

# *User's Manual*

English



*In-Line*

*Board inverter*

This manual is intended for the inline device specified on the previous page. The manual contains information to assist the operator to start and operate the device properly, and to maintain it. Hardware and software mentioned in this document are subjected to continuous development and improvement. Consequently, there may be minor discrepancies between the information in the document and the performance and design of the hardware and software. Specifications, dimensions and other statements mentioned in this document are subject to change without prior notice.

Manufacturer and its suppliers shall not be liable for any damages related to the software or hardware, or for any other damages whatsoever caused of the use of or inability to use any manufacturer product. This is applicable even if manufacturer has been advised of the damage risk. Under any circumstances, manufacturer's entire liability shall be limited to replace such defective software or hardware which was originally purchased from manufacturer.

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# 1. Safety

Before starting the machine, it is essential that the operator, the foreman, and any other personnel involved in the machine operation understand the following points:

- ❑ The machine must be operated by trained personnel only.
- ❑ Anyone operating this machine must obey all warning signs. See the section entitled *Warning Signs* in this chapter.
- ❑ All personnel involved in machine operation must understand the use of the emergency stop button. See the following section entitled *Emergency Stop*.
- ❑ Do not use chemicals or other substances, which may have any influence on the operator or other personnel involved in the machine operation.
- ❑ Apart from weekly, monthly and yearly maintenance as described in the *Maintenance* chapter of the User's Manual, the machine is to be serviced by authorized personnel only.
- ❑ All covers and shields must be intact, mounted and closed while the machine is in operation.
- ❑ Do not disable or disengage any built-in safety switches or sensors.
- ❑ No hands or fingers are allowed near the moving parts of the machine.

## Emergency stop



The emergency stop button is positioned at the rightmost position in the control panel and stops all movements of the machine immediately when activated.

The emergency stop button has to be pulled up or turned counter clockwise to enable restart of the machine.

The machine must always be switched off when hands, fingers, tools or other objects are in the danger area of movable machine elements.

## Warning signs

Throughout the manual this symbol is used to call your attention when a task is about to be performed, that could be harmful to personnel or damage the machine. The symbol often refers to the warning signs, which must be obeyed to eliminate the risk of injury.

If there are instructions accompanying this symbol, they must be followed.



*Figure 1-1 Attention*

### High Voltage

The sign warns of electric shock. Units on which this sign is placed contain dangerous voltage levels. Power must be switched off before opening the unit. Only authorized service personnel are allowed to operate the machine when the unit is open.

This sign is applied as follows.

- ▣ One sign on the cover of the electrical cabinet.

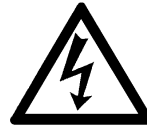


Figure 1-2 Electric shock

**The signs must be kept clean and readable.**

If a sign is missing, it must be replaced immediately.

### Moving parts

The sign warns of moving machine parts. Units on which this sign is placed contain moving machine parts. Power must be switched off before maintenance, service or opening the unit. Only authorized service personnel are allowed to operate the machine when the unit is open.

This sign is applied as follows.

- ▣ One sign on the infeed cover.
- ▣ One sign on the outfeed cover.



Figure 1-3 Moving parts



**Do NOT try to remove a jammed board while the power is on.**

## 2. About the Documentation

### User's manual

The *User's Manual* contains information to assist the operator to start and operate the machine, and is divided into the following main parts:

**Chapter 1:** Safety instructions.

**Chapter 2:** Information about the documentation.

**Chapter 3:** Installation instructions.

**Chapter 4:** Description of the machine and its basic operation.

**Chapter 5:** Operational information for production.

**Chapter 6:** Maintenance instructions.

**Chapter 7:** Service instructions, available products and options.

## 3. Installation

### Delivery

The machine is delivered fixed on a pallet.

Preparation Before the installation, prepare the location so, that electric power is available.

Ambient conditions the ambient air must be clean.

### Allowed humidity

0 to 35°C	10 to 90 % noncondensing
35 to 60°C	10 to 60 % noncondensing

### Allowed temperature

Operating	5 to 40°C (41 to 104°F)
Storage	-40 to 60°C (-40 to 104°F)

### Technical data

Length	500 mm (19.7")
Voltage	100-240 VAC
Frequency	50/60 Hz
Power consumption	max. 800 W
PCB Length	50-450 mm (2.0 - 17.7")
PCB Width	50-360 mm (2.0 - 14.2") 50-508 mm (2.0 - 20.0")
PCB Thickness	0.8-4 mm (0.03 - 0.2")
PCB weight	max 3 kg (6.6 lbs)

The machine can be lifted with a forklift truck. Put some wooden boards between the forks and the frame parts before lifting.



## Installation

*The installation must be carried out by authorized service personnel.*

The complete machine line must be carefully levelled along the board inverters belts. Use a spirit level across and along the machine when adjusting the feet.

The fundament must be rigid and sturdy. The machine must not rock.

The machine must be placed in a manner that allows access to all parts of the machine and so that service actions are not obstructed. There must be a free space of one meter around the machine, except for the other machines included in the production line.

### **Joining the units**

The frameworks of the units should be joined and bolted together with four plates and screws.



### **Mains supply**

The switching power supply must be manually switched between 120VAC and 230VAC.

## 4. Product Description

### Main Parts

The Board inverter consists of a solid steel framework and an inverting conveyor. It is equipped with a control panel and an electrical cabinet. A photo sensor is positioned at the beginning and end of the belt section.

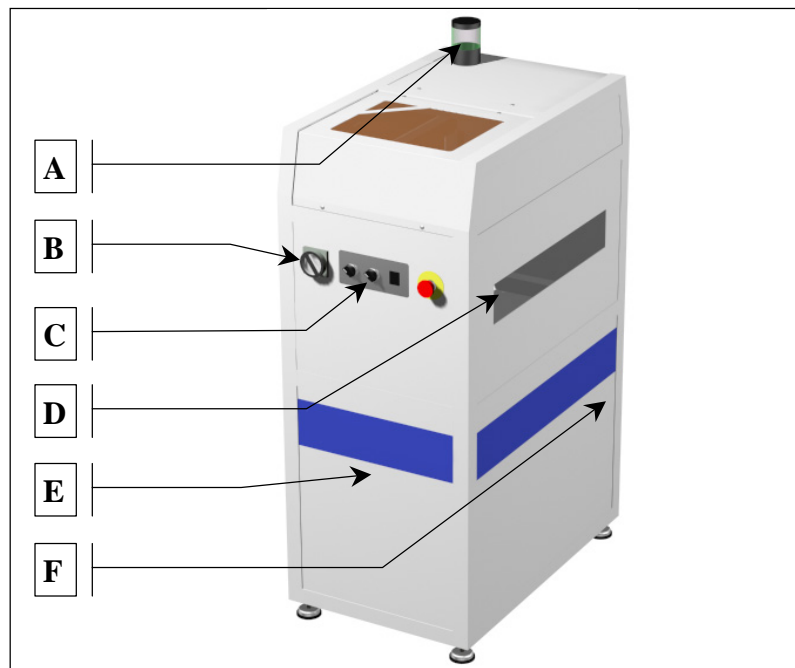


Figure 4-1 Main parts

- A. Status indicator
- B. Main switch
- C. Control panel
- D. Inverting conveyor
- E. Electrical cabinet (Behind cover)
- F. Connectors for supply voltage and SMEMA (Behind cover)

## Control system

### Board inverter control panel

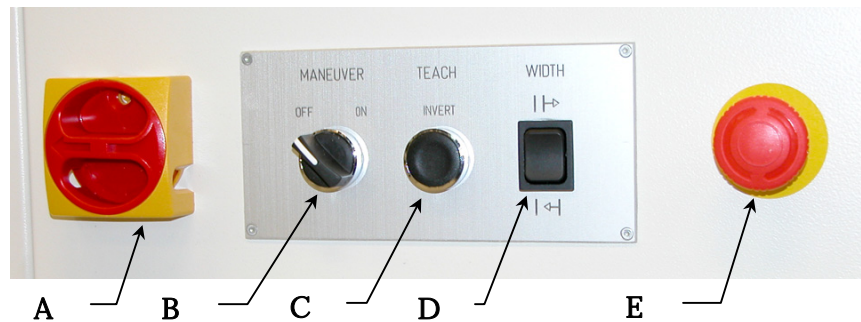


Figure 4-2 Control panel

- A. Main switch
- B. Manoeuvre switch
- C. Teach button
- D. Control switch
- E. Emergency stop button

#### *Main switch:*

0: Mains supply to the electrical cabinet is off.

1: Mains supply to the electrical cabinet is on.

Note: The machine is not running if the manoeuvre switch is set to ON before the main switch is set to 1.

First set the main switch to 1, then the manoeuvre switch to ON, or turn the manoeuvre switch to OFF and back to ON.

#### *Manoeuvre switch:*

OFF: The machine is stopped and power supply to all moving parts is disconnected.

ON: The machine is started. If the inverting conveyor is at 0° or 180° when started, the machine is immediately ready for production. Else a rotation to 0° or 180° is done before the machine is ready for production and allows infeed of PCBs. The status indicator (beacon) is lit when the machine is in production and no error has occurred.

**Teach button:**

Hold for 3 seconds to enter *Teach mode*.

*Board flow programming* is performed in teach mode and is described on page 14.

The status indicator will go out when teach mode is entered. When in teach mode, hold for 3 seconds to exit. The status indicator lights up when teach mode is exited and the machine is ready for production.



Note: It is not possible to enter teach mode if the flip unit is stopped before inversion is finished. I.e. when the flip unit is not in one of its two rotational outermost positions. In addition, none of the two PCB-present sensors must be activated.



When in *Teach mode* and before board flow programming is started (a PCB present sensor is activated), the teach button can be used to rotate the flip unit to change start position. A short press on the button will toggle flip unit position between 0° and 180°. If necessary, a rotation of the flip unit can be performed without a subsequent board flow programming. When board flow programming is started, the button function will change as described on page 14.

**Control switch:**

Increases or decreases conveyor width. Width movement continues until the control switch is released or an end limit is reached.



*Width adjustment is automatically disabled if any of the two pcb-present sensors are activated, or if the conveyor motor is running.*

*Check the conveyor for obstructive objects before adjusting the width. If width adjustment is performed while a PCB is located between the two sensors on the conveyor, damage may occur in the width adjustment mechanism.*

**Emergency stop button:** This button is described in detail on, page 5 section *Emergency stop*.

**Status indicator, normal operation**

A beacon with a green lens is used as status indicator. It indicates the current machine state. There are two possible states.

1. *The light is out:* The manoeuvre switch is “OFF”, the machine has no supply voltage, the machine is in teach mode, or, an error has occurred.
2. *The light is continuously lit:* The manoeuvre switch is “ON” and no error has occurred. The machine is ready for production.

**Status indicator, board flow programming**

In programming mode, during board flow programming, the beacon indicates a successful programming step.

The lamp is lit for one second when a board-present sensor is activated, or when the *Teach (invert) button* is pressed.

If the lamp becomes continuously lit during board flow programming with no sensor activated, the board flow memory is full and no more programming is possible. The memory can hold up to 10 board flow sequences. One board flow sequence contains three steps:

1. Infeedside, left/right
2. Invert, yes/no
3. Outfeedside, left/right

## 5. Operation

### Setting up the machine for operation

#### **Board flow programming (Teach mode)**

Board flow sequence is always programmed at the manufacturer, according to the customers specifications, but can be re-programmed at customer site if necessary.

The board flow memory can hold up to 10 board flow sequences. One board flow sequence contains three steps:

1. Infeedside, left/right
2. Invert, yes/no
3. Outfeedside, left/right

Follow the instructions below if the board flow sequence needs to be changed:

1. Set the *Manoeuvre switch* to ON.
2. Press and hold the *Teach button* for at least three seconds until the status indicator light goes off. The machine is now in teach mode.
3. Activate the board-present sensor on the board-infeed side for a short moment. The status indicator (beacon) lights up for one second to indicate a successful programming step.
4. Press the *Teach (invert) button* once if the board should be inverted. If the board should go through the machine without being inverted, skip this step.
5. Activate the board-present sensor on the board-outfeed side for a short moment.
6. Repeat step 5 to 7 for each required board flow sequence.
7. Press and hold the *Teach button* for at least three seconds until the status indicator light goes on. The board flow sequence is now re-programmed.

### **SMEMA communication**

'Smema IN 1' and 'Smema OUT 1' are used for left to right board flow.

'Smema IN 1' must be connected to 'Smema OUT' on the machine placed left of the Board Inverter (BI).

'Smema OUT 1' must be connected to 'Smema IN' on the machine placed right of the BI.

'Smema IN 2' and 'Smema OUT 2' are used for right to left board flow.

'Smema IN 2' must be connected to 'Smema OUT' on the machine placed right of the BI.

'Smema OUT 2' must be connected to 'Smema IN' on the machine placed left of the BI.

### **Final settings**

Turn the *Manoeuvre switch* to "ON". Adjust width of the conveyor by the *Control switch*, see page 12. Width movement continues until the control switch is released or an end limit is reached. Make sure the PCB can be moved manually through the whole length of the conveyor without getting jammed. The machine is now ready for production.

## Function

The Board inverter (BI) turns a PCB upside-down to make processing possible on both sides. Board infeed side, invert status (yes/no) and outfeed side, are all determined by the programmed board flow sequence. When there is a board on the preceding machine the BI receives a signal that says board available. The BI sends back a ready signal and the board is transported into the BIs conveyor to the second PCB-sensor. When the board has reached the second PCB-sensor and the conveyors have stopped, the 'flip unit' rotates 180° CW or CCW depending on the previous position, and on the board flow programming. The board is transported out of the BI when the subsequent machine signals that it is ready to receive a board. When the board has left the BI, the BI is ready to receive a new board.

## Alarms

If the supply voltage is connected, the *Manoeuvre switch* is "ON" and the light on the status indicator is out, an alarm state has occurred. See *Control system, status indicator*, on page 13 for more information.

See the table on next page for possible alarm causes and troubleshooting.

Reset an alarm state by turning the *Manoeuvre switch* to "OFF", and then back to "ON". Alarms cannot be reset if the *Emergency stop* button is pressed down (activated).



## Alarm table

<b><i>Alarm type</i></b>	<b><i>Description</i></b>	<b><i>Recommended action</i></b>
<b>Flip unit error 1</b>	The two PCB-sensors on the flip unit were (are) simultaneously activated.	1. Make sure the board does not cover both sensors. If so, the board is too big. 2. Check the sensitivity of the sensors and adjust it properly. The sensitivity is adjusted with a small screwdriver.
<b>Flip unit error 2</b>	The two position sensors (0° and 180°) were (are) simultaneously activated. These sensors are positioned behind the control panel cover.	1. Check the inputs on the PLC. See electrical drawings.
<b>Flip unit error 3</b>	One or both position sensors (0° and 180°) and the 'high speed area' sensor were (are) simultaneously activated. These sensors are positioned behind the control panel cover.	1. Check the inputs on the PLC. See electrical drawings.
<b>Flip unit timeout</b>	The expected position sensor (0° or 180°) was not activated within 10 seconds when a rotation was performed. These sensors are positioned behind the control panel cover.	1. Check the inputs on the PLC. See electrical drawings.
<b>Conveyor timeout</b>	One or both PCB-sensors on the flip unit were (are) activated longer than allowed during a board transfer. The time limit is set to 20 seconds.	1. Check for jammed board. 2. Check the sensitivity of the sensors and adjust it properly. The sensitivity is adjusted with a small screwdriver.
<b>Emergency stop</b>	The <i>Emergency stop</i> button is pressed down.	Pull the <i>Emergency stop</i> button up and/or turn counter clockwise to reset the emergency stop.

## 6. Maintenance

The maintenance of the machine is an important task and must not be overlooked. Follow the maintenance schedule and keep the machinery in a clean condition.

### Maintenance schedule

*Weekly:*

- ▣ Keep the machine clean, See "Cleaning".

*Monthly:*

- ▣ Check the conveyor belt condition and renew the belts if required.

### Cleaning

*General:*

- ▣ Keep the machine clean all over.

*Photo sensors:*

- ▣ The most sensitive parts are the photo sensors located at both ends of the conveyor. If they become covered by dust, the machine will not work. Wipe off dust from the sensors using a soft cotton rag.

### Lubrication

All bearings are of sealed type and do not require any additional lubrication.

## 7. Service

### Exchange of conveyor belt

1. Disconnect the power supply at the mains plug.
2. Remove the conveyor belt by pulling it to the side.
3. Fit the new belt by pushing it in place from the side.