. A set of different markers is included with the wireless handwheel.

In addition, the machine operator must be informed that he must ensure/verify every time before using the handwheel that he uses the correct handwheel for the respective machine tool.

If the machine operator moves with the HR too far away from the HRA, a vibration alarm announces that transmission is weak before the machine operator has actually left the radio range. If the machine operator leaves the radio range anyway, or if radio communication is interrupted for other reasons, the HRA relay contacts for Emergency Stop and for the permissive buttons will open. You must ensure through appropriate wiring that this triggers an Emergency Stop on the control.

HEIDENHAIN also recommends that you always place the wireless handwheel into the HRA 551FS adapter when you are not using it. This prevents you from confusing the different handwheels. It also ensures that the handwheel battery is recharged and prevents an unexpected Emergency Stop reaction triggered by an empty battery.

Specifications	HR 550FS with HRA 551FS
Radio range (max. distance between the HR and the HRA)	Max. 20 m in direct line of sight (depending on the ambient conditions)
Ambient temperature during operation	0 °C to + 40 °C
Ambient temperature for charging process of battery	+ 5 °C to + 40 °C (recharging the battery at a temperature of < + 10 °C may reduce the battery life)
Storage temperature of NiMH rechargeable battery	-20 °C to +21 °C with a state of charge of 40%
Power supply for HRA 551FS	12 V
Display resolution	128 x 64 pixels
Power consumption	Max. 10 W during charging phase
Batteries	Package with 4 x AA batteries NiMH 4.8 V/2400mAh
Complete charging time	Approx. 150 minutes
Life of rechargeable battery	Approx. 16 hours with a utilization of 50%
Radio frequency	ISM band 2.4 GHz
Transmitter power	10 mW
Usable number of channels	16
Number of possible HRs with wireless transmission	Only one wireless HR per machine tool
Degree of protection	IP 54 for HR 551FS IP 54 for HR 550FS
Max. voltage for relay contacts in HRA 551FS	250 V~
Max. current for relay contacts in HRA 551FS	3.6 A
Reaction times of Emergency Stop and permissive buttons safety functions	Time until the reaction of the relay contacts: max. 170 ms; typically 60 ms
FCC-ID	YJKHR550FS
Weight HR 550	1 kg
ID for HR 550FS without mech. detent	598 515-xx
ID for HR 550FS with mech. detent	606 622-xx
ID HRA 551FS	731 928-xx

When using a wireless handwheel and the HRA adapter at X23 of the MB 6xx, you must ensure that the assignment between the handwheel and the HRA is unambiguous. The individual serial numbers of the wireless handwheel and the HRA are used for mutual assignment. When the control to which the HR and the HRA are connected is switched on for the first time, both units exchange their serial numbers and store them. To do this, the wireless



handwheel must be located in the HRA. If this is the case, the HR and the HRA communicate only over the serial interface.

Both serial numbers (HRA and HR) will then also be saved in the control. If you remove the HR from the HRA during the initialization process, the process will be canceled and a corresponding error message will be issued.

During the Emergency Stop test and when the connection to the wireless handwheel is set up, the system ensures that only the HR and the HRA are addressed, whose serial numbers have been assigned unambiguously to each other. If a difference is found in one of the comparisons of serial numbers, the connection will be terminated. The relays for Emergency Stop and the permissive buttons remain open during the complete process.

Switching the HR 550FS on/off

The HR 550FS can be switched off/on by pressing the CTRL key and the medium soft key simultaneously. To switch the HR 550FS on, press CTRL + medium soft key and then one of the two permissive buttons. The HR 550FS does not run a power-up test and can therefore not be used until a permissive button has been pressed. During the power-up test, the background illumination of the HR 550FS is active, but the display remains blank. The permissive buttons are tested at the end of the power-up test. None of the permissive buttons may be pressed at this time. In the event of error, an error message appears on the display, informing you that a permissive button is pressed. As a result, the power-up test cannot be completed. The display is not filled with characters until the power-up test has been completed successfully; the „OFF-LINE,“ message appears on the display. If an error is found during the power-up test, an error message appears on the display and the service department must be informed.

The handwheel is configured in a menu that you open by pressing the SET UP WIRELESS HANDWHEEL soft key. After you have pressed the MOD key, this soft key is displayed in the second soft-key row in the Programming and Editing mode of operation if machine parameter MP7640 has been set to the value 12. The following functions are available:

- Assigning the handwheel to a specific handwheel holder
- Setting the radio channel
- Analyzing the frequency spectrum for determining the optimum radio channel
- Selecting the transmitter power
- Statistical information on the transmission quality

For configuring the HR 550FS handwheel, refer to the chapter „Configuring the HR 550FS Wireless Handwheel,“ in the User's Manual for the control.

The functions that can be defined for the soft keys on the HR 550FS are the same as for the HR 520.

After the wireless handwheel has been configured, it can be activated via the handwheel activation key. Machine operation then switches from the machine operating panel to the handwheel. The machine tool builder must ensure through the PLC program that the machine can be operated by only one operating unit at any one time. Machine operating panel and handwheel must never be active at the same time. The display of the wireless handwheel and the display on the screen inform the operator when the wireless handwheel is active.

Radio transmission regulations

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy. If the equipment is not installed and used in accordance with the instructions, the equipment may cause harmful interference to radio communication. There is no guarantee, however, that such interference will not occur in a particular installation.



Hinweis

This wireless handwheel from HEIDENHAIN must be installed and used in strict accordance with the manufacturer's instructions as described in this technical documentation and the user's manual for your control. Any other installation or use will violate FCC Part 15 regulations. Modifications not expressly approved by Dr. JOHANNES HEIDENHAIN GmbH could void your authority to operate the equipment.

This device must not be co-located or operating in conjunction with any other antenna or transmitter.



Thanks to the wireless connection between the handwheel and the control, the HR 550FS wireless handwheel system and the HRA 551FS handwheel adapter provide maximum ease of use to the machine operator. The wireless communication uses the public, and therefore freely available, 2.4 GHz radio band via a special radio transmission protocol from HEIDENHAIN.

The wireless handwheel system attains a high and certified safety standard because of its dual-channel transmission protocol. The safety functions of the HR 550FS fulfill the requirements of performance level d, category 3, according to EN ISO 13849-1. Single errors do not lead to the loss of the safety functions. The service department must be notified if an error occurs. Only the functions of the permissive buttons and the Emergency Stop switch are classified as safety functions of the HR 550FS.

The safety functions must not be bypassed or deactivated in some other way.

Modifying or rebuilding the HRA 551FS and HR 550FS is not permitted and may lead to a loss of the safety functions.

The machine operator is responsible for identifying the area in which the wireless handwheel may be used. The wireless handwheel itself does not provide any configuration possibilities or limit values for defining a certain maximum range of use.

Because a handwheel is always connected with the movement of axes, the operator must always be able to trigger an Emergency Stop of the machine. This results in a special situation for the Emergency Stop switch of the HR 550FS wireless handwheel system. An unsafe situation in the radio communication must always trigger a safe reaction from the control. Therefore, an interference in the radio communication also means an Emergency Stop of the HRA 551FS as reaction.

An unexpected Emergency Stop of the machine is undesirable and may cause damage to the contour of the workpiece being machined. It is therefore essential to ensure a noise-free radio communication. Reliable operation of the wireless handwheel always requires planning the coexistence of the radio users active in the frequency and radio range concerned. If this cannot be guaranteed because there is no free radio channel available, we strongly advise against using the wireless handwheel system. HEIDENHAIN cannot guarantee noise-free radio communication of the HR 550FS and HRA 551FS wireless handwheel system.

Even if an available radio channel has been found and the proper functioning of the system has been ascertained, it is possible that the availability situation of the 2.4 GHz ISM band will change over a longer period of time. If this situation cannot be corrected by changing the wireless handwheel system or the competing radio system to another channel, it may become necessary to revert to using a handwheel with cable.

The following situations lead to an Emergency Stop reaction:

- The HR 550FS wireless handwheel is placed into the wrong HRA 551FS handwheel adapter.
- The HR 550FS wireless handwheel is switched off outside of the HRA 551FS handwheel adapter.
- Radio communication between the HR 550FS wireless handwheel and the HRA 551FS handwheel adapter is interrupted.

- The charge of the handwheel battery becomes too low.



Hinweis

- The power-up test of the HR 550FS must be repeated within no more than 168 hours. The HR 550FS handwheel and the HRA 551FS handwheel adapter must be turned off and on again to conduct the test. It must be ensured by the PLC program that this requirement is met.
- To guarantee the HR's Emergency-Stop and permissive-button safety functions, the respective contacts must be connected to the Emergency Stop chain and further safety circuits (if present) or safe inputs of the control.



**HRA 551FS –
Connector
overview**

HRA 551FS			
Internal pin layout	Connector	Function	Page
<p>The diagram shows the internal layout of the HRA 551FS. At the top right, there is a 9-pin D-sub connector labeled X223. At the bottom center, there is a 10-pin connector labeled X230. The board is enclosed in a metal housing with mounting holes at the corners.</p>	X223	Serial handwheel interface	1 ,Äi 9
	X230	Emergency stop, permissive buttons of handwheel	1 ,Äi 10

**X223: Serial
interface on
the HRA**

Connecting cable for serial interface from X23 of the MB to X223 in the HRA ID 683 259–xx.

Pin layout:

HRA 551FS	
9-pin D-sub connector	Pin layout
1	Do not assign
2	0 V
3	Do not assign
4	+12 V
5	Do not assign
6	DSR,Äi
7	RxD
8	TxD
9	Do not assign
Housing	External shield

Pin layout:

HRA 551FS	
8-pin Phoenix terminal	Pin layout
1	Permissive button contact A / terminal 1
2	Permissive button contact A / terminal 2
3	Permissive button contact B / terminal 1
4	Permissive button contact B / terminal 2
5	Emergency stop contact A / terminal 1
6	Emergency stop contact A / terminal 2
7	Emergency stop contact B / terminal 1
8	Emergency stop contact B / terminal 2

The relay contacts for the permissive buttons and Emergency Stop button on the HRA are four individual, normally open contacts.

- Behavior of the Emergency Stop contacts
When the Emergency Stop button is not pressed, the relays are actuated, and therefore the relay contacts are closed. If an Emergency Stop is triggered, the control voltage of the relays will be switched off and the relay contacts will open. For the control and the associated safety circuits, the relay contacts have the same effect as normally closed contacts.
If the batteries of the wireless handwheel are empty or if the wireless handwheel is out of range, the relay contacts are open.
- Behavior of the contacts for the permissive buttons
Depending on the setting in MP7645.3, the permissive buttons are represented as two normally open contacts, or as one normally open contact and one normally closed contact. This makes it possible to adapt the handwheel (permissive buttons) to the requirements of the planned safety concept of the respective machine.
HEIDENHAIN recommends setting the MP7645.3 to 1 to make the handwheel permissive buttons short-circuit proof. To ensure compatibility with previous machine designs, MP7645.3 is set to 0 by default.
• $\text{MP7645.3} = 0$:
When neither of the two permissive buttons is pressed, both relays are without control voltage, and therefore the relay contacts are open.
When at least one permissive button is pressed, both relays are actuated and both relay contacts close.
• $\text{MP7645.3} = 1$:
When neither of the two permissive buttons is pressed, one of the relays is without control voltage, and relay contact A is open. When at least one of the permissive button is pressed, the relay is actuated and relay contact A closes. When neither of the two permissive buttons is pressed, control voltage is applied to the other relay and relay contact B is closed. When at least one of the permissive button is pressed, the relay is not actuated anymore and relay contact B opens. MP7645.3 must be set to 1 for machines with HEIDENHAIN Functional Safety.



Hinweis

The interface complies with the requirements of EN 60204-1:2006 for „Ä protective extra-low voltage (PELV)“.



Pin layout for the various extension cables, adapter cables, connecting cables, and the handwheel:

Extension cable ID 281 429-xx			Adapter cable ID 296 466-xx			Connecting cable ID: see ,ÄIntroduction,Ä chapter			HRA 551FS	
D-sub connector (male) 9-pin		D-sub cnnctr. (female) 9-pin	D-sub connector (male) 9-pin		Coupling on mounting base (female) (5+7)-pin	Cnnctr. (male) (5+7)-pin		Cnnctr. (female) (5+7)-pin		
Hsg.	Shield	Housing	Hsg.	Shield	Housing	Hsg.	Shield	Housing	Hsg.	Internal X230
2	White	2	2	White	E	E	White	E	E	
4	Brown	4	4	Brown	D	D	Brown	D	D	
6	Yellow	6	6	Yellow	B	B	Yellow	B	B	
7	Gray	7	7	Gray	A	A	Gray	A	A	
8	Green	8	8	Green	C	C	Green	C	C	
					6	6	Black	6	6	8
					7	7	RD/BL	7	7	7
					5	5	Red	5	5	5
					4	4	Blue	4	4	6
					2	2	WH/GN	2	2	3
					3	3	BN/GN	3	3	1
					1	1	GY/PK	1	1	4, 2
					WH/BN	3	Contacts A + B			
					WH/YL	2	Contact B (permissive button)			
					WH/GN	1	Contact A (permissive button)			
					WH/BL	1	Contact A/Terminal 1 (EMERGENCY STOP)			
					WH/RD	2	Contact A/Terminal 2 (EMERGENCY STOP)			
					YL/BK	3	Contact B/Terminal 1 (EMERGENCY STOP)			
					WH/BK	4	Contact B/Terminal 2 (EMERGENCY STOP)			



Hinweis

The interfaces comply with the requirements of EN 61800-5-1 for ,Äprotective extra-low voltage (PELV).,Ä



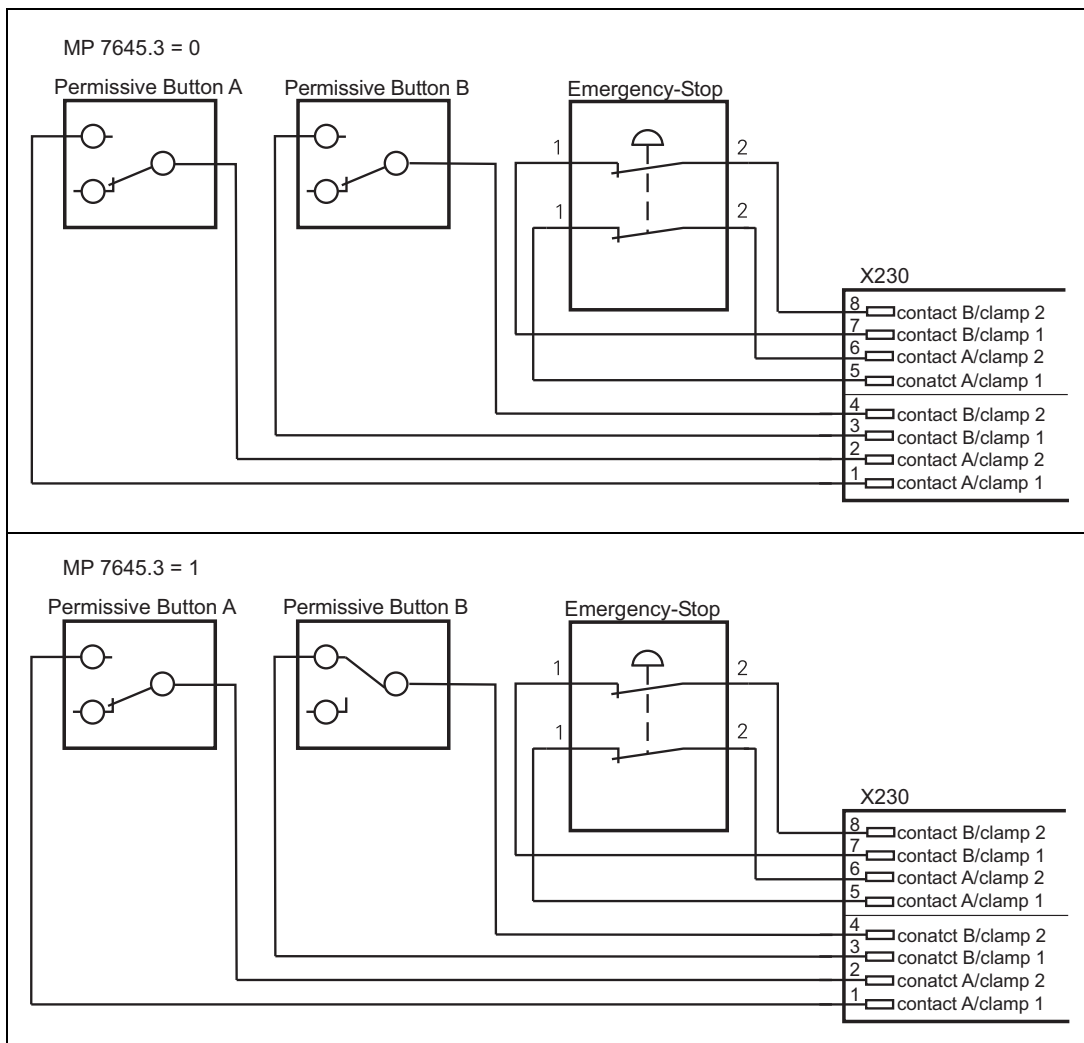
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Only units that comply with the requirements of EN 61800-5-1 for ,Äprotective extra-low voltage (PELV),Ä may be connected.

The adapter includes plug-in terminal strips for the contacts of the EMERGENCY STOP button and permissive button (max. load 24 V, \ddot{A} i, 1.2 A).

The plug-in terminal strips are supplied together with the adapter cable. If you have an immediate need for these terminal strips, they can be ordered in advance. See the „Additional components,“ table below.

Internal wiring of the contacts for the EMERGENCY STOP button and the permissive button:



Additional components	ID
Connecting cables	
Spiral cable	312 879-01
Normal cable	296 467-xx
With metal armor	296 687-xx
Plug-in terminal strips for advance ordering	
4-pin terminal block	266 364-12



Settings

- ▶ Enter MP7640 = 12 (HR 5x0).
- ▶ In MP7641, you specify whether you are using an HR 5x0 with or without detent, and whether the keys on the handwheel are to be evaluated by the NC or PLC.

All settings that can be defined in the machine parameters of the HR 520 can also be used for the HR 550FS. The PLC markers of the HR 520 also match those of the HR 550FS.

All keys of the HR 5x0 are evaluated by the NC. Certain keys are mapped to PLC markers. The six LEDs of the HR 5x0 can be controlled by the specified PLC markers.

F1	F2	F3	F4	F5
	X	Y	Z	
	IV	V	VI	
	↑	Hand-wheel active/inactive	↓	
	- (M4667)	Rapid traverse (M4663)	+ (M4666)	
	Spindle start (M4664) LED (M4684)	Actual position capture LED (M4689)	NC start (M4661) LED (M4681)	
	Spindle stop (M4665) LED (M4685)	Ctrl (M4668) LED (M4688)	NC stop (M4662) LED (M4682)	

