SK 500 / SK 600
Operating Manual

schwer + kopka

**Advanced EnvelopeMonitoring System
for all types of metal forming machines:**
- multi station cold formers (up to 16 channels)
- transfer presses
- stamping machines
- thread rolling machines
- cold headers
- insertion applications

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Contents

1   Safety instructions

No water!	No chemicals!	No mechanical force!

0 - 50 °C	<50% (40°C), <90% (20°C)

85 - 265 V≈
50/60 Hz
25 W

Disconnect power supply before opening housing!

The product must not be disposed of as household waste. Dispose of the product through the WEEE scheme or return it at your own cost to **SK**.

2   <u>Front panel with Teach-In button</u>

Timing LED

Yellow =
Teach-In

Green =
monitoring

Stop LED
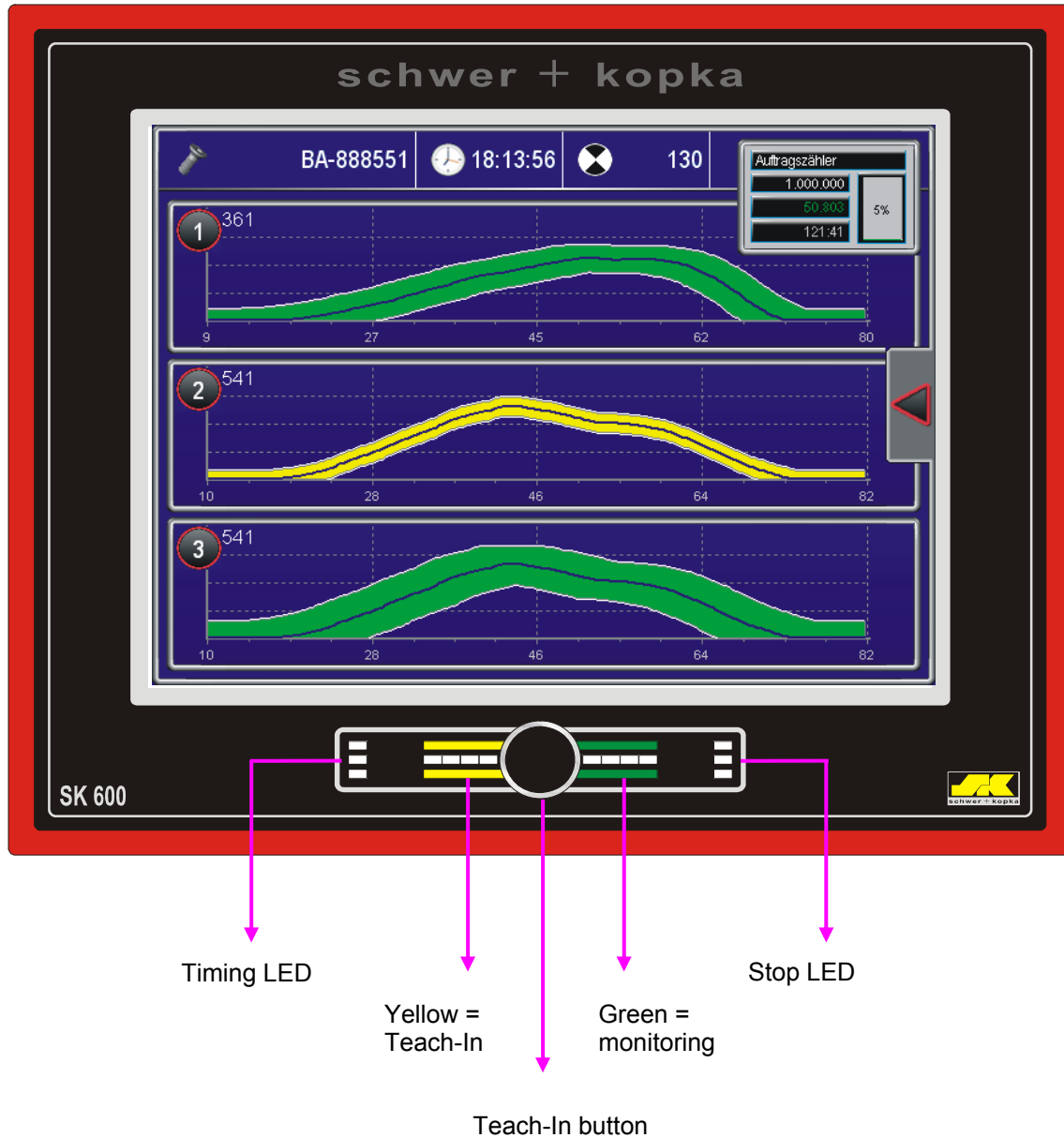
Teach-In button

For a description of the function of the Teach-In button, see page 32 in chapter
13.1 Configuration of basic settings
Teach-In phase and Stop-Auto mode.

3   The toggle principle

The **SK 500** and **SK 600** monitoring systems feature integrated toggle technology.

The toggle principle allows for quick switching between the main display screens of the system. In the top right corner of the individual screens, you find a thumbnail image of another screen that can be called up by touching it:

Toggle window:
Toggling between curve and counter display.
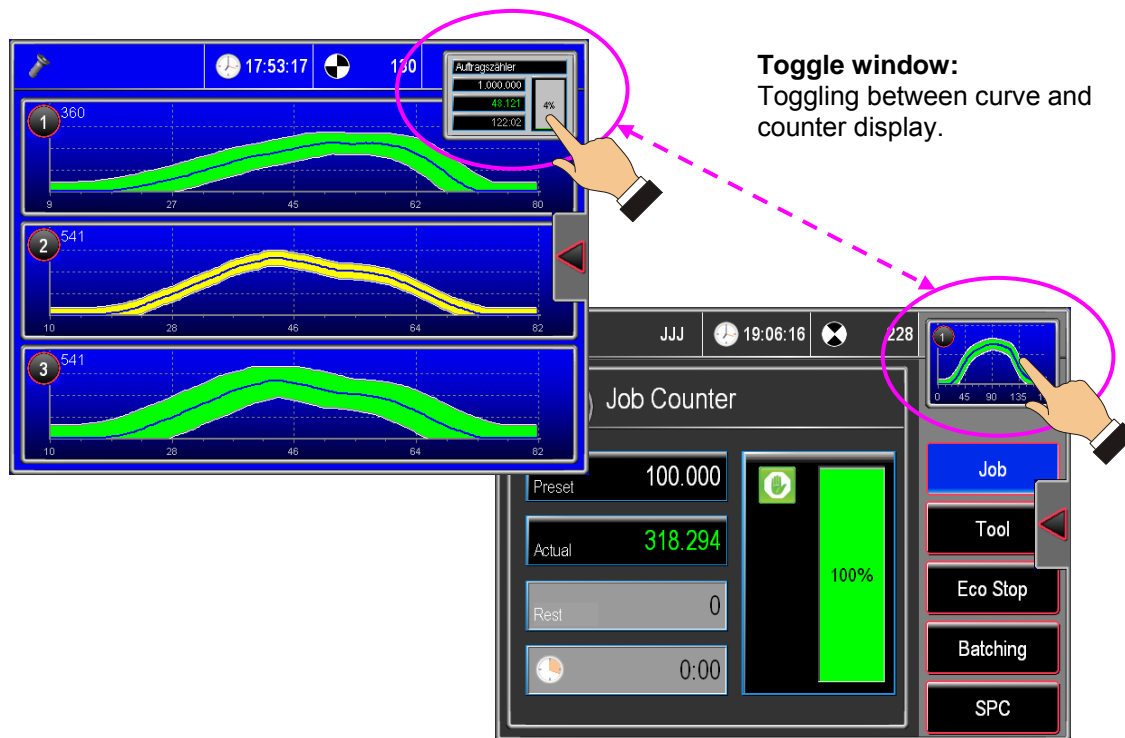
The toggle window is available in the various monitoring modes, the menu and the SET mode screens. This principle enables operators to quickly return to the basic screens of the process monitoring system and the counters (home function).

The last selected monitoring channel or counter is shown in the toggle window (live window).

By default, the system always toggles between the counter and the curve screens.

4 Start screen (channel overview)

After switching on the device, the screen shows an overview of the channels. By touching the areas highlighted in yellow, the operator can call up other functions. The text fields not highlighted in yellow are display fields only.

Part-no. — Time — Current rpm — Toggle window

Change to SET mode for the adjustment of the monitoring parameters

Quick navigation button

Touch to call up a single channel

5 Single curve screen

Maximum force — Stability **Q** — Current rpm — Toggle window

SET mode

Touch the maximum value field to activate the overwrite mode. The maximum value is displayed in yellow and the curves are overwritten.

Q-master signal stabilisation

Quick navigation button

Change to next or previous channel

5.1 Screen zoom

In the envelope and trend screens of the process monitoring system, the user has the option to zoom in on a section of the image. This is done by drawing a box around the area, dragging your finger across the area. To return to the original size, move the finger in the opposite direction (zooming out). The zoom area outline disappears when the screen is closed.

Original size

Zoom area

By selecting the overwrite mode during zooming in (by touching the max. value of the curve) the signal fluctuations (grey curve) are shown at high resolution, even for highly stable signals.

6   Monitoring parameters in SET mode

The monitoring limits (sensitivity, puzzle monitoring, trend, etc.) are set in **SET mode** in the single curve screen. To set the system to SET mode, simply enter the desired channel number.

Touch channel number for **SET mode**
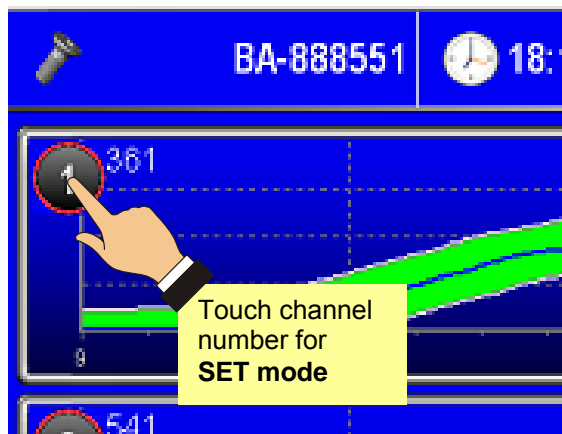
While **SET mode** is active, the channel number is shown in silver grey.
After 30 seconds of idle time, SET mode is terminated.

6.1   Sensitivity (envelope width)

Touch the channel number to call up SET mode.

De-Activate SET mode

Change channel

Adjust sensitivity
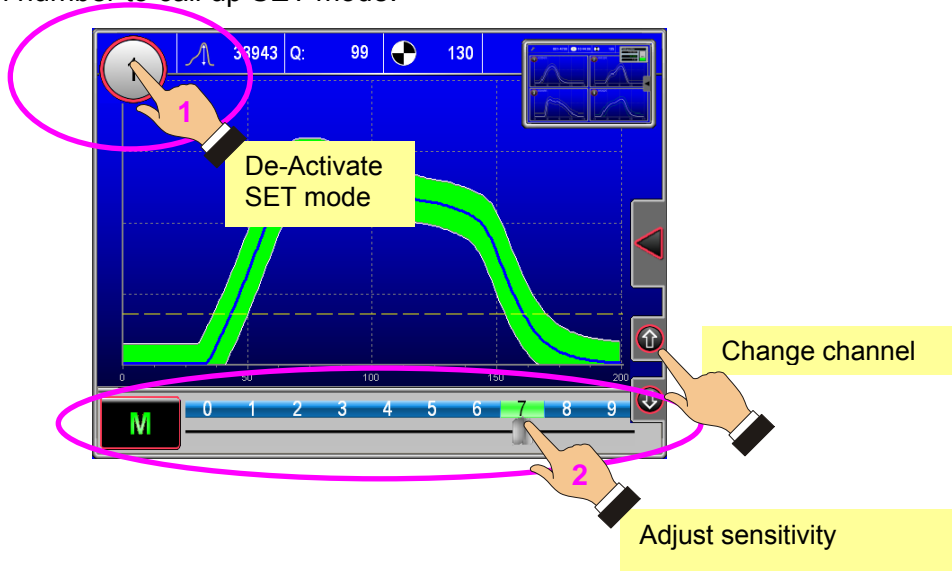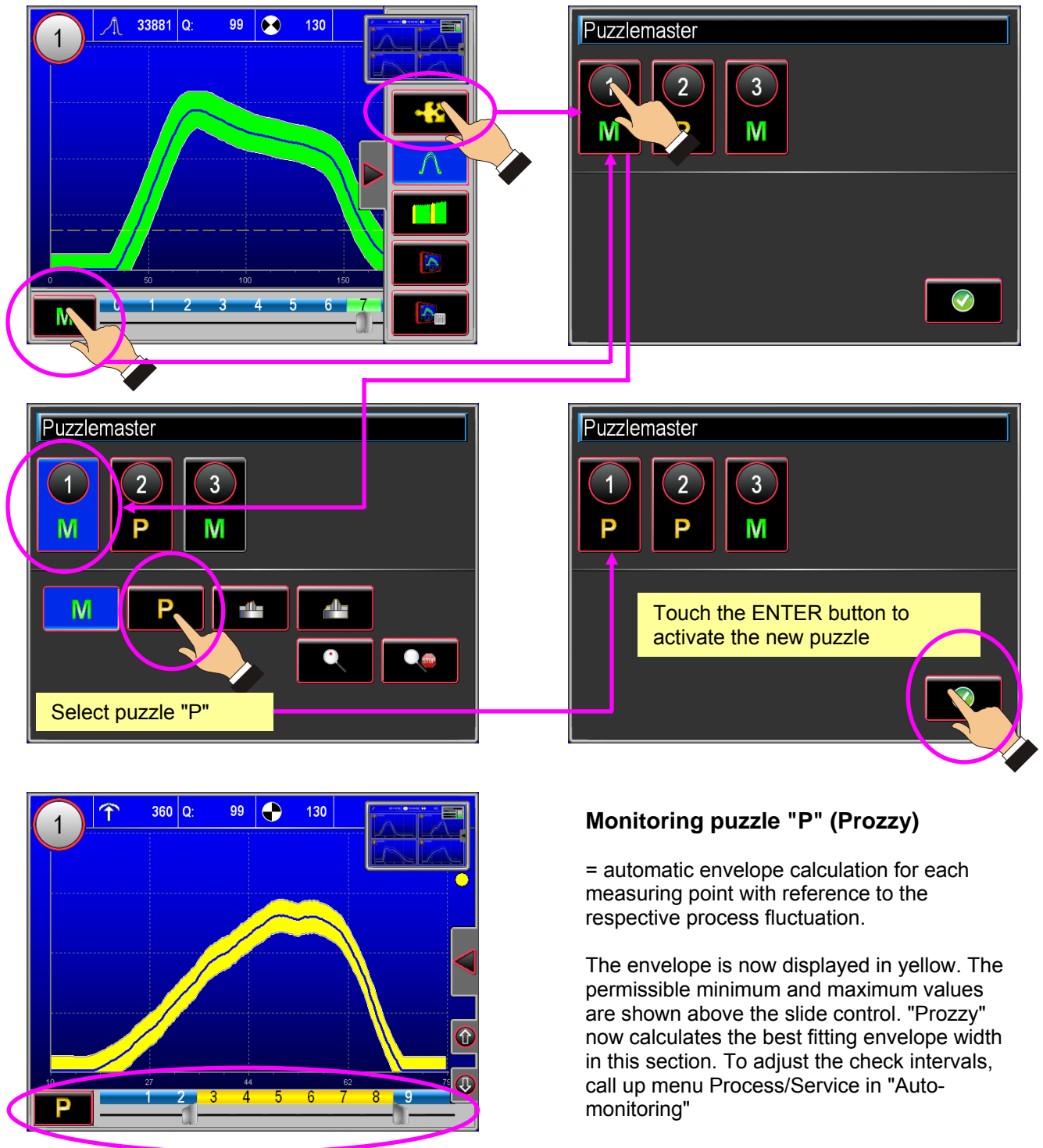
The sensitivity (envelope width) can be adjusted from **1** (low) to **9** (very high) by touching or moving the side slide control at the bottom of the screen.

At **sensitivity "0"**, the envelope monitoring of the respective channel is switched off.
The envelope disappears from the screen and the channel number is displayed in red.

6.2 Auto-monitoring with "Prozzy" puzzle[1]

To change from manual envelope adjustment "**M**" to automatic envelope adjustment "**P**", first activate the **SET mode** in the single curve screen. To choose a monitoring puzzle, touch the active puzzle button to the left of the sensitivity scale **or** call up the Puzzlemaster with the quick navigation button.

Monitoring puzzle "P" (Prozzy)

= automatic envelope calculation for each measuring point with reference to the respective process fluctuation.

The envelope is now displayed in yellow. The permissible minimum and maximum values are shown above the slide control. "Prozzy" now calculates the best fitting envelope width in this section. To adjust the check intervals, call up menu Process/Service in "Auto-monitoring"

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[1] SK Puzzlemaster (with Prozzy puzzle) is a device option that can be added at any time.

6.2.1 Configuration of monitoring intervals ("Prozzy" puzzle)

The intervals of the "Prozzy" monitoring puzzle can be configured in the Configuration menu (Configuration / Service / Monitoring parameters).

In Prozzy mode, the functions Auto*master* and Q*master* **are always active**. The menu screen however shows how the two functions Auto*master* and Q*master* are set when the system changes to monitoring puzzle "M" (manual).

Please observe items 4 and 5.

4. **Prozzy start phase:** After this interval (run time in AUTO mode in seconds) has lapsed, the Prozzy function performs the first calculation of the fitting envelope width.

5. **Prozzy interval:** Time interval (in seconds) during which the Prozzy function checks whether the envelope width can be adjusted further while the machine is running.

Recommendation: Choose the longest possible interval, as this increases the amount of data that is used by the Prozzy function for the calculation. If possible, the monitoring puzzle "P" should be combined with the Stop-Auto function.

Item 3: "Curve character" allows for a new type of monitoring, which should however only be activated after consultation with the SK service technician.

6.3 Selecting additional monitoring puzzles with SK Puzzlemaster[2]

To select the monitoring puzzles (expert programs), proceed as described in "Auto-monitoring with "Prozzy" puzzle" (previous chapter). Certain puzzles cannot be switched on or off during an active monitoring phase. A message to this fact is displayed on the device.

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[2] SK Puzzlemaster is a device option that can be added at any time.

6.3.1 Available monitoring puzzles[3] (status 07/2010)
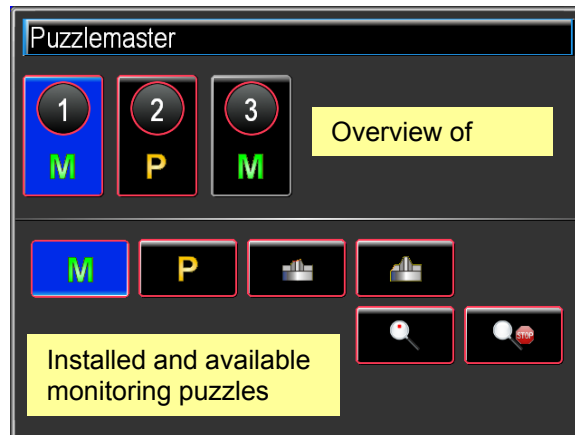
The following monitoring puzzles (expert programs) are available or can be installed:

1. Punch tip breakage
2. Punch side breakage
3. Cracked head
4. Rotated head
5. Piercing
6. Manual profile puzzle (configurable)
7. Zoom
8. Rising slug detection (on stamping machines)
9. Immediate stop
10. Roll back monitor (on thread rollers)

To install additional monitoring puzzles and to enable installed puzzles for a **30-day trial period**, access the code system in the Options section under "**Upgrade-Options**".

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[3] Missing monitoring puzzles can be added.

7 Quick navigation button in SET mode

  Puzzlemaster

  Envelope monitoring

  Trend

  Main menu "Process"

  Additional parameters
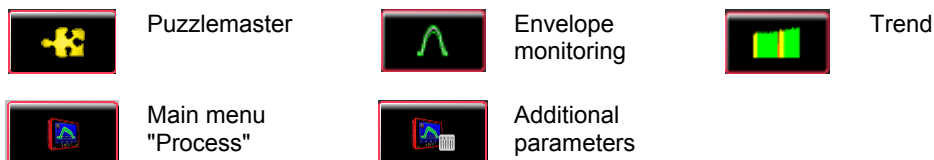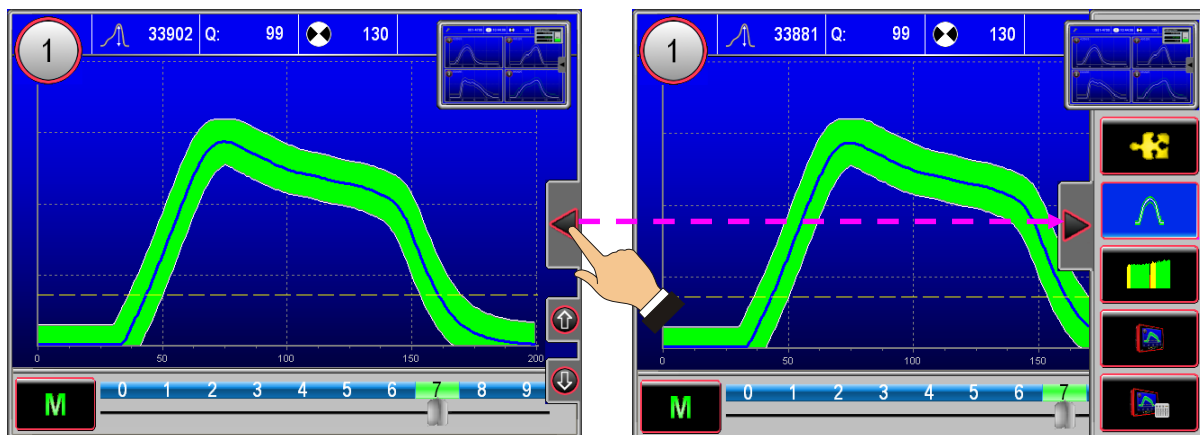
The quick navigation options are hidden after 30 seconds of idle time.

7.1 Trend monitoring

The trend monitoring screen shows the maximum force values of the last 250 strokes, where by the last stroke is always added from the right. Strokes performed in Teach-In mode (not monitored) are shown in yellow. Strokes performed during monitored operation are shown in green. Signals that have resulted in a shut-down (e.g. trend errors or values outside the envelope) are shown in red. An upper and lower trend limit can be set for the trend values. The lower limit is however only activated, if there is also a set upper limit.

Trend limit not active: the indicator of the respective trend limit is off.
A set but inactive limit value is shown in the diagram as a dashed red line.
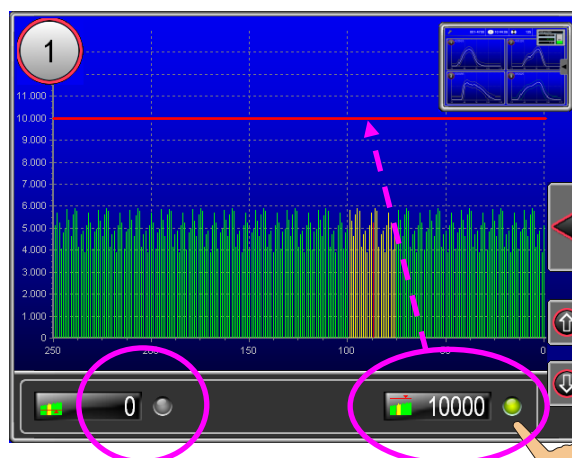
The limit is activated by touching the indicator (changes to green).

The active trend limit is displayed as a thick red bar.

An absolute trend limit is based on the actual value of the sensor signal as measured by the monitoring device. Absolute trend limits must normally be adjusted to the new part at each product change.

7.2   Calling up Process menu

Touch the quick navigation button in SET mode to access the "Process" main menu. From here, you can call up all available options of the main menu.
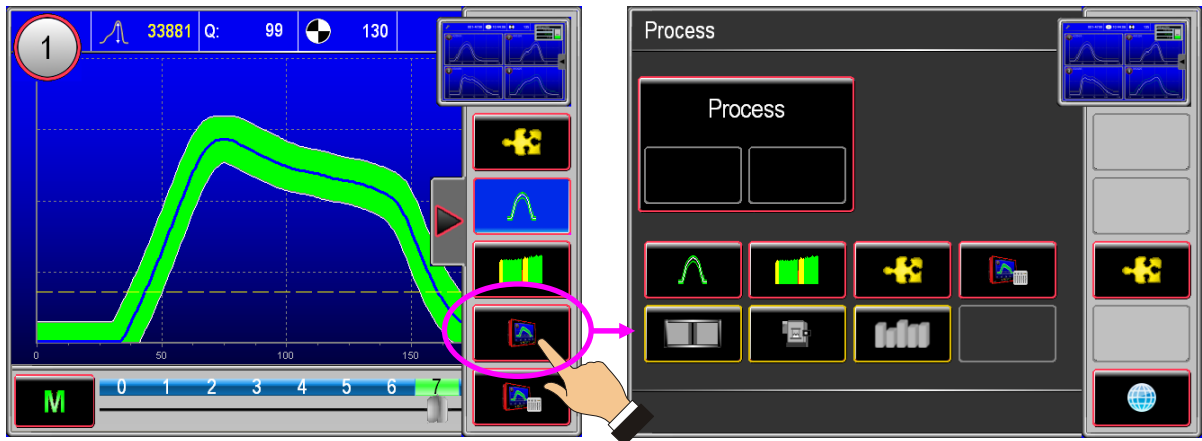
7.3   Additional parameters
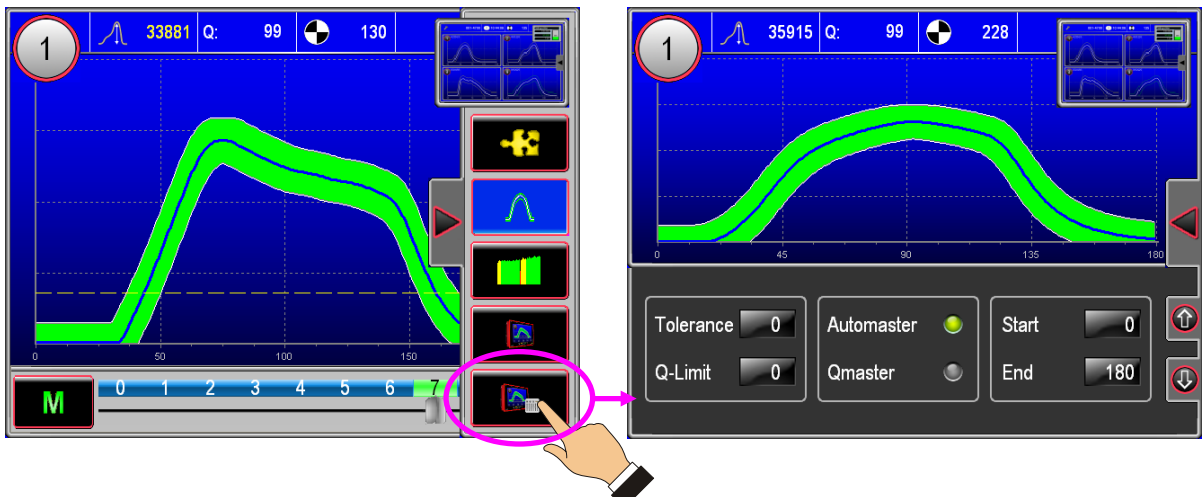
Touch the button for additional parameters to activate the following monitoring functions[4]: Tolerance, Q-Limit, Auto*master*, Q*master*, Start and End measuring windows.

The above functions are described in more detail on the following pages.

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[4] Some of the monitoring functions are optional and can be installed separately when required.

7.3.1   Tolerance

The **Tolerance** value corresponds the number of consecutive parts with deviations (e.g. outside the envelope) that are tolerated before the machine is automatically shut down. The tolerance setting thus enables operators to prevent unjustified or unwanted stops by instructing the machine to ignore random signal changes. The tolerance value can be set to a value between 0 and 9:

0 =   **no part** with deviations is tolerated. The machine is stopped when the first faulty part is detected.

1 =   1 faulty part is tolerated. If this part is followed directly by a second faulty part, the machine is stopped.

9=   up to 9 consecutive faulty parts are tolerated. The machine is stopped when nine faulty parts are followed by a tenth faulty part.

Normally, the tolerance value should be set to **0** to ensure that every detected fault results in a machine stop.

For multi-station processes, it is particularly important that **Tolerance = 0** is set, so that faulty parts are **not** transferred to the next station where they could cause further damage.

7.3.2   Q-Limit

Monitoring of process stability and quality (**Q**)

The **Q** factor is a percentage value describing the stability and repeat accuracy of the forming process from stroke to stroke. A low Q factor (e.g. well below 90) indicates that there are significant fluctuations in the process, as the signals vary from part to part. Accordingly, the quality of the parts also fluctuates within a certain range. As a result, the envelope limits of the process in question are quite wide.

A smooth and stable process where the signals deviate only little from each other results in a high Q factor of 95 or higher. As a result, the envelope limits are closer to each other, which again results in a better product quality and higher sensitivity of the monitoring process.

The Q factor is calculated separately for each monitoring channel and is indicated in the single curve screens of the respective sensor as "Q". If required, you can set a **QL** (Q-Limit, minimum permissible Q value) for each channel. If the Q factor of the respective channel is below this minimum value, e.g. due to high signal scatter, the machine is stopped with an error message, as the set minimum quality is not reached.
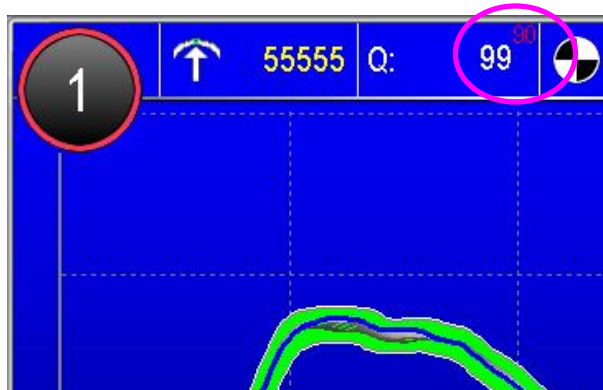
If Q-Limit is active, the Q-Limit value is displayed in red in the top right corner beside the actual Q value (white).

7.3.3   **SK**Auto*master*

With the **SK**Auto*master*, the system automatically adjusts the analysis window to fit the actual curve.

The measurement and evaluation of the force progress is thereby optimised for each process as the window automatically zooms in on the actual force curve. This ensures that the monitoring system always focuses on the actual working range and does not collect data during the "dead" times. When changing from Teach-In to monitored automatic mode, the **SK**Auto*master* automatically adjusts the measuring window, so that the curve is displayed in such a way that it is spread across the entire screen width.
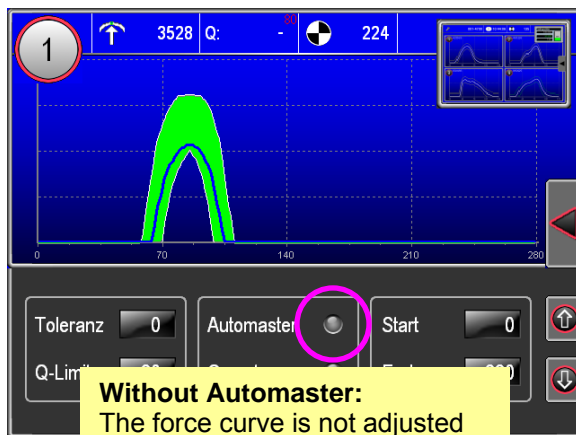
Without Automaster:
The force curve is not adjusted to the screen width.
The available monitoring capacity is wasted as "dead" intervals without signals are also monitored.
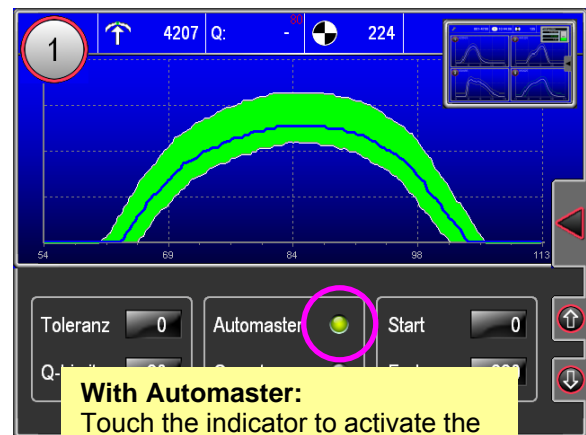
With Automaster:
Touch the indicator to activate the Automaster:

The measuring window is adjusted so that the force curve fills the entire width of the screen.

7.3.4   **SK**Q*master*

SKQ*master* = automatic compensation of signal fluctuations caused by machine RPM variations

In certain machines, the rpm fluctuates somewhat due to the chosen drive system. In others, the trigger signals (cycle) for monitoring are produced by auxiliary shafts that show a certain imbalance (e.g. in machines with chain drives).

In both cases, the speed fluctuation results in a horizontal scatter of the sensor signals on the screen. It is possible to adjust the envelope settings to ensure that the horizontal offset of the force curve does not result in unnecessary machine stops. This has however the disadvantage that the monitoring accuracy becomes very poor.

The **SK**Q*master* function stabilises the sensor signal by automatically compensating the horizontal curve offset. This means that you can work with the normal narrow envelopes without causing unnecessary machine stops.

The yellow Q dot indicates that the Q*master* function is active
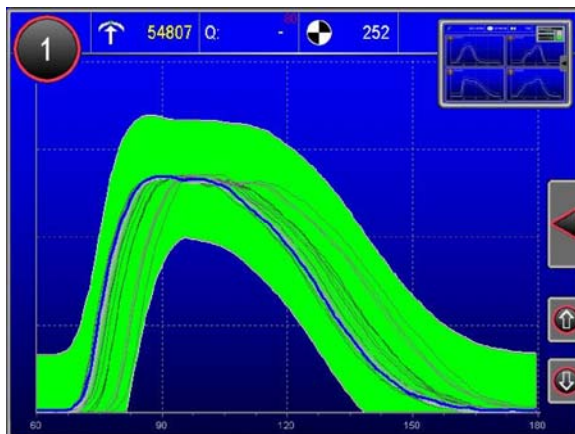
Envelope monitoring with fluctuating signals and without **SK**Q*master*: the envelope limit range is very wide and the sensitivity is thus very low.
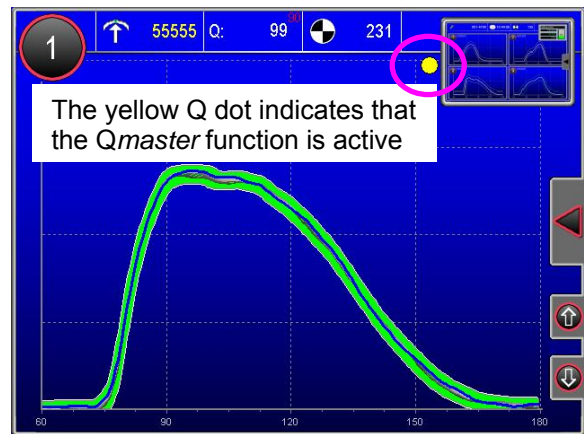
SKQ*master* stabilises the horizontal offset. It is now possible to operate the system with a much narrower envelope limit range. The number of (unnecessary) machine stops is reduced.

7.3.5   **Adjusting timing window**
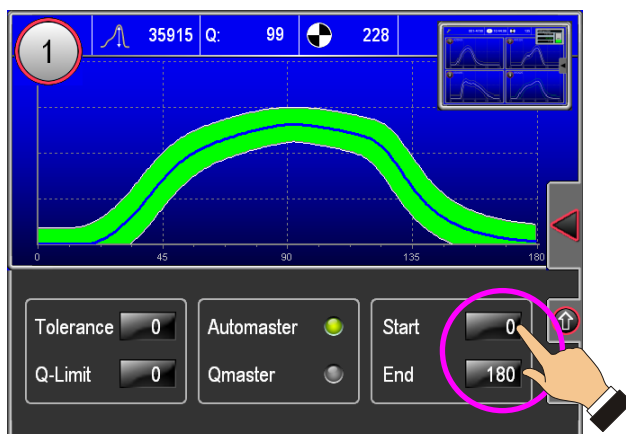
The size of the timing window = size of measuring window

Is entered through the start and end value in degrees of crank angle. To change the values, touch the "Start" or "End" field.

If **SK**Auto*master* is active, the actually monitored measuring window is automatically adjusted to be displayed across the entire screen width.

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8   Stop signal and communication line

If the monitoring device stops the machine, the system automatically displays the screen containing the information that has caused the stop (e.g. counter, envelope, trend, etc.). This enables the operator to quickly identify and eliminate the cause of the problem.

The display line at the top of the screen indicates the reason for the stoppage in plain text together with the time and date.

When a signal is outside the envelope, the stop signal is displayed as a red curve.

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9   Optional equipment (device options)

9.1   **SK**Puzzle*master*

The **SK**Puzzle*master* consists of two basic puzzles
- Manual **"M"** = manual envelope adjustment and
- Prozzy   **"P"** = automatic monitoring

For instructions on the operation of puzzle **"P"**, see page 10, chapter 6.2 Auto-monitoring with "Prozzy" puzzle.

9.2   **SK**Part*master*

With the **SK**Part*master*, you can store and call up monitoring parameter values for each part. It is part of the Analysis/Statistics menu. We recommend including access to the Part*master* in the quick navigation button. For details, see page 29, chapter 11.8 Adding individual functions to favourites.

Green = active part
Blue = currently marked part, which is also shown in yellow further up in the list

Loading, storing and deleting parts
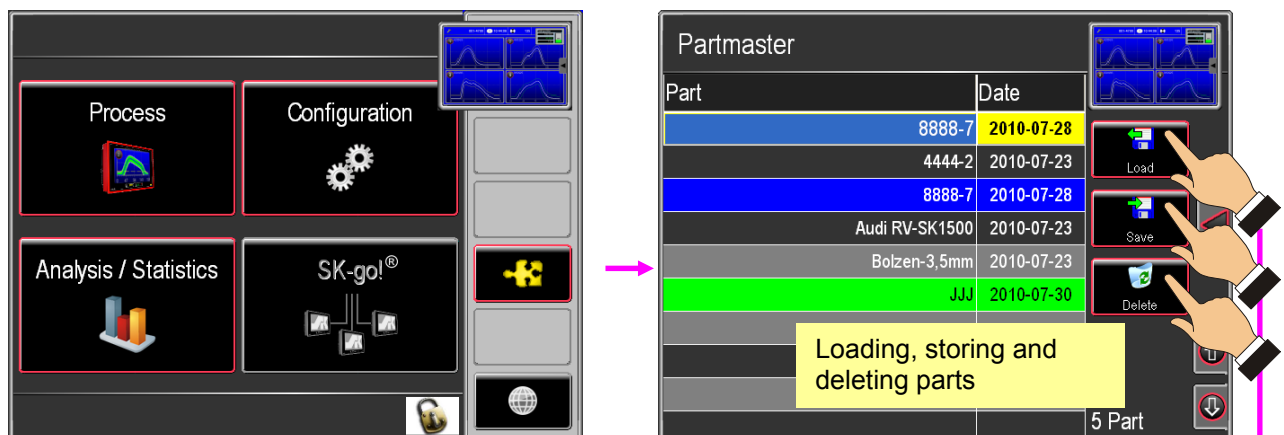
Caution: Parts can only be deleted if the service code is activated. Otherwise, the button is disabled.

When saving the part data, an alphanumerical key board is displayed so that the operator can enter the part number.

Confirm the entry with the ENTER button (green)
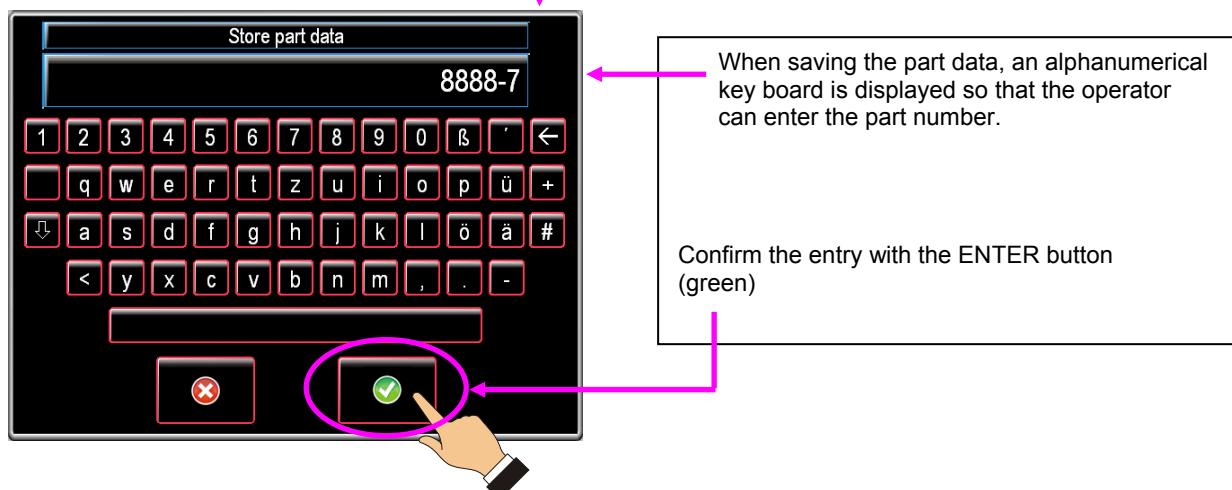
To store the data of a part for the first time:

Please note that data storage is only possible while the machine is running in AUTO mode (to ensure that the active envelopes are also stored).

OVERWRITE PARAMETERS YES / NO

If you wish to save new data for an existing part (e.g. because you have found better settings for the part and wish to use these in the future), the archived data can be overwritten.

By calling up stored part data:

- all relevant monitoring parameter values are set to the previously stored values

- The current signals can be compared with the stored envelopes (in grey) (set-up aid)

It is not possible to load part data while the system is in **monitoring mode**.

9.3 **SK**Single*master*

This option has been designed for idle stroke detection during the Teach-In phase on thread rolling machines. This allows for an accurate calculation of the envelope, even if there are idle strokes recorded during the Tech-In phase.

For instructions regarding the operation of the SK Singlemaster, see page 34, chapter 13.1.3 Idle stroke detection.

9.4 **SK**Q*master*

SKQmaster (compensation of signal fluctuations caused by machine)
For details regarding this function, see page 17, chapter 7.3.4SKQmaster.

9.5 **SK**Auto*master*

SK-Auto*master* (automatic adjustment of measuring window)
For details regarding this function, see page 16, chapter 7.3.3SKAutomaster.

9.6 DMI Die Match Indicator

The DMI indicates the track position of the tools in thread rolling machines. It has been devised to ensure that the rolling dies can be adjusted so that the indicator (blue line) is as close as possible to the green center. If the indicator is right of the center, the operator is notified with a message to adjust eccentricity to the left and vice versa.
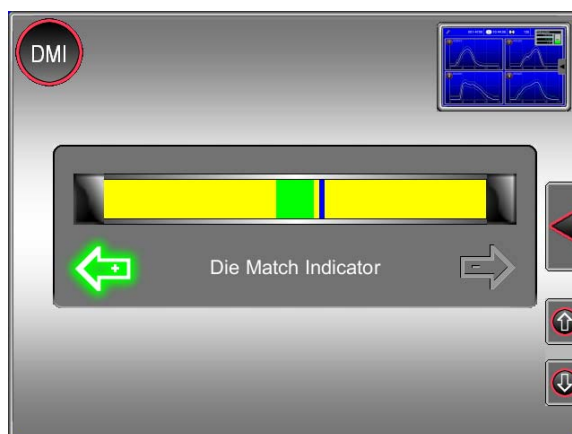
Condition for correct DMI operation:
Rolling dies must be parallel to each other (vertically and horizontally)

9.7 Purchasing and testing device options

If you wish to upgrade your system with one of the device options, you can test it free of charge for 30 days, provided that the selected function is available for your device model.
To test or purchase an option, you must access the code system:

Device options that are not included in the device menu are show with a yellow box.
Touch the option you wish to purchase or test. A window for the entry of the ordering code is displayed:
This ordering code must be communicated by phone, e-mail or fax to IMPAX/SK so that a release code can be issued. When communicating the ordering code, please inform us whether you require a release code for purchase or for a 30-day trial period.

Available options shown in yellow box
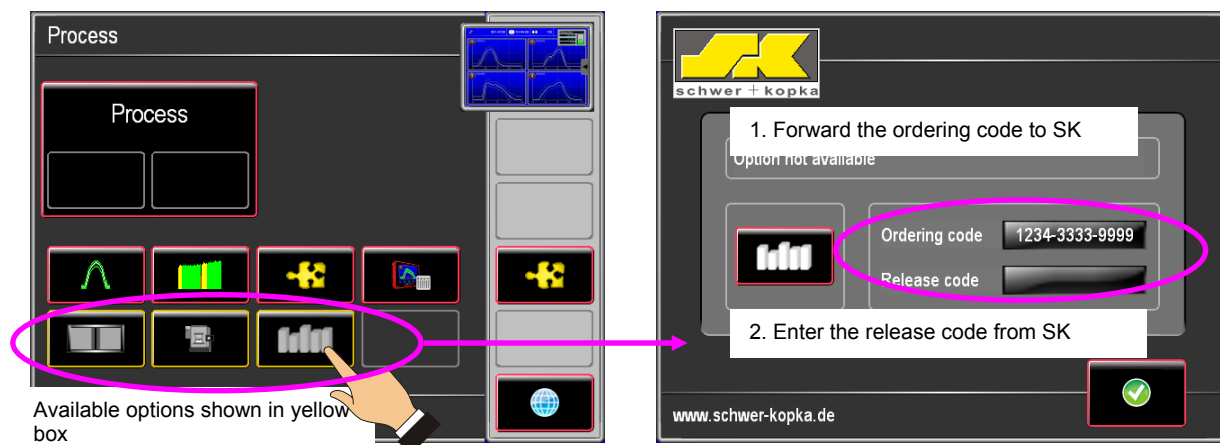
10 Screen splitting by means of drag & drop

Additional information such as **Trending** and the **Die Matching Indicator (DMI)** can be displayed together with the associated monitoring channel. This is done by splitting the screen into two halves. The screen remains split until the relevant setting is changed.

When called up, zoom channels are always shown together with the parent channel. The screen can be split in SET mode (1) of the single channel, using the respective quick navigation button.

In the example below, the "Trend" function is added to the main screen of the curve by drag & drop (2). Touch the "Curve" button (3) in the quick navigation panel to reverse this step.

Single curve in SET mode   Curve and trend display (split screen)
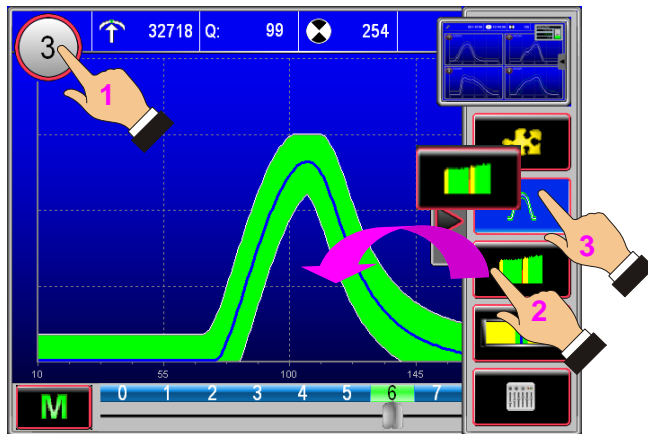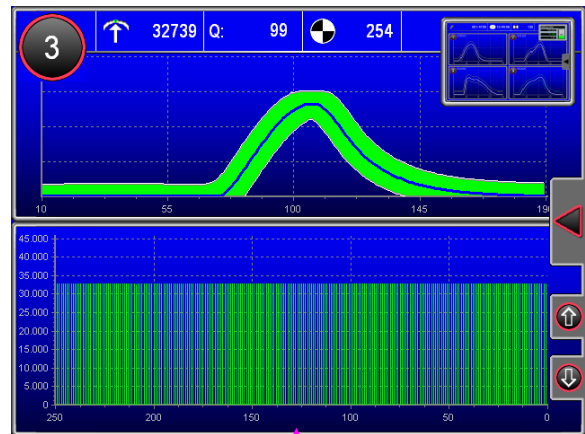
10.1 Zoompuzzle – zoom channel display

A zoom channel can be installed through the **"Zoom" monitoring puzzle** in the Puzzlemaster[5]. This allows for a more sensitive and improved fault detection, especially where it is possible to zoom in on a fault-relevant and stable signal range. The active zoom channel is always linked to a parent channel whose channel number is displayed beside the magnifying glass. In the parent channel window, the zoom area is shown as a hatched area.

By selecting single channel display, the screen is split into two windows showing the **parent channel** and the associated **zoom channel** respectively.
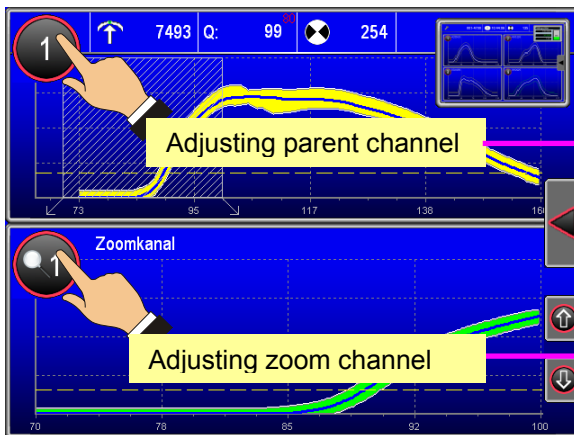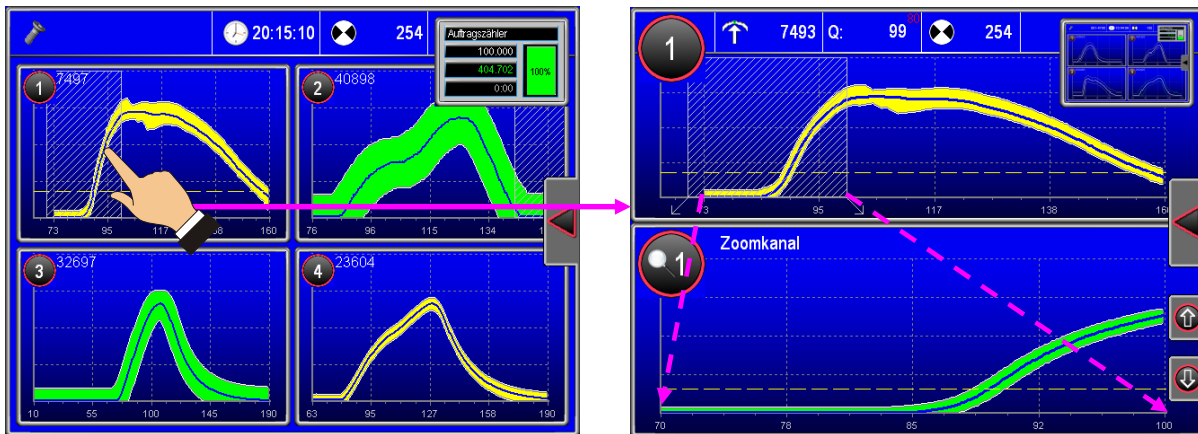
In SET mode of the individual channel numbers, the monitoring limits for the zoom and the parent channel can be set separately.

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[5] SK Puzzlemaster and "Zoom" monitoring puzzle are device options that can be added at any stage.

11 Counter

Touch the toggle window to call up the counter screens.

Toggle window = toggling between counter and curve display

The selected counter is shown in blue

Counter options

Hand button **red** = machine stop active

Hand button **green** = machine stop not active

11.1 Job counter

SET panel of the job counter:
- Parts per stroke
- Include parts in Teach-In?

Scheduled quantity

Actual quantity

Remaining quantity

Remaining time

Hand button **red** = machine stop active
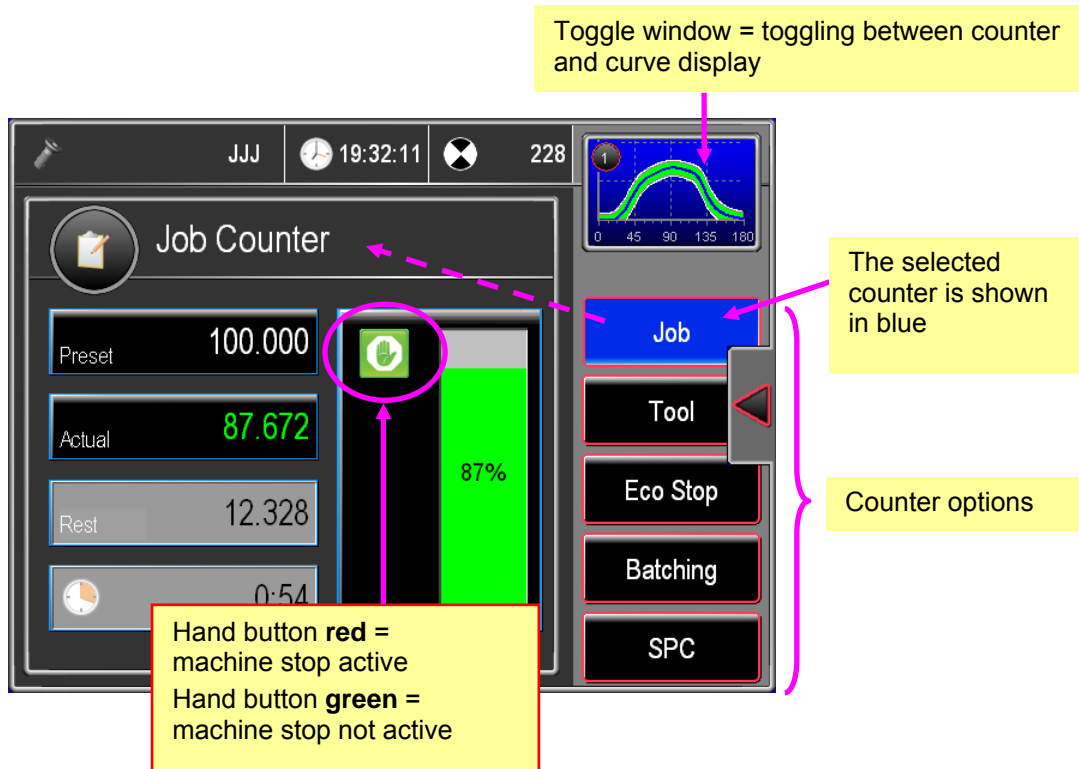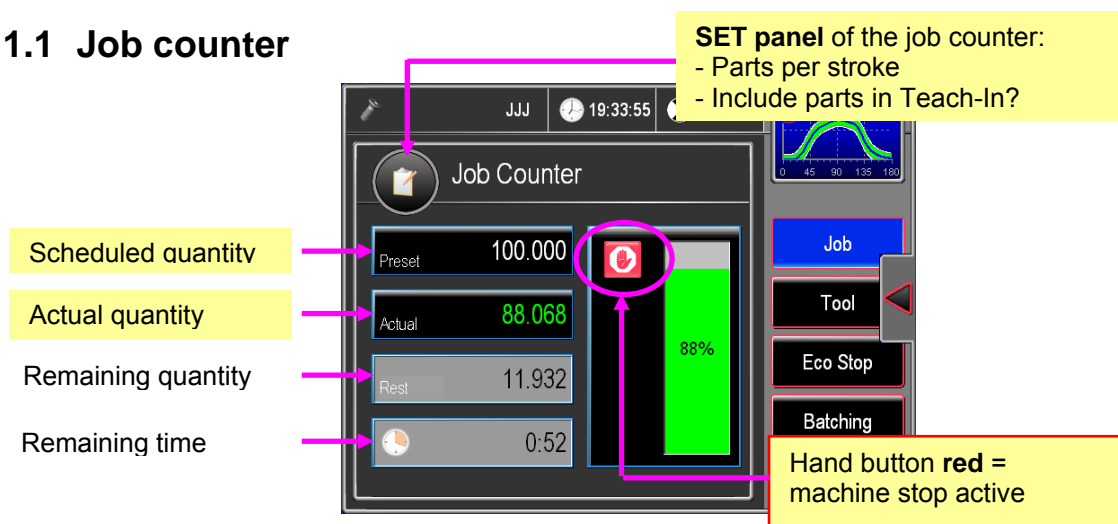
Touch the scheduled or actual quantity field to change the counter values. An input field with numerical keypad is displayed. **All entries must be confirmed by touching the "E" button. Otherwise, they are not applied**. In Remote Network-controlled monitoring systems, the input of scheduled and actual quantities might be locked.

11.2   Tool counter

Scheduled quantity

Actual quantity

Remaining quantity

Remaining time

Hand button **red** =
machine stop active

11.3   Counter with Eco Stop

Scheduled quantity

Actual quantity

Remaining quantity

Remaining time

Hand button **red** =
machine stop active

The counter with Eco Stop is normally used for the monitoring of overrun shifts, ghost shifts and other production phases where the machine is not restarted after a stop.

To save energy, the machine is stopped as soon as the scheduled quantity is reached. After a subsequent **additional buffer time of 60 seconds, the main switch of the machine is actuated,** so that all devices are disconnected from the machine power supply.

Starting the counter with Eco Stop:
The counter with Eco Stop is activated by touching the green stop hand button, which then changes to red. If the counter with Eco Stop is active (hand in red), the green monitoring LED on the device front panel **flashes**.

11.4   Batching counter

To activate the batching counter, you must first enter the scheduled quantity and the number of containers. The maximum number of single containers that can be set is 16. After the last container is filled, the stop signal is generated.
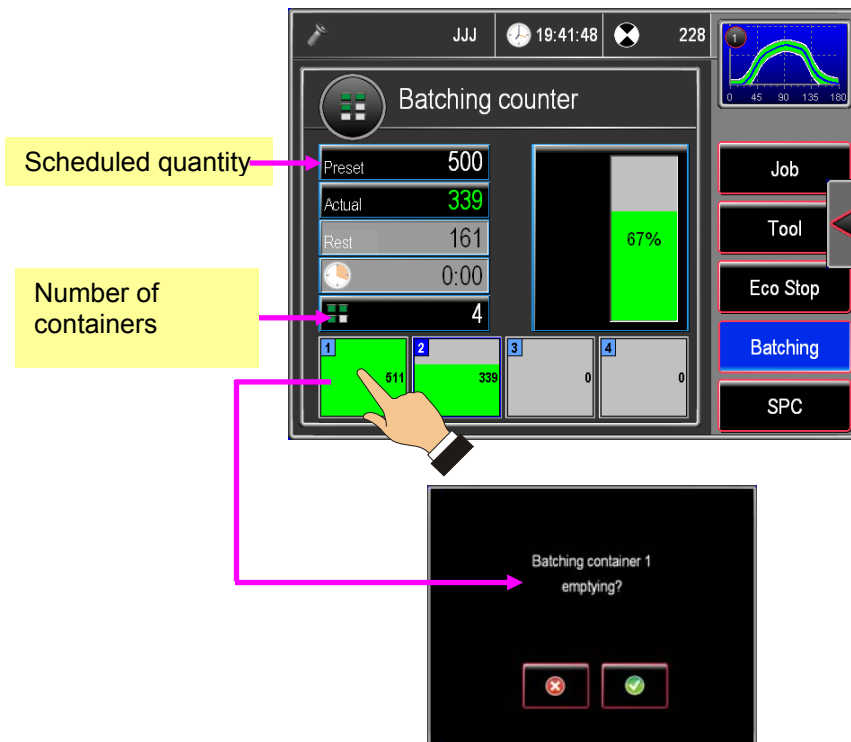
By touching a single filled container, this container can be reset to 0 (e.g. if a container is emptied).

If the container counter is set to **"0"** (zero), the batching counter is not active.

11.5   SPC counter

The SPC counter is used to keep track of the preset check intervals.
Normally, regular dimension checks of the manufactured parts are required during series production, whereby the measured values are compared with those in the documentation. The SPC counter integrated into the process monitoring device is able to determine the next check time based on the actual manufactured quantity.

The settings of the SPC counter can be adjusted by touching the SET button on the counter screen.
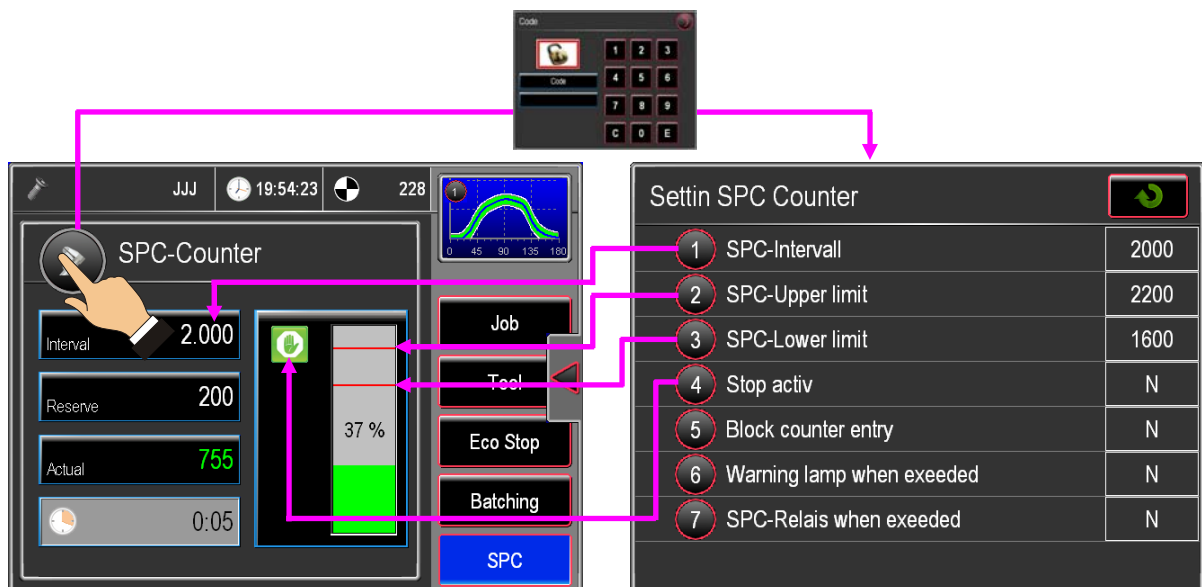
After the check interval has lapsed, the machine operator is notified with a message window (see below) and must then confirm that the check is to be performed. If no check is performed within the set buffer time, the machine is stopped (depending on whether stop function is active or not).

Apart from the integrated SPC counter described here, the machine can also be equipped with a SPC counter that is linked to a CAQ system. If no positive SPC check signal is sent within the preset check interval, production is stopped.

Interfaces to the CAQ-linked checking system exist for systems from Quipsy, Babtec and Böhme & Weihs.

Menu layout

The main menu can be called up through the quick navigation button in the multiple channel or the single channel screen (by touching the **globe** icon).

Caution: if the system is in SET mode, the quick navigation bar includes other buttons (for the setting of the monitoring parameters).
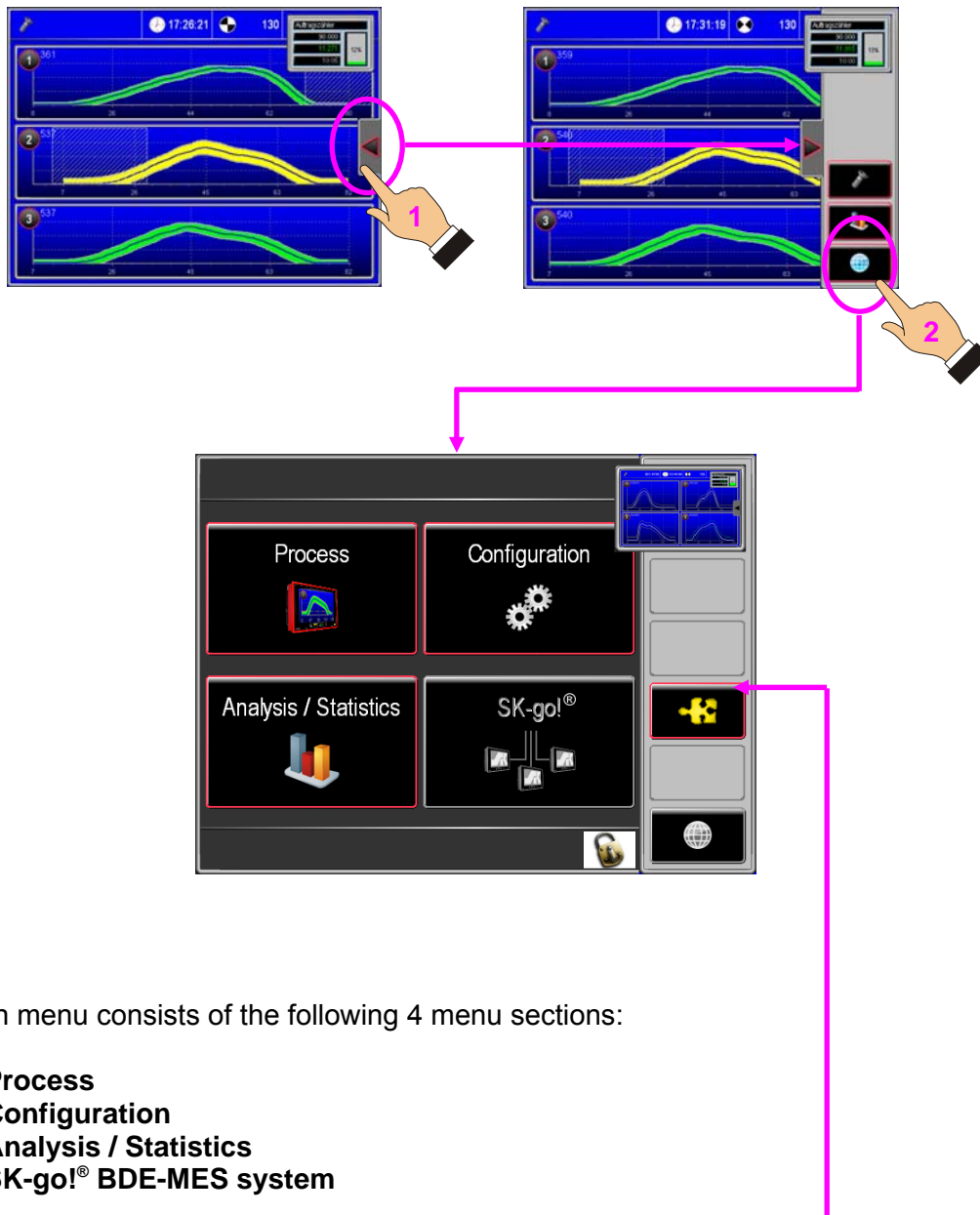
The main menu consists of the following 4 menu sections:

1. **Process**
2. **Configuration**
3. **Analysis / Statistics**
4. **SK-go!® BDE-MES system**

Upon delivery, the quick navigation button does not include any favorites.

11.6   Menu control and favorite settings

To add a function to the favorite bar of the quick navigation button, drag & drop the respective function to the list. The main menu button (globe icon) is included by default and cannot be removed from the list.

11.7   Adding menu panel to favorites

Using your finger, drag & drop the menu panel to a position in the favorite list. Favorites can be removed and added at any time. The favorites are always accessible through the quick navigation button even in normal monitoring mode. To remove a function from the favorite list, drag & and drop it back to the main menu panel.
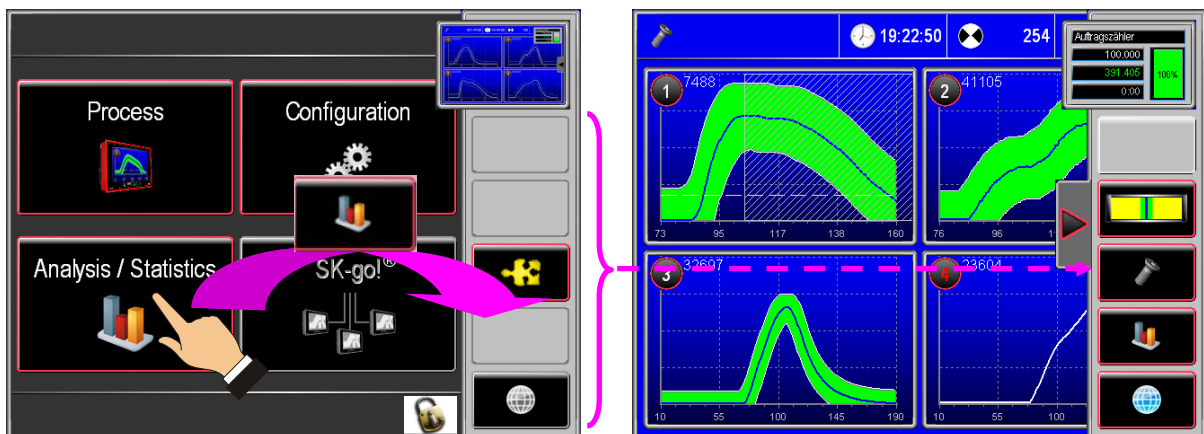
11.8   Adding individual functions to favorites

Individual functions of the 4 menu panels can also be added to the favorites so that they are accessible through the quick navigation list.
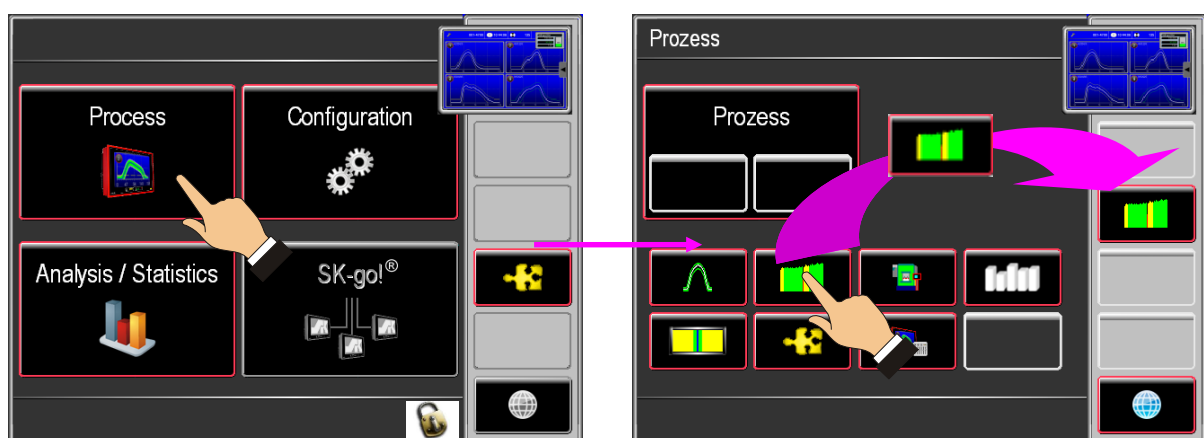
Depending on the installed software, the following favorites can be set: Partmaster, Die Match Indicator, Machinemaster, Toolmaster, a specific menu screen or data collection functions such as job and personnel management, etc.

11.9 Mini-favorites

For each menu panel, 2 menu options can be dragged & dropped in the control panel of the main menu, thus becoming "mini-favorites". These mini-favorites are always displayed when the main menu is called (globe icon).
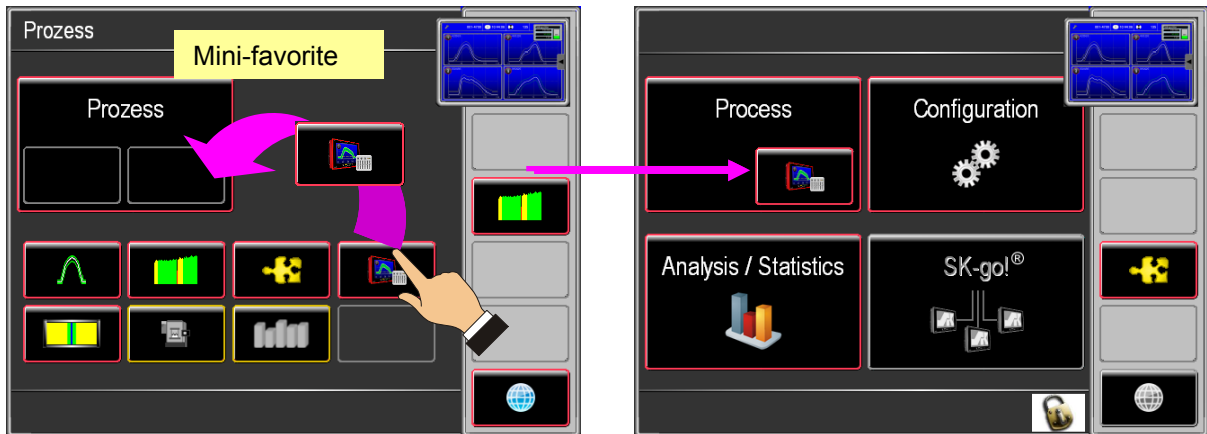
In this example menu option "Additional parameters" has been added to the process menu panel. Touch the globe icon to return to the main menu.

12 Process menu

The process menu panel enables operators to call up the various monitoring methods such as envelope, trend, puzzles, DMI, etc.
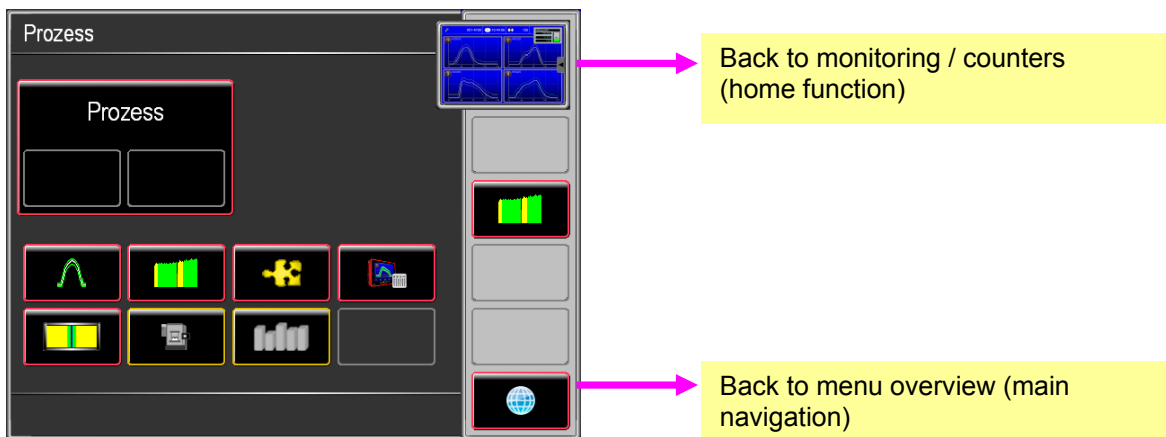
Envelope monitoring	Trend	Puzzlemaster
Additional parameters	Die Matching Indicator DMI	Absolute force
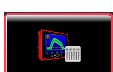
13   Configuration menu

On the configuration menu panel, the various parameters and functions of the monitoring system can be viewed and edited. Please note that the service area is protected by an access code.

Back to monitoring / counters (home function)

Back to menu overview (main navigation)
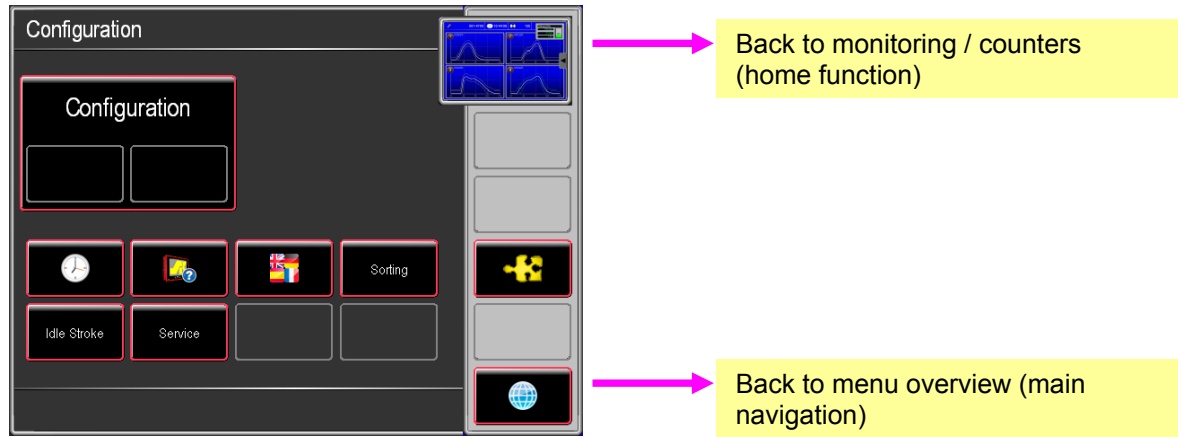
Setting date / time	Software version and update	Select language
Sort parameters	Idling parameters	Service area

13.1 Configuration of basic settings

13.1.1   Teach-In phase and Stop-Auto mode

Teach-In button

Teach-In = Learn

Touch the **Teach-In** button to start the teach-in process for the calculation of the envelopes and to automatically activate monitoring after the teach-in process is completed. The number of teach-in strokes is set in parameter **Strokes in Teach-In** in the service area of the configuration menu. To keep the number of strokes during the teach-in phases as low as possible, we recommend activating Stop-Auto transition, which ensures that the previously learned envelopes are retained so that it is not necessary to complete another Teach-In phase.

The Stop-Auto menu can be found in the "Configuration / Service" menu panel and is code-protected.

1) After the number of number of strokes performed in Teach-In mode entered here has been reached, the

2) With STOP-AUTO mode, the learned envelopes are retained after a machine stop.

13.1.2   Sort function

All SK monitoring systems can be used for the control of suitable sorting equipment so that detected non-conforming parts can be separated from the accepted parts. We recommend that the machine is stopped when such a part is detected, so that the non-conforming part can be examined and suitable corrective measures can be taken.

Alternatively, the machine can be programmed to continue production, while the non-conforming parts are automatically sorted. In this case, the machine is only stopped, if the number of consecutive non-conforming parts exceeds a certain limit. This number can be entered through parameter "Tolerance"(see page 15, chapter 7.3.1 Tolerance).

Channel-specific activation
of sort function

Sorting		1	2
Channel		1	2
1	Sorting	N	N
2	Sorting delay	0	0
3	Sorting quantity (parts)	1	
4	Sorting distance in Seconds	0	
5	Fast-sorting	N	
▽	Sorting 2		

Sorting 2		
1	Sort in Teach-In mode	N
2	Sort in STOP	J
3	Sort when idling	N
4	Sort for Crash-Control	N
5	Sort when approaching env.	N
▽	Sorting	
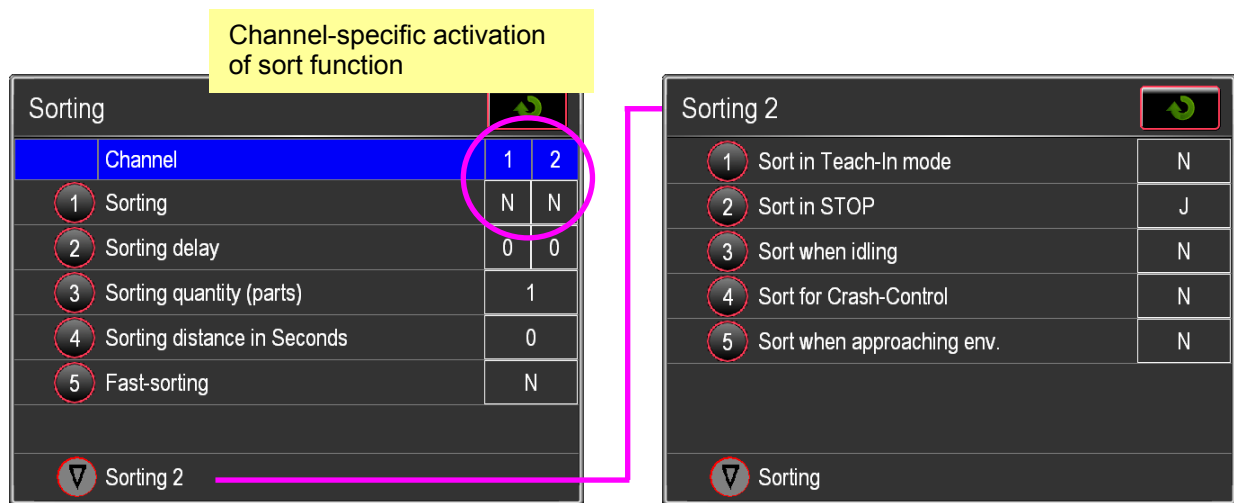
Sort function settings

1. **Sort (Y/N)**:
   "**Y**" indicates that sorting is activate for the respective channel. "**N**" indicates that it is deactivated for the respective channel.

2. **Sorting delay (parts)**:
   Indicates whether the sort pulse for the respective channel is to be generated with a delay. This is useful for machines where the parts require some time to reach the sorting point. The delay ensures that the number of acceptable parts sorted is as small as possible.
   Enter the delay in numbers of machine strokes.

3. **Sorting quantity (parts)**:
   Indicates the number of parts that are to be sorted out in the event of a fault (based on number of machine strokes). This parameter ensures that all non-conforming parts are reliably sorted out. If this value is set to a number greater than 1, it is unavoidable that a certain number of acceptable parts are also sorted out. This is normally accepted for safety reasons.

4. **Sorting distance in seconds**:
   This parameter is used, if the conveyor belt is coupled to the machine drive, and if a sorting delay that is independent of the machine stroke rate is required.

5. **Fast-sorting (Y/N)**:
   The sort pulse is generated immediately after a value outside the envelope is detected, so that the sort gate can be operated without any delay. (Certain monitoring functions such as Q-master and Prozzy cannot be combined with fast-sorting).

Page 2 of sort menu

1. **Sort in Teach-In mode (Y/N)**:
   This function allows the operator to set the sorting equipment permanently to sort while the machine is in Teach-In mode. This ensures that all parts that are not monitored while in set-up mode are separated from the acceptable parts.

2. **Sort in Stop (Y/N):**
   This function allows the operator to set the sorting device permanently to sorting while the machine is in stop mode.

3. **Sort when idling (Y/N)**:
   If set to "**Y**", the sorting device is switched on during each detected idle stroke. In certain machines (e.g. thread rollers), idle strokes occur frequently due to the machine design and are detected as idle strokes and not as faults or errors by the monitoring device. It is however possible that non-conforming parts (e.g. bolts that are too short or too thin) are produced, whereby the force signals are similar to those of idle strokes, so that they are ignored. To ensure that such non-conforming parts are properly separated, the machine can be configured to sort at each idle stroke signal.

4. **Sort for Crash-Control (Y/N)**:
   If set to "**Y**", the sort gate is switched on for crash control strokes. Crash control strokes are machine strokes during which the forces are only monitored for excessive loads (= crashes). This option can be useful in situations where standard fine envelope monitoring is to be suspended as parts are deliberately dropped from the transfer conveyor.

5. **Sort when approaching env. (Y/N):**
   If this function is activated, all parts are sorted while the envelope adjusts to fit the monitoring signal (e.g. after idle stokes or with STOP-AUTO transition).

13.1.3   Idle stroke detection

Certain machine types such as thread rolling machines tend to perform frequent idle strokes due to bottlenecks in the feed rails. Normally, an idle stroke is considered an error, and the monitoring system would switch off the equipment. To prevent such unnecessary stops, the monitoring system can be programmed to distinguish between idle strokes and real errors and to permit a certain number of consecutive idle strokes before the machine is stopped. The system only stops the machine if the total number of consecutive idle strokes exceeds the pre-programmed limit. The following parameters can be configured:

Channel-specific activation of idle stroke detection

Idle Stroke		
Channel	1	2
1 Idle stroke detection	N	N
2 Idle stroke limit [%]	25	
3 Max. no. of idle strokes	50	
4 Singlemaster limit	0	
5 Max. idle strokes in Teach-In	50	
6 Flash delay	0	
7 Env. widening after idle[%]	0	

1. **Idle stroke detection (Y/N)**:
   Allows the operator to select the monitoring channels for which idle stroke detection is to be activated.

2. **Idle stroke limit (%)**:
   Idle stroke limit value in percentages of the maximum force. If the current force is below this limit value, the stroke is registered as an idle stroke. In this example, each force that is smaller than 10% of the normal force is considered an idle stroke. This idle stroke limit is visible during monitored operation.

The dashed line indicates the idle stroke limit
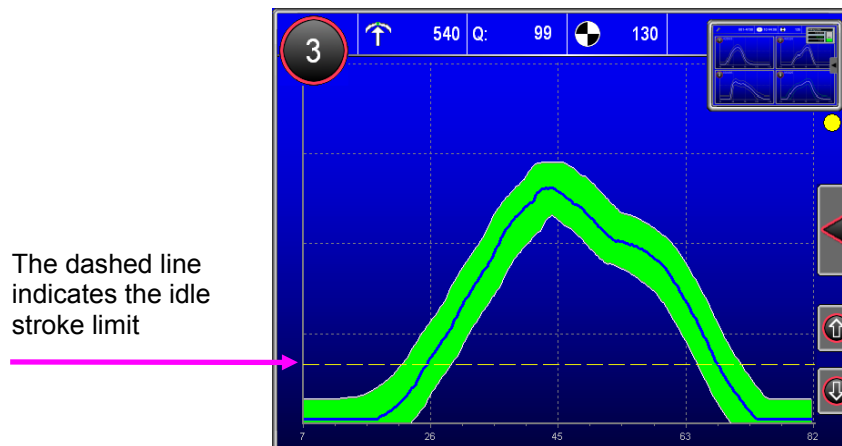
3. **Max. no. of idle strokes (parts)**:
   This parameter defines the number of consecutive idle strokes that are permitted before the machine is stopped (in this example: 500 parts). During this interval, the warning lamp flashes.

4. **Singlemaster limit (absolute idle stroke limit):**
   This value determines that very small force signals (whose maximum value is smaller than the entered value) are registered as idle strokes. This ensures that sporadically occurring idle strokes, that are common in applications such as thread rolling, are not learned.
   The Singlemaster limit is visible in Teach-In mode as a dashed line.

5. **Max. idle strokes in Teach-In (0 + 9999):**
   Maximum permissible number of idle strokes in Teach-In mode (in conjunction with item 4, SK Singlemaster, this function is used to prevent that idle stroke signals are learned).

6. **Flash delay**:
   This parameter is used to define the number of consecutive idle strokes that are permitted before the optional warning lamp begins to flash. It prevents constant flashing of the lamp in the event of irregular part feed.

7. **Envelope widening after idle strokes:**
   Indicates by how much the envelope is to be widened in order to prevent unnecessary stops after resumption of the feed. The value is entered in percentages.

13.2 Service area

The service area contains the critical set-up parameters that are protected by an access code. The parameters should only be modified by authorized personnel.

13.2.1   Code input and service menu

When choosing some of the menu options, the user is requested to enter the service code.
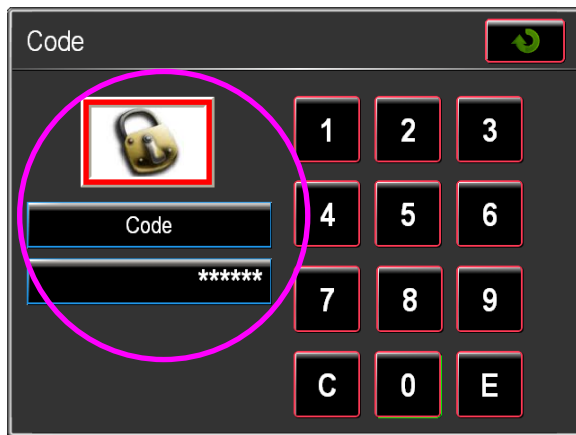
Menu locked =
To access the menu area, the user must enter the service code. Unless the code is entered, the padlock symbol is surrounded by a red frame.
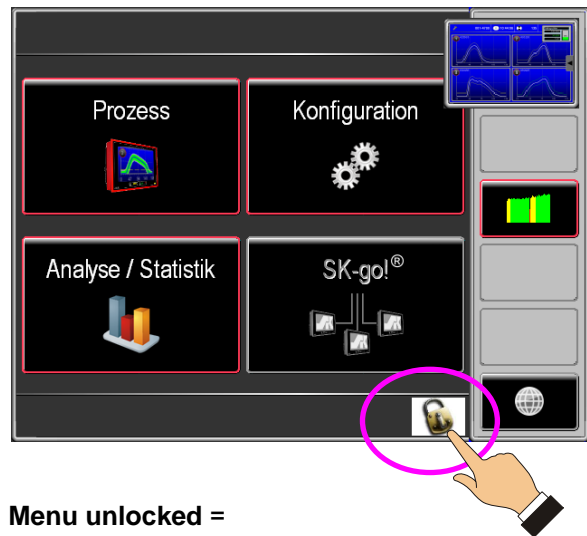
Menu unlocked =
If the service code is active, the menu can be accessed and the padlock symbol is shown as a small icon in the bottom right corner without a red frame. The service code is automatically reset if no entry is made in the menu panel within 5 minutes.
The code can be instantly deactivated by touching the padlock icon.

14 Analysis / Statistics menu panel

	Machine-master
	Partmaster
	Statistics
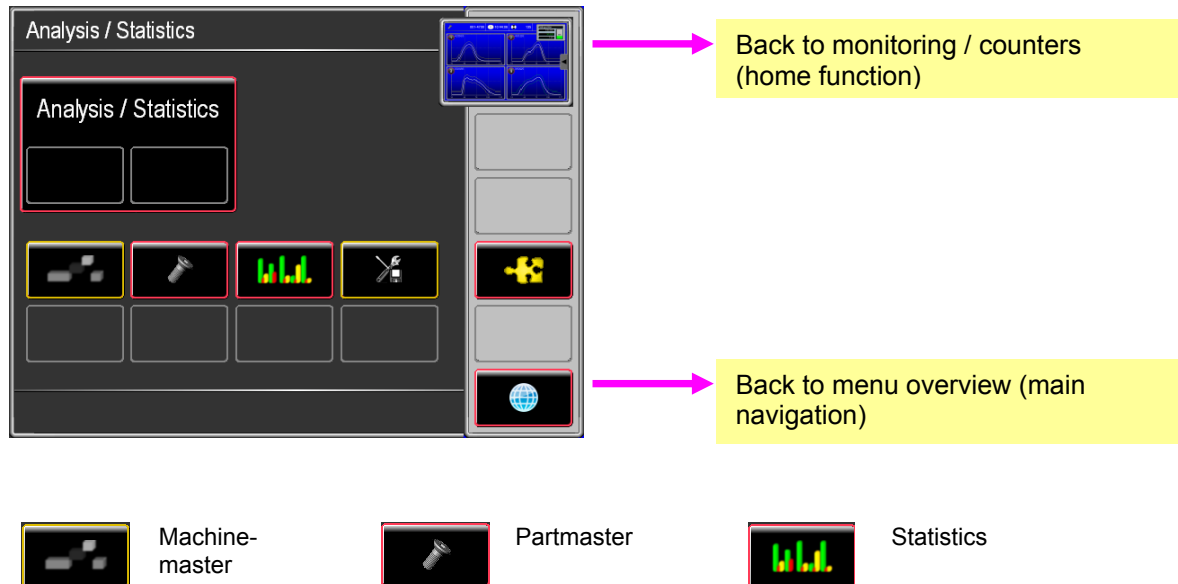
Machinemaster provides a visual log of all stoppages that have been initiated by the monitor. Archived Errors can be sorted to present stored information in different ways.

Partmaster is a storage feature enabling you to retain previous envelopes, machine speeds, set-up parameters, etc. according to a designated number for recall at a later date.

Statistics displays the total number of accumulated strokes in each mode of operation.

15 System layout

System Layout - Standard with V-Box 8 for SK 500 – SK 600 – SK 800

DB 25 male

DB 25 female

STAK 200 female

Prod. no.: 610150
V-Box cable - 5m
5 m flat round cable, 25-pin
5 m corrugated hose PG21
1 D-Sub 25 plug
1 D-Sub 25 socket

Prod. no.: 610161
I2 interface cable - 5m
5 m flat round cable, 25-pin
5 m corrugated hose PG21
1 D-Sub 25 plug
1 D-Sub 25 socket
1 Stak200
5 m power
cable (24V) 3x1.0

Prod. no.: 32110-5 to -8
V-box 5 to V-box 8

DB 25 female

Prod. no.: 302202
Interface in
steel sheet housing

Prod. no.: 610165
M1 machine connecting cable - 5m
5 m power cable (85-240V) 3x1.0
5 m connecting cable 12x1.0
5 m corrugated hose PG21

Prod. no.: 311980
Hybrid Kit Superflex 3m
1 sensor Superflex 3m
cable RG178
3 m Festo protective
conduit 4mm
1 D-Sub 15 plug

Prod. no.: 650172
Initiator
Initiator cable
(5m 3x0.5mm)
M12 plug

1 2 3   4 5 6   7 8

Machine

Switch cabinet

System Layout – Quick-Install for SK 500 – SK 600 – SK 800

D-SUB 25

DB 25 female

Prod. no.: 650172
Initiator
Initiator cable
(5m 3x0.5mm)
M12 plug

Prod. no.: 610160
I1 interface cable
5 m flat round cable,
25-pin
5 m corrugated hose
PG21
1 D-Sub 25 plug
1 D-Sub 25 socket

Prod. no.: 3111918
Quick Kit Superflex
1 sensor Superflex
3m cable RG178
3 m Festo protective
conduit 4mm
1 D-Sub 25 plug

Prod. no.: 302201
Interface for
top hat rail installation

DB 25 male

1 2 3 4 5 6

Machine

Switch cabinet

16   Technical data

- 10.4" TFT colour display
- Operating system Windows XP-Embedded
- CPU 800MHz
- 2 GB CF card
- Weight 4.3 kg (not including mounting bracket)
- Protection class IP54 (front)
- Power supply 24 VDC / 3 A

17   Ports (rear panel)

SK 500
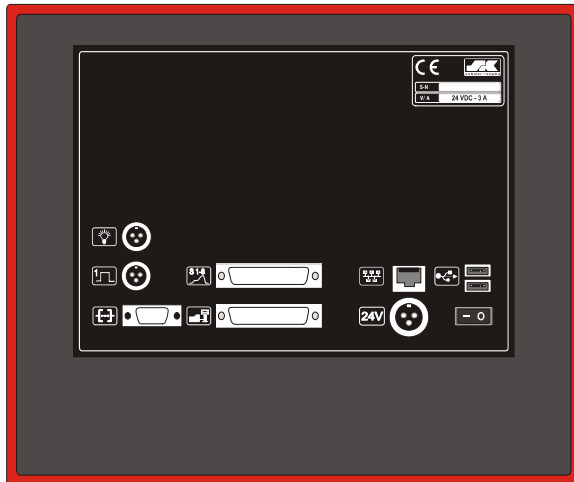
SK 600
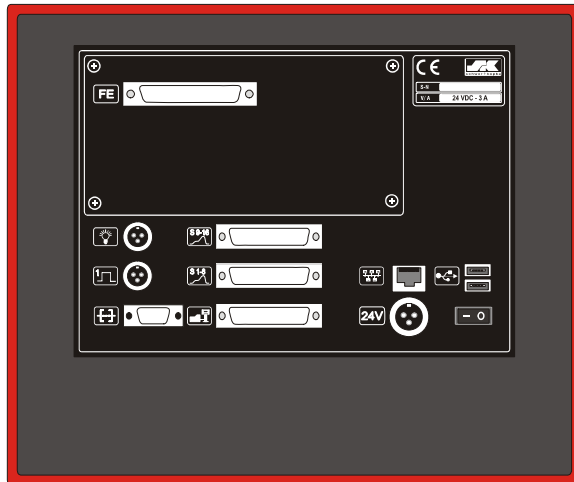
Functions:

Connection	SK 500	SK 600
Timing	X	X
Warning lamp	X	X
Serial interface	X	X
Interface	X	X
V-Box 1 / channels 1-8	X	X
V-Box 2 / channels 9-16		X
Ethernet (PC)	X	X
2 x USB (PC)	X	X
24V auxiliary plug	X	X
Frontend or digital extension		X

17.1   Sensor quick installation (D-SUB 25)

As the SK 500 / SK 600 monitoring systems are equipped with integrated dynamic charge amplifiers, the sensors can be connected directly to the device. For this purpose, use a special D-Sub 25 plug with integrated terminals.

Connecting options:
- 6 x piezo sensors
- 2 x DMS X113
- 24V/GND
- INI 1, 7 and 8 (rotary encoder)
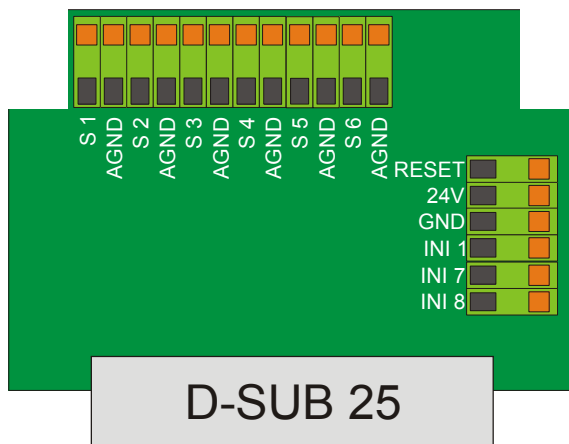
Direct connection by means of the D-Sub 25 plug is **only possible for sensor inputs 1-6**.
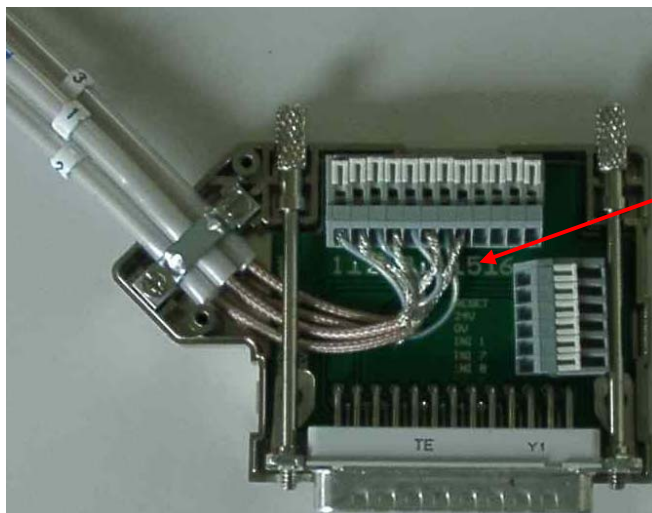
CAUTION:
When connecting standard shielded sensor cables (RG178 or RG58), it is important that the shield is only stripped by max. 1.5 cm.
➔ Otherwise, there is a risk of short circuit at the DB25 plug!

17.2 Interface

(DB25 - male)

Pin	Assignment	Pin	Assignment
1	RS 422 RX +	14	RS 422 RX -
2	PE	15	NT GND
3	24 V	16	24 V
4	NT GND	17	BDE 2
5	BDE 1	18	Relay 3
6	Relay 2	19	Relay 1
7	COMMON	20	BYPASS
8	INI 8	21	INI 7
9	INI 3	22	INI 2
10	INI 1	23	NT GND
11	24 V	24	PE
12	RS 422 TX +	25	RS 422 TX -
13	PE		

Using an adapter element, the signals to the I1 plug can be connected to the SK monitoring device.

The output signals can be forwarded to the PLC system through an external opt coupler.

➔ COMMON must be bridged to NTGND ➔ Bridge from PIN 7 to PIN 23

If required, the input signals can also be connected through optocouplers.

The relay 1-3 outputs can also be connected to COMMON (PIN 7) through floating connections (NPN).

➔ COMMON =   external GND

➔ Relays 1-3=   switched GND

17.3 24VDC

(STAK 200 - male)

Pin	Assignment	Ölflex 3x1mm2
1	24V	Core #1
2	GND	Core #2
3	PE	green/yellow

17.4 Timing connection

(INI 1 / INI 2)

MURR M12 connector 5-pin	Cable *	Assignment
1	brown	+24V
2	-	-
3	blue	GND
4	black	INI 1
5		INI 2

*standard cable

17.5 Warning lamp connection

MURR M12 connector 5-pin	Cable *	Assignment
1	brown	+24V
2	blue	WL
3	-	-
4	-	-
5	-	-

17.6 Ethernet

Terminal	Function	Description
1	TX1	transmit +
2	TX-	transmit -
3	RX+	receive +
4	nc	
5	nc	
6	RX-	receive -
7	nc	
8	nc	

17.7 Serial (RS 232)

Terminal	Function	Terminal	Function
1	nc	6	nc
2	RX232	7	RTS
3	TX232	8	CTS
4	12V (100mA)	9	5V (250mA)
5	GND		

18   Interface

The interface is designed as a top hat rail module. For wall installation, we provide a special housing for the top hat rail module and other extensions (protection class IP67).

Dimensions = 216 x 106 x 60 mm

The following connections are
- 85 to 240V
- Relay 1, 2, 3 or 4
- BDE 1 and 2
- INI 1, 2, 3, 7 and 8 (rotary

SK200 to SK800

SK500 to SK800 24V

External bypass switch

85 - 240V   INI 1-8   Relay 1-4   BDE 1+2 Signal
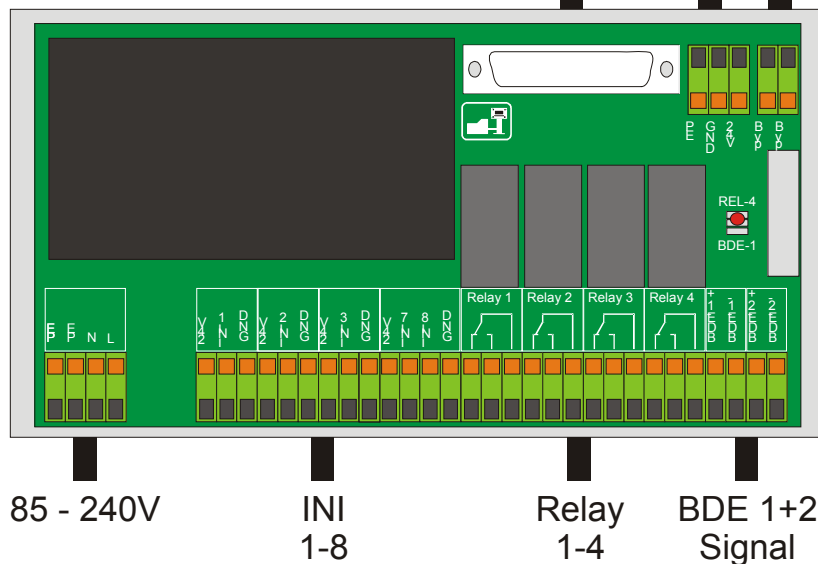
The range of functionalities can be extended with an adapter.
It is for example possible to connect additional relays or inputs. The details of the extension are yet to be defined.

18.1 Interface indicators and bypass switch

The following indicators are mounted on the interface board:

Green LED on:
➔ 24V OK

Yellow LED on:
➔ Bypass enabled.
Relay disabled.

Red LED on:
➔ Short circuit between 24V power supply and device.

Red LED on:
➔ Short circuit at 24 V output side, initiators, etc.

Bypass key
➔ Bypass is OFF. Relays are in operation.
➔ Bypass is ON. Relays are disabled.

Solder jumper REL4-BDE1 :
Top solder point:
REL4 active (default)
Bottom solder point:
BDE1 active

REL-4

BDE-1

18.2 Wire connections

Gn/gb
2
1

PE
PE
N
L

24V
INI 1
GND
24V
INI 2
GND
24V
INI 3
GND
24V
INI 7
INI 8
GND

11
5

Relais 1 — Sortieren

10
9
8

Relais 2 — Dosieren

7
4

Relais 3 — Motor Stopp

3

Relais 4 — Not-Aus

BDE-1 +
BDE-1 -
BDE-2 +
BDE-2 -

BDE-1   REL 4

Kabelstecker
DB25 - Stift
Schneidklemm

Gn/gb
2
1

PE
GND
24V
Byp
Byp

Standardbelegung
der Relais.
Kann über Software
umkonfiguriert werden

Lötjumper:
BDE 1 oder Relais 4
aktiv.
Standard:
Relais 4

Versorgung 85V-240V / 50-60Hz

Ölflex 3x1mm²

Maschinenanschlusskabel

Ölflex 12x1mm²

24V zum Gerät
nur bei SK500,SK600 und SK800

Ölflex 3x1mm²

zum Gerät

25 pol. Flachrundkabel

18.2.1 Standard assignment of relay outputs

Relay no.	Function	Description
1	Sorting	Controls sorting gate, if machine is not to be stopped in the event of a process error.
2	Batching	Control of a batching device.
3	**Motor Stop**	**Motor STOP (top or rear dead center)**
4	**Emergency stop**	**Motor STOP (instant) or periphery stop**

Other possible relay functions:

Relay no.	Function	Description
---	Immediate stop	Immediate stop of machine with certain functions, e.g. Stop puzzle
---	Conveyor belt	Shut-down of conveyor at 1st machine stroke after restart (in STOP Teach-In or STOP-AUTO mode)

18.2.2 BDE outputs
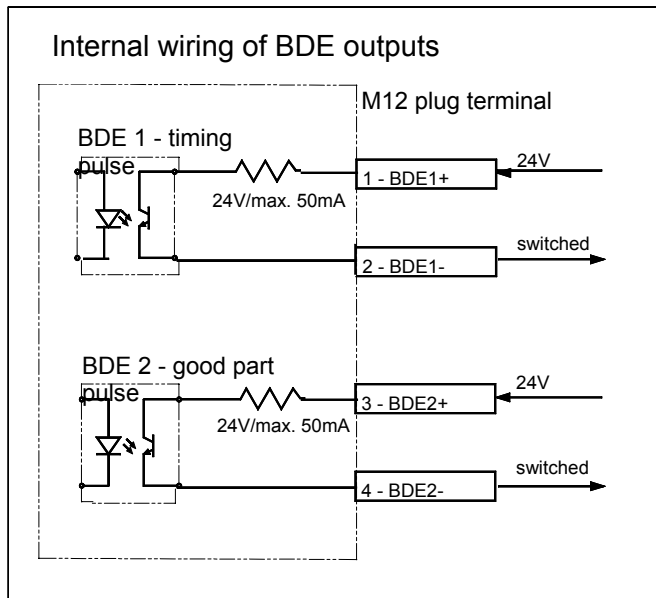
Other possible BDE output assignment:

Relay no.	Function	Description
---	BDE 1	Timing pulse
---	BDE 2	Good part pulse

18.2.3 Assignment of initiator inputs

INI1..INI8 (24V)

Input	Function without rotary encoder	Function with rotary encoder
INI 1	**Timing initiator**	**K0 with rotary encoder**
INI 2	*freely assignable*	*freely assignable*
INI 3	*freely assignable*	*freely assignable*
INI 6	*freely assignable*	*freely assignable*
INI 7	*freely assignable*	**Rotary encoder K1**
INI 8	*freely assignable*	**Rotary encoder K2**

When using a rotary encoder, the K0 signal can be used instead of an initiator for synchronization.