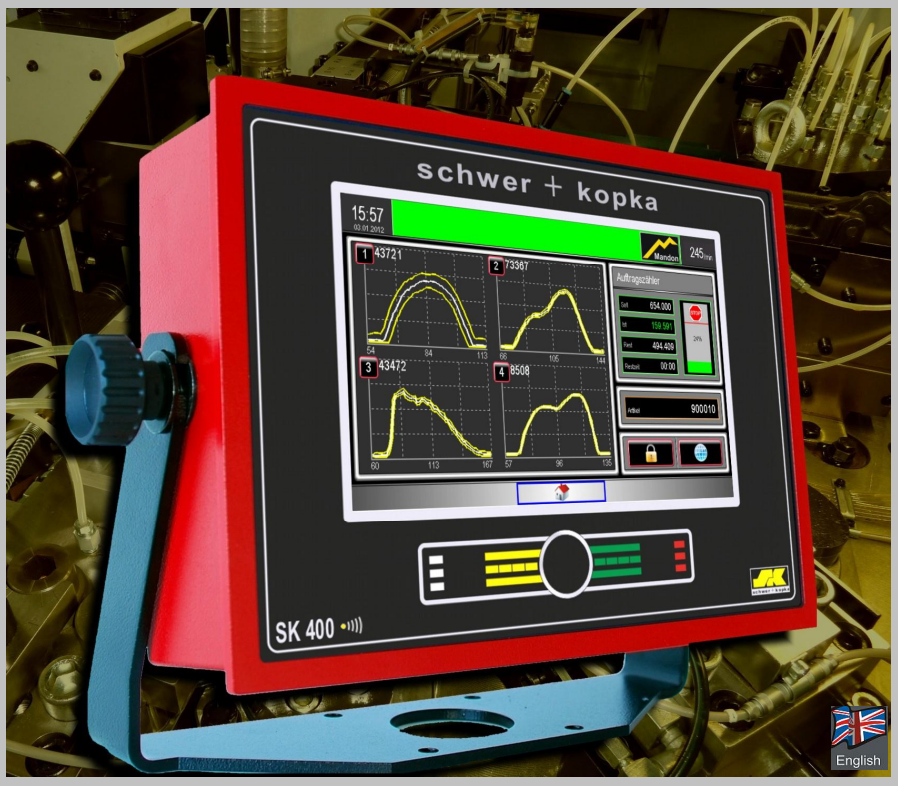
schwer + kopka

Operating Manual
SK 400



Processing Monitoring Systems for Metal Forming Machines:

- Multi-station Cold Formers (up to 16 channels)
- Stamping Presses
- Transfer Presses
- Thread Rollers
- Cold Headers
- Insertion Applications
- Hot Forging Machines

Process Technologies Group, Inc.
30W106 Butterfield Rd.
Warrenville, IL 60555

Phone: 630-393-4777
Fax: 630-393-4680

www.impaxptg.com

Status: 01.11.2012

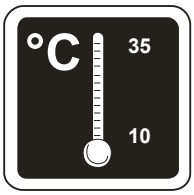
Contents

1 Safety instructions

No water!

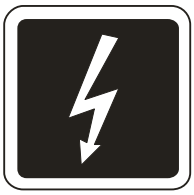
No chemicals!

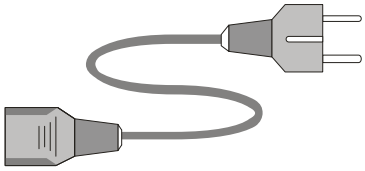
No mechanical force!



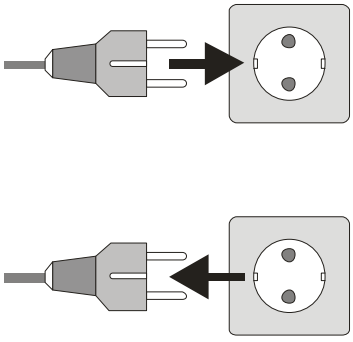
0 - 50 °C

<50% (40°C), <90% (20°C)



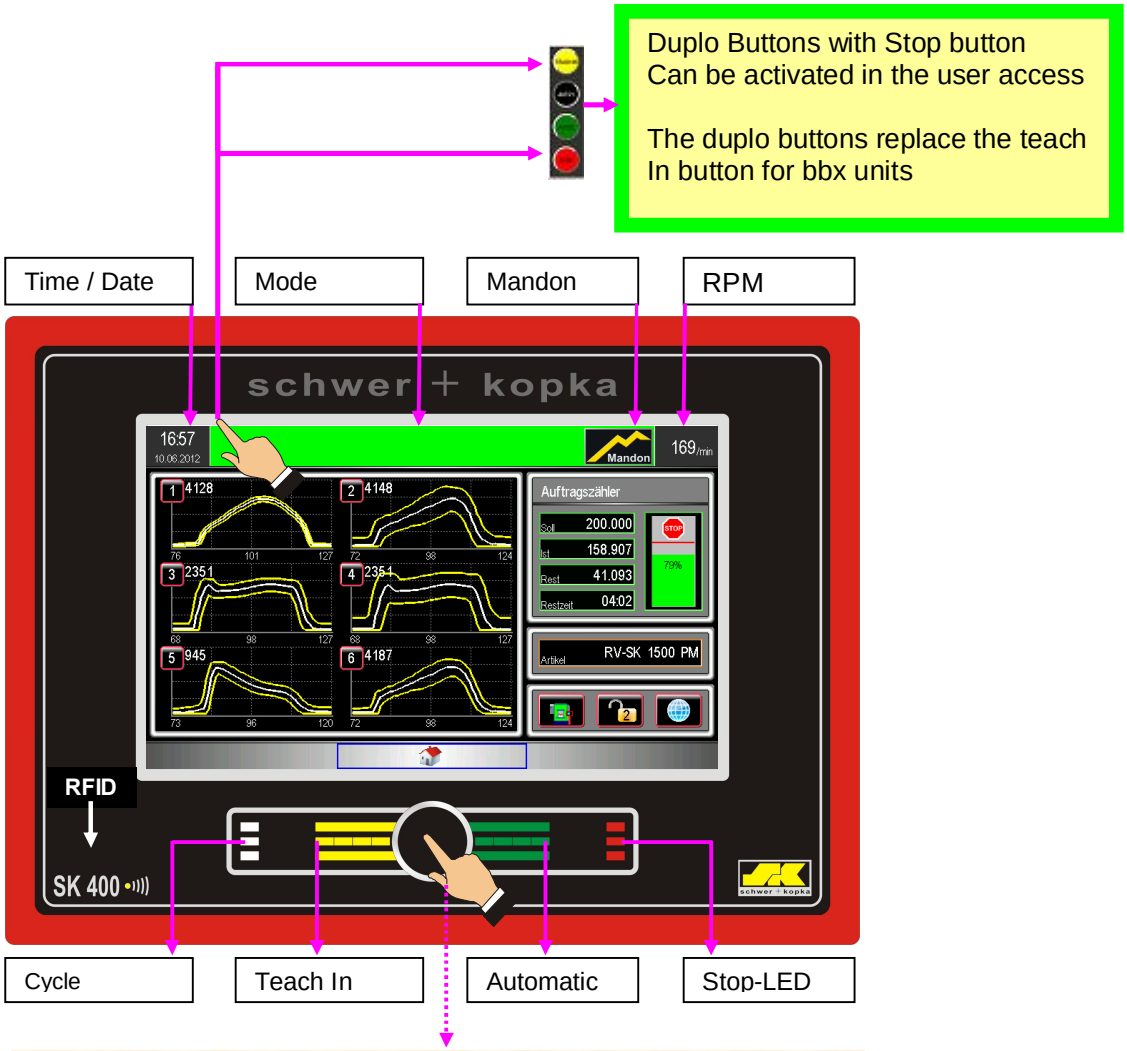


85 - 265 Vå
50/60 Hz
25 W



Disconnect power supply before opening housing!

2 Front panel with Teach-In Button



The **Teach-In** button starts the learning process for establishing the envelope limits and activates the automatic monitoring mode. If you want to learn new limits after a machine Stop, keep the Teach-In button pressed for **2 seconds** to turn the yellow mode on.

When **Stop-Auto** mode is activated, the learned limits will remain active when restarting the machine

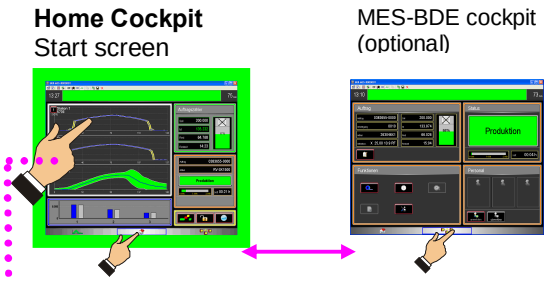
For a description of the function of the Teach-In button, see the Teach-In phase and Stop Auto mode chapter

3 The navigation principle

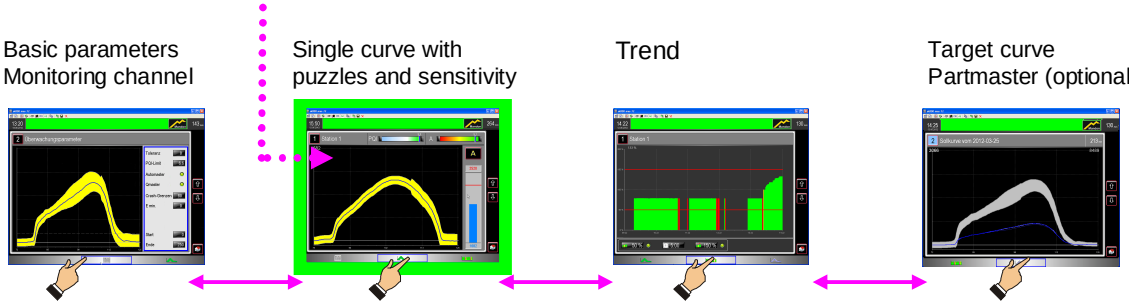
The cockpit operating software of the monitoring system is based on the multi-cockpit and multi-function navigation. The goal is to provide the user with all input possibilities and information without a menu prompt. The home cockpit (start screen) combines the most important functions and information and it also provides access to other device functions. Additional options such as MES (Data collection) are summarised in an additional cockpit and can be reached by pushing the home cockpit laterally.

After you access an individual curve, you can go to the channel-specific function area. Only the monitoring channel with active monitoring parameters is the central focus of all activities. Here it is also possible to access supplemental functions such as trends or target curve displays through lateral motions. The channel-specific monitoring parameters such as tolerance, E-min or the size of the measurement window are intuitively controlled and set on the supplemental parameter side. These do not include separate menu access. The non-channel-specific monitoring parameters (for example strokes-in, teach-in, sorting and idle stroke parameters) are, on the other hand, controlled in the menu area.

Level 1: Multi Cockpit Navigation: By lateral movement of the home cockpit



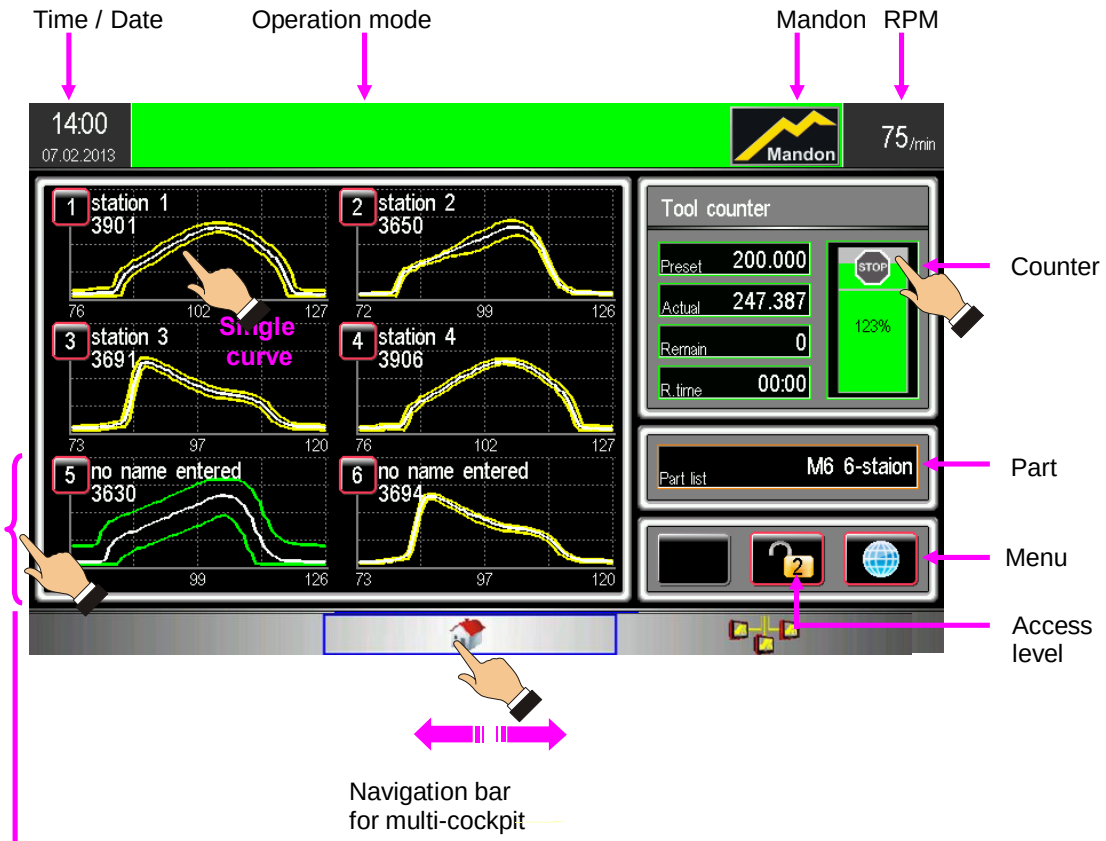
Level 2: Multi Function Navigation (after calling up a monitoring channel)



You can return back to the home cockpit with the Home button (start screen)

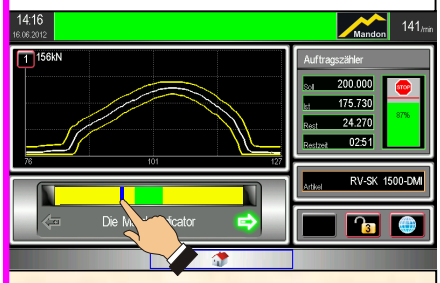
4 The Home Cockpit (start screen)

After the device is switched on, the home cockpit is displayed first with the channel overview. The load profile, the job counter and the most important data on the current part round out the start screen.[1]



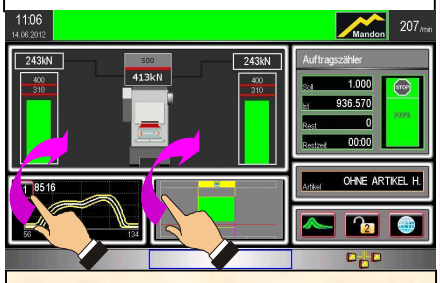
The lower quarter of the home cockpit changes according to the scope of functions.

DMI Die Match Indicator



The DMI bar shows current die match position)

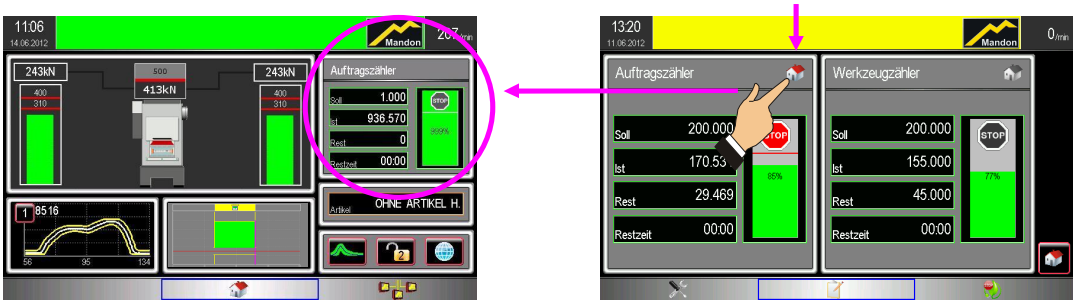
Pressmaster / Binarymaster



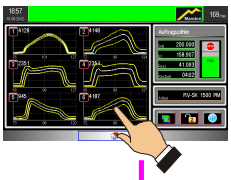
Change between these functions by sliding into the center field

1 The home cockpit can be modified, for example with additional MES functions or additional monitoring functions (DMI, DMA, binary display, load profile, absolute force display and others.

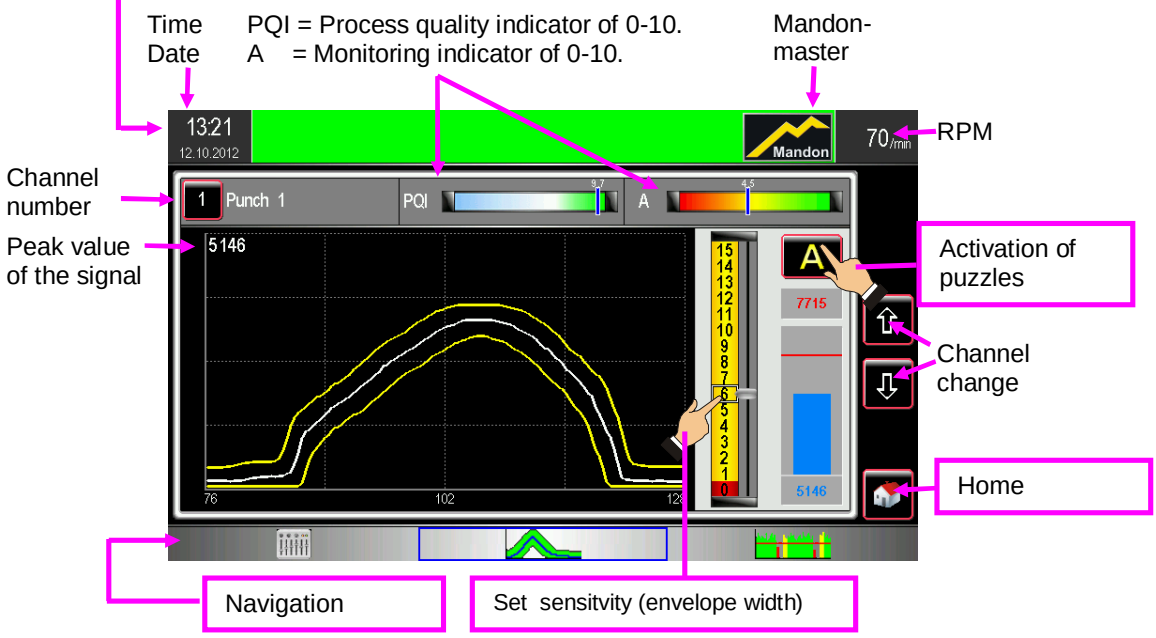
The home symbol in a counter screen sets the default counter in the home cockpit



5 Single curve display



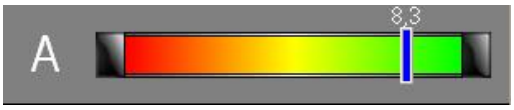
You can go to the single curve display by pressing on a monitoring channel in the home cockpit. From here, you can view and modify set monitoring parameters and go to the adjacent channels.



5.1 PQI and A values

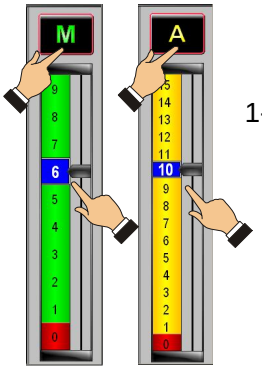
PQI = **P**rocess **Q**uality **I**ndicator from 0 to 10. Assesses the quality of the measurement signal and thereby the sensor and the process. A PQI over 7 is considered stable (=green PQI area). Shown in red: Limit for PQI = Monitoring of signal stability.

A = **A**djust = Monitoring indicator of 0-10 assesses the settings of the monitoring parameters. A value over 7 - depending on the PQI - also identifies the green area on the scale. **Attention:** In addition to sensitivity, the parameters, Q-master and Automaster are also included in the calculation. A measurement window which is too large (monitoring the zero line) or deactivating the Q-master thereby reduces the monitoring performance and thereby the calculated A-value.



5.2 Envelope curve sensitivity (sensitivity)

By touching on the "M" or "A" button (M= manual envelope curve sensitivity, A=Mandon automatic envelope curve sensitivity, the slide controller for the envelope curve width opens instead of the peak width display



1-9 green = Manual sensitivity input, 1 = wide, 9 = narrow

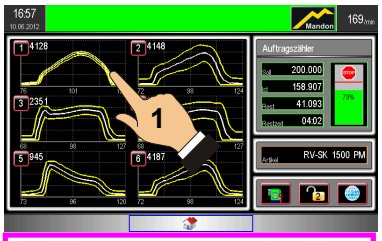
1-15 yellow = Intelligent, adaptive, dynamic Mandon envelope curve which evaluates the process fluctuations, calculated into process monitoring. As a result, better monitoring results are achieved with fewer false stops.

0 red = Envelope curve monitoring stopped, channel is not monitored

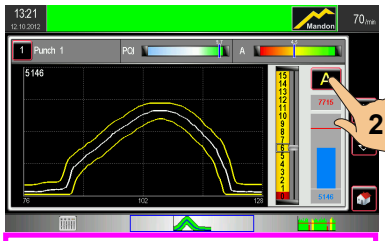
The higher the monitoring sensitivity selected, the higher the monitoring indicator (A) increases on the scale of 0-10

5.3 Toggling between monitoring "M" and "A"

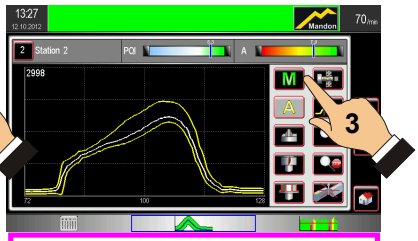
Both monitoring puzzles "M" and "A" are included in the standard SK Puzzlemaster. The activated puzzle also appears as an icon when accessing the single curve display. Toggle by pressing on the active icon



Calling up single curve

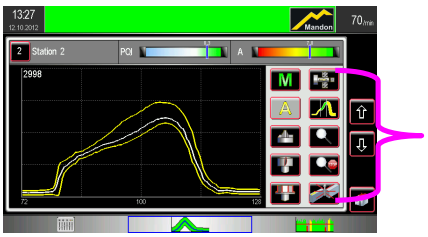


Pressing active icon



Other puzzles (if available)

5.4 Selection of additional monitoring puzzles



The following monitoring puzzles are available or can be retrofitted:

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

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

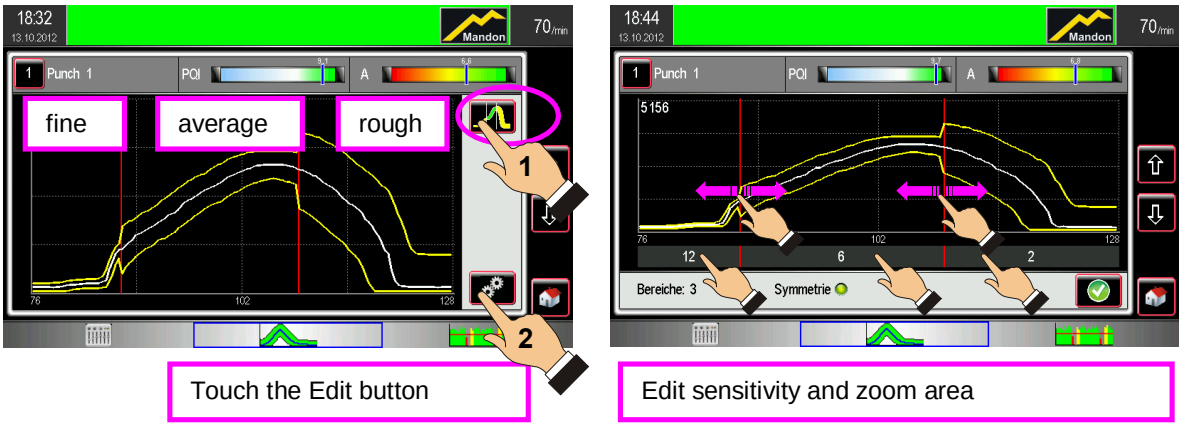
5.4.1 Zoom Puzzle – Zoom channel display

A zoom channel is activated via the **Zoom monitoring puzzle** in the puzzle selection. This allows more sensitive and improved fault detection, especially when it is possible to zoom in on a stable signal range which is relevant to specific faults. The active zoom channel is always linked to a parent channel with a channel number which is displayed next to 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 (top)** and the associated **zoom (bottom)** channel respectively. The one in grey is ready to edit (parent channel or zoom channel)

In this example, the period at the beginning of the signal has been magnified to increase this zone's sensitivity.

5.4.2 Profile monitoring puzzle

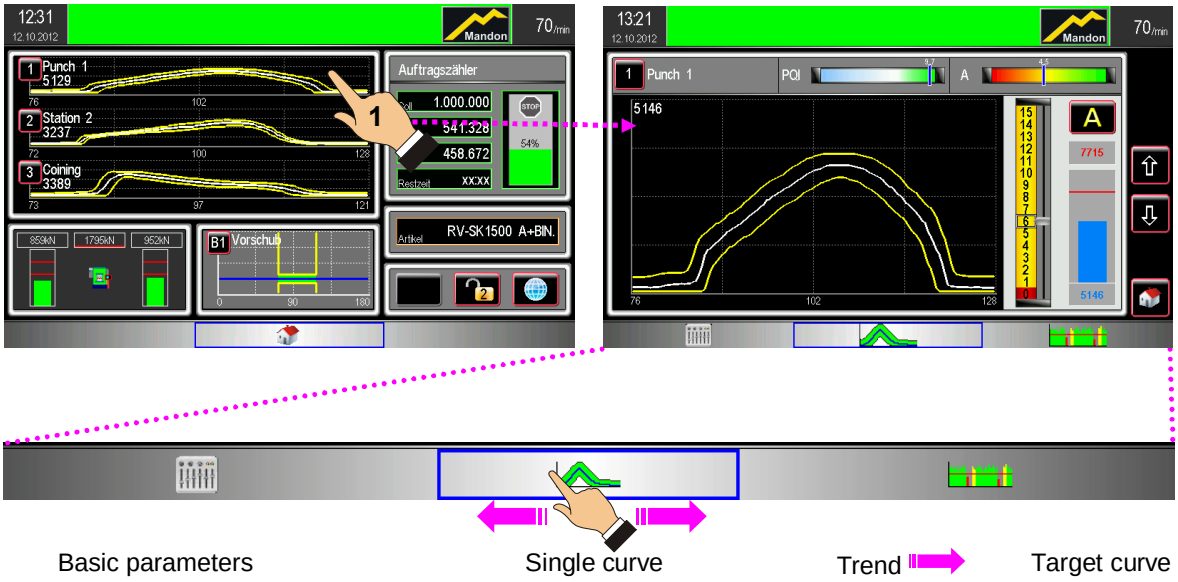
Different windows of the monitoring signal are monitored separately via the profile monitoring puzzle. For example, an unstable area can be hidden or an important area can be monitored more closely.



Up to 3 separate profile zones can be defined. The zones can be moved over the limit bar on the screen. The value can be changed by touching the sensitivity value. The symmetry setting determines if the envelope curve offsets are equal for the top and bottom envelope curve (symmetry on) or not (symmetry off). The red limit bar can be moved in automatic mode, only in in stop or teach In mode.

6 Channel-specific supplemental functions (curve)

In the channel-specific supplemental area, you leave the home cockpit by viewing a single curve.



6.1 Basic parameters of a monitoring channel

Through the basic parameters of a monitoring channel, you move left by navigating on the channel level.

The following monitoring functions can be activated via the Basic Parameter button [2]: Tolerance, Q-Limit, Auto*master*, Q*master*, measurement window start and end.

[2] Some monitoring functions are optional and can be retrofitted if necessary

6.2 Tolerance

The **Tolerance** value corresponds to the number of consecutive parts with deviations, e.g. envelope curve violations, which are tolerated before the machine is automatically shut down. The tolerance setting enables operators to prevent unintentional stops by instructing the machine to ignore random signal changes. Tolerance can be set to the values 0-9:

0 = **No part** deviation is tolerated. The machine stops immediately when the first faulty part is detected.

1 = One (1) part with deviation is tolerated. If a second part deviation occurs, a machine stop signal is generated.

9= Nine (9) parts in succession are tolerated. The stop signal is generated on the tenth part. All deviations must be in succession.

Normally, the tolerance value should be set to zero 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.

Tolerance (without a machine stop signal) is allowed if the function "Sort" is set to "Yes" - otherwise the value is set to "0".

6.3 PQI limit

Monitoring of the PQI indicator (process stability)

On a scale from 1 to 10, the **PQI** (process quality indicator) describes how stable and how repetitive the forming process actually is. A low **PQI** of less than 7, for example, indicates a more unstable process in which the signals are not repeatable from stoke to stoke. As a result, the quality of the process is being affected by certain variables. By nature, the envelope limits are farther apart with a fluctuating process of this type.

In a smooth and stable forming process, in which the signals repeat with great precision, the result is high PQI values between 7 and 10.0. Tighter envelope limits are automatically calculated which in turn boost the sensitivity of the monitoring.

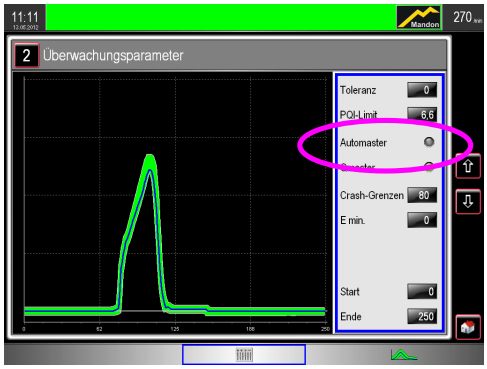
The **PQI** is calculated for every monitoring channel and displayed on the single curve screen of the respective sensor as a PQI. A **limit value** can be set for each channel (PQI limit) as a minimal PQI. If the PQI of this channel is below this minimum value, e.g. due to high signal variability, the machine is stopped with an error message, due to the minimum quality setting not being maintained.

An active PQI limit is shown in the scale as a red bar (here PQI limit = 6.6)

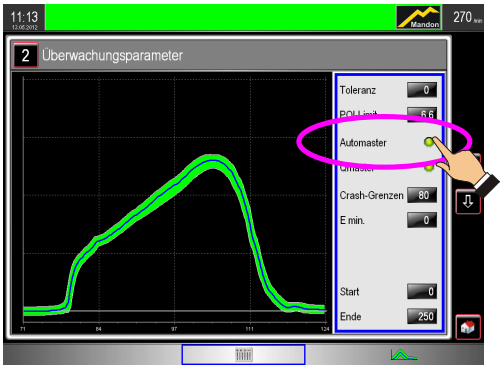
6.4 **SK**Auto*master*

With the SKAutomaster, the system automatically adjusts the measuring window to the actual curve.

The measurement and evaluation of the force signal is thereby optimized 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 ñon-metalòsignal and is not evaluating machine noise which occurs during the off-metal portion of the cycle. When changing from Teach-In to monitoring mode, the **SK**Automaster automatically adjusts the measuring window, so that the curve is displayed in such a way that it is spread across the entire screen width. With the Mandon envelope curve technology (yellow envelope curve color), the function **SK**Auto*master* is always used by default and must be switched off if necessary.



Without **SK**Auto*master*:
The measured signal is not optimally adjusted to the screen width. The monitoring is wasted on "dead" intervals without signals, the monitoring result is not ideal.



With **SK**Auto*master*:
Touch the indicator to activate the Automaster: The measuring window is adjusted automatically so the force curve fills the entire width of the screen.

6.5 Adjusting timing window using manual settings

The timing window = size of the 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 SKAutomaster is active, the monitored measuring window is automatically adjusted to be displayed across the optimum screen width.

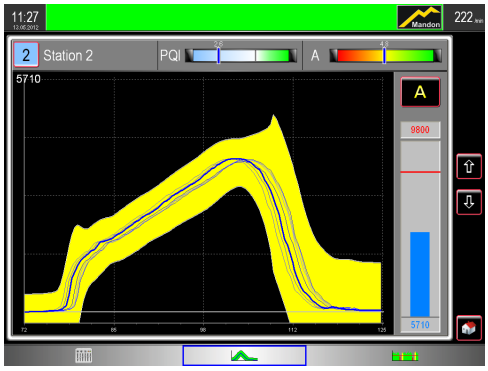
6.6 SKQmaster

SKQ*master* is an automatic compensation for machine generated signal fluctuations

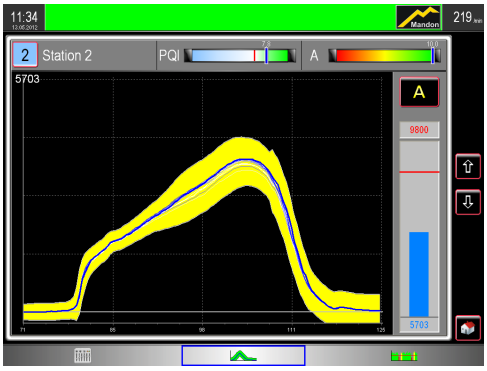
Due to their drive systems, some machines experience slight fluctuations in speed due to unstable, running idler shafts or issues with machine lubrication or condition.

In these cases, the speed fluctuation causes a lateral back and forth fluctuation of the sensor signals on the screen. Usually this requires very wide envelope limit settings so the monitoring signal does not result in machine shut-downs. At the same time, monitoring precision is lost because the process is so variable only wide control limits can be used.

The **SK**Q*master* function stabilizes the sensor signal by automatically compensating for the lateral curve offset. Now you can set fine envelope curves and also avoid unnecessary machine stops. With the Mandon envelope curve technology (yellow envelope curve color) the function **SK**Q*master* is always used by default and must be switched off if necessary.



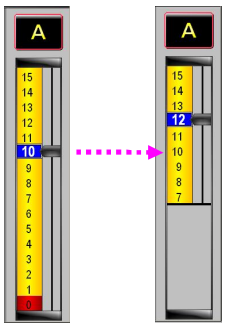
Without **SK**Q*master*:
To avoid unnecessary false shutdowns, the envelope curve monitoring must be set very wide to accommodate fluctuating signals. The monitoring result suffers from this.



With **SK**Q*master*:
The lateral signal fluctuations are stabilized. Narrower envelope curve monitoring can be run simultaneously with less faulty shut-downs. The monitoring result is improved.

With speed deviations that are too large and cannot be compensated for with **SK**Q*master*, it may be necessary to install a rotary encoder to stabilize the measurement signals.

6.7 E-Min



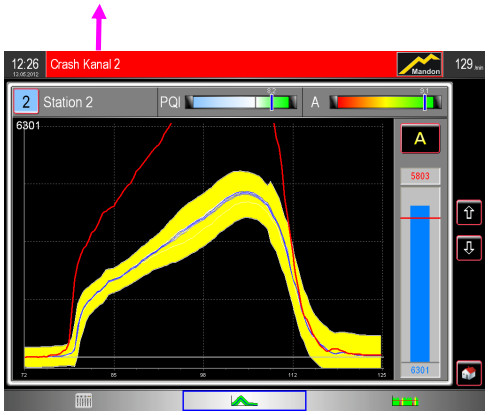
The monitoring sensitivity for a channel can be locked with a minimum level so a defined minimum sensitivity is always set. The sensitivity scale under the minimum limit is greyed out in the single curve display.

6.8 Crash limits and communication line

If the monitoring system switches the machine off, the display screen showing the reason for the shut down (e.g. counter, envelope curve, trend etc.) is automatically displayed as a message in plain text on the communication line [3]. As a result, the fault in the machine can be located more quickly and remedied.

Shut-down of envelope curve violation
On the top communication line.
The reason for the shut-down is shown in plain text.

Crash shut-down
If the peak value increases drastically by more than 50%, the crash message is shown in plain text.



The shut-down signal is displayed as a red curve for envelope curve violations. If the peak value increases drastically by more than 50% (default setting), the message **"Crash"** is shown during shut-down. This crash limit can be set in the Monitoring 2 menu in the service window.

Attention: With very small signals, a 50% signal deviation can occur within the envelope curve, and a crash message occurs without the measured signal leaving the envelope curve. In this case, the limit must be adjusted or shut down.

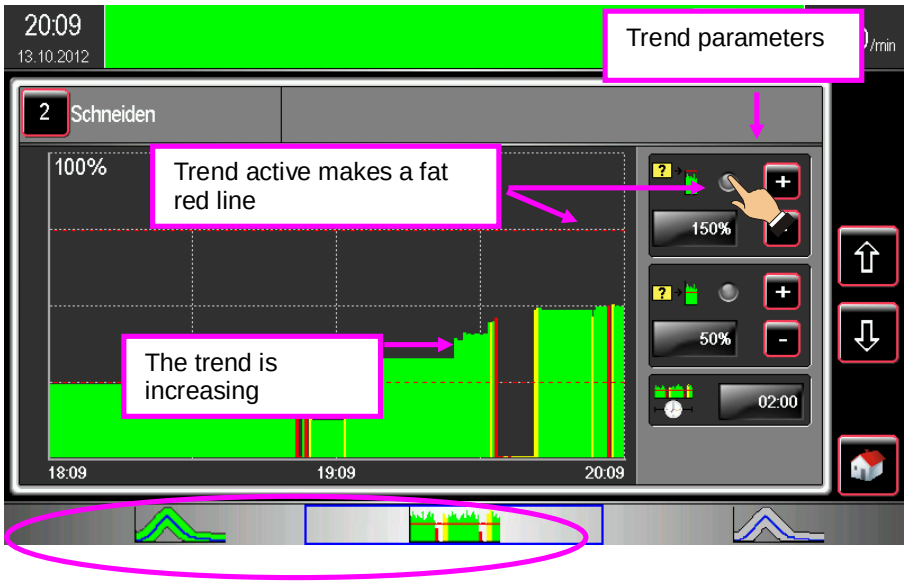
Increase: = Set a value of 80% or higher. Shut down = Enter value "0". Crash is also displayed if the maximum signal value on the limit should be reached.

[3] Additional messages can result from the SK Mandon message and information system.

6.9 Trend monitoring

Trend monitoring detects long-term peak force changes as a complement to envelope curve monitoring. In trend monitoring, the maximum values are determined (default setting) or are optionally shown as an absolute value (signal in Mv) from the last 250 strokes and monitored on request.

Strokes in teach-in mode (not monitored) are shown in yellow, strokes in monitored operation in green. Signals which have resulted in a shut-down (e.g. trend error or envelope curve monitoring) are shown in red. Machine idle states are identified as gaps in the trend graph.



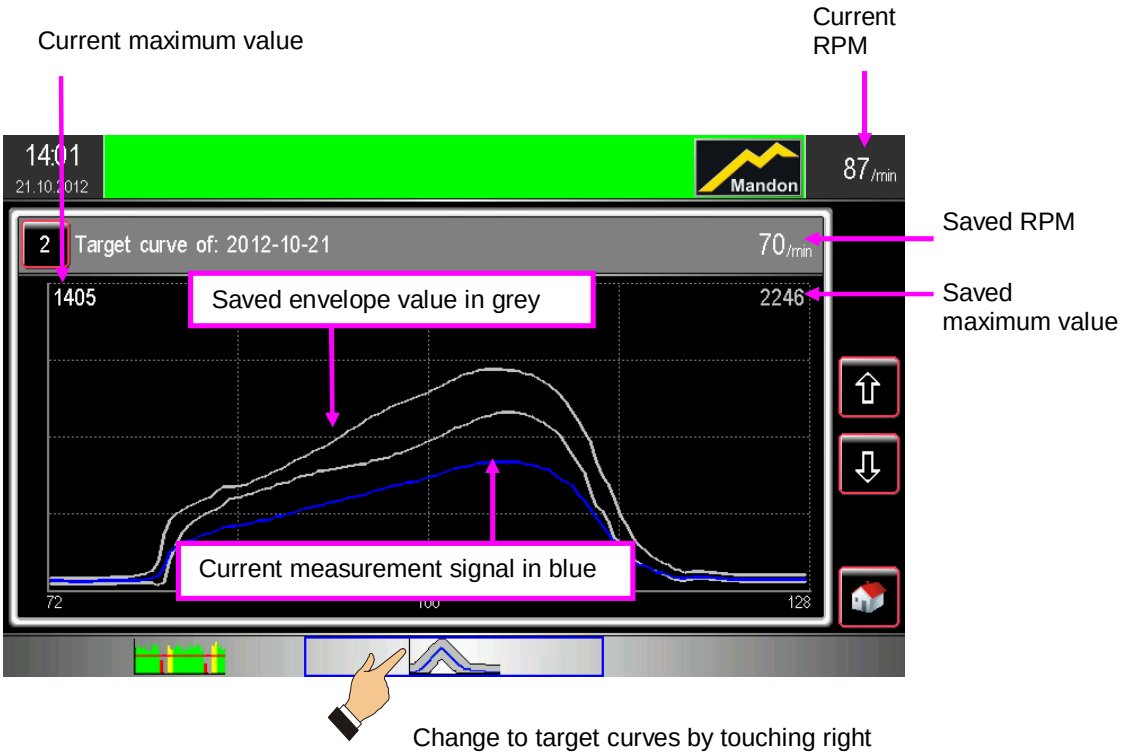
Change to trend view by touching right

You can activate and change the trend limits by tapping on the channel numbers. The trend values can be given an upper and lower trend limit. The limits are activated or deactivated via the green control lamp. Active trend limits are identified with a bold red line. Passive trend limits are shown as a dashed red line.

Toggling from the average trend on a single stroke trend (single stroke display) occurs in the menu, under the item:
Configuration / Monitoring / Next page / Trend

6.10 Set-up aid and target curve display

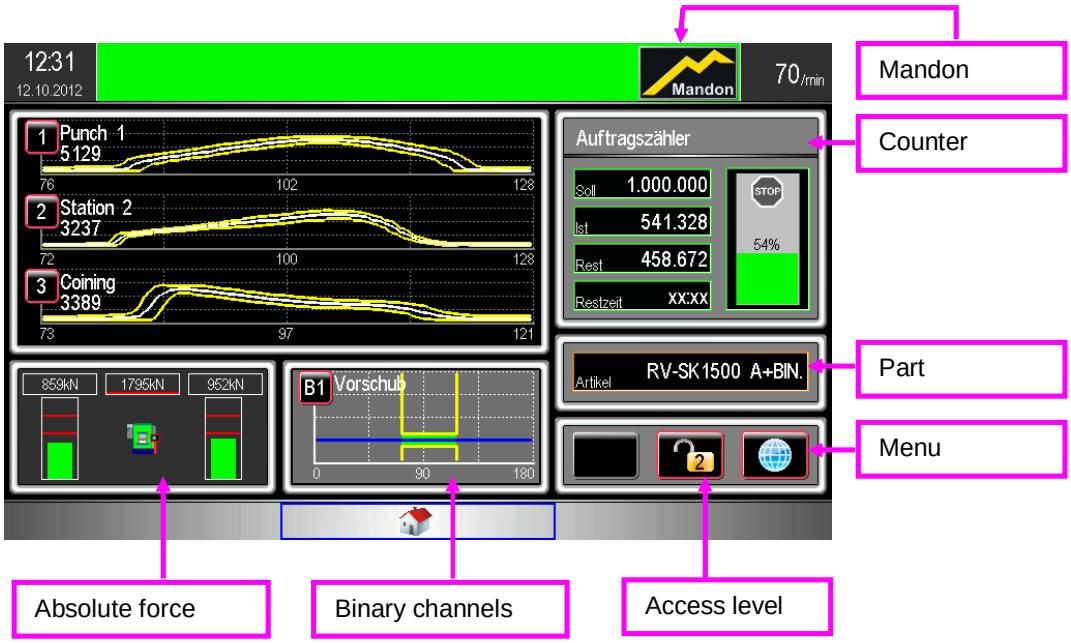
The target curve display is used as a set-up aid and shows process changes between the current job set-up and a previously saved job. Saving a curve display is only possible in monitored automatic mode[4]. The goal is to set up the machine and tool in such a way that the current measurement signal in blue migrates to the saved envelope curves (in grey). Often, the curve form itself (slightly higher or lower than saved envelopes), is the deciding factor for repeatability of the process. Such differences can be associated with material fluctuations, poor load distributions, tooling issues, etc.



SK Partmaster is a machine option and can be retrofitted if necessary.[4]

7 Functions with direct access from the home cockpit

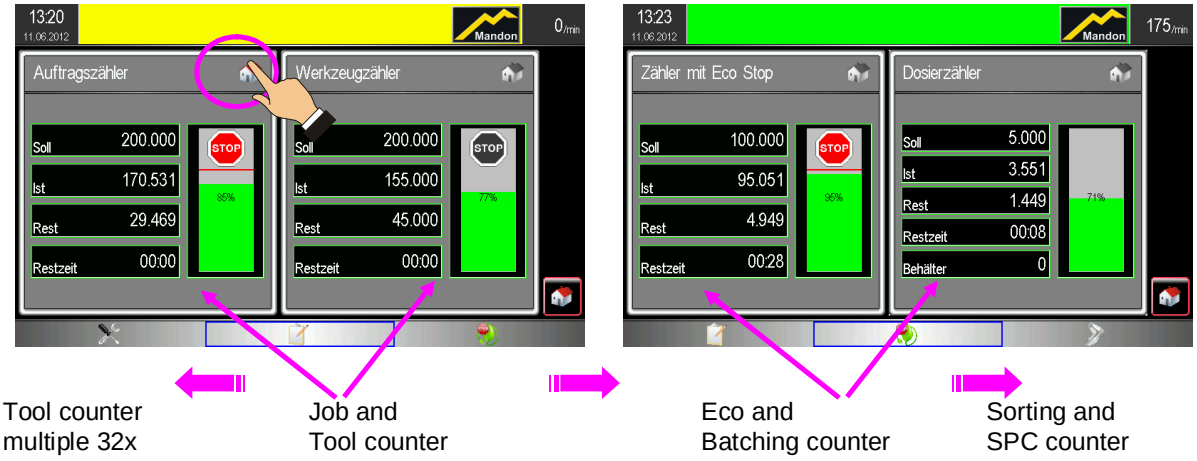
In addition to the single curve display, some important device functions can be reached directly from the cockpit:



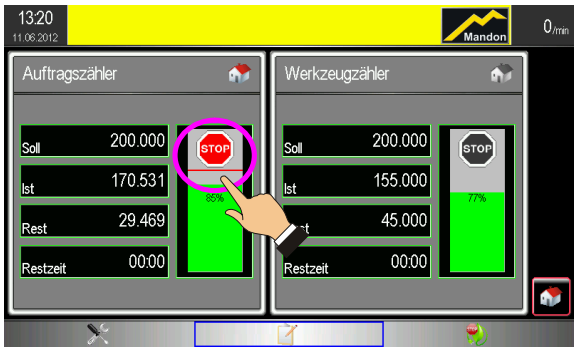
The two (2) displayed functions in the lower left hand image (Absolute force and Binary channels) can change according to application based on the purchased options

7.1 Counter overview

The counter overview appears by tapping on the counter window. Each counter with an activated home icon appears in the home cockpit[5]

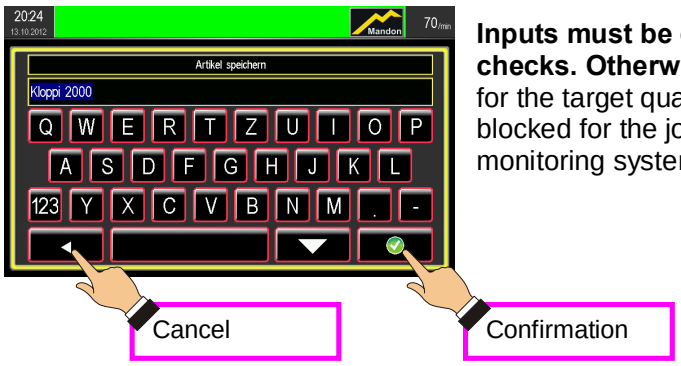


7.1.1 Job and tool counter



Touching the stop symbol (turns red) activates a stop when reaching the part number. When the stop symbol is pressed again, stop is deactivated and identified with the greyed out stop symbol.

Counter specifications or a previously produced amount can be set by pressing on the target or actual quantity. In addition, an input field with a numeric keyboard appears.



Inputs must be confirmed with green confirmation checks. Otherwise, they are not applied. The entries for the target quantity and actual quantity can be blocked for the job counter for BDE-controlled monitoring systems

[5] Some counters are optionally available

For the job counter:

The number of produced parts per stroke and the decision whether the parts are included in the count during the Teach-In phase are indicated in the menu under the item:
Configuration / Counter

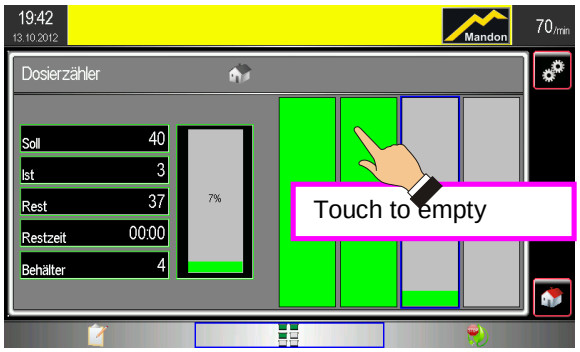
7.1.2 Counter with Eco Stop

The counter with Eco Stop is normally used for monitoring after-run 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 circuits are disconnected from the machine power supply.

To activate the ECO Stop, the stop impulse must be configured in the machine control cabinet!

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 (red hand), the green monitoring LED on the device's front panel **flashes**.

7.1.3 Batching counter



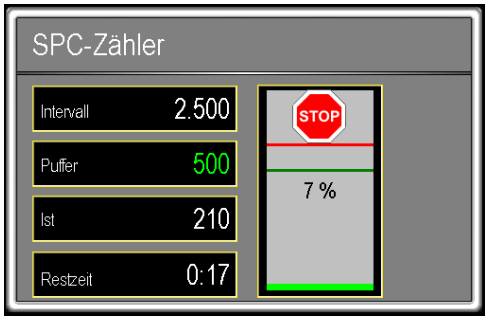
To activate the batching counter, you must first enter the scheduled quantity and the number of containers. The maximum number of single containers that can be set is 16. After the last container is filled, the stop signal is generated. If the container counter is set to "0" (zero), the batching counter is not active.

The container can be emptied by touching it, which resets the count to zero.

7.1.4 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 SPC evaluation periods 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 device code is entered. If the interval input is **"0"** (zero), the batching counter is not active.



Additional parameters for the SPC counter configuration are located in the menu, under the item: **Configuration / Counter / Next page / SPC counter**

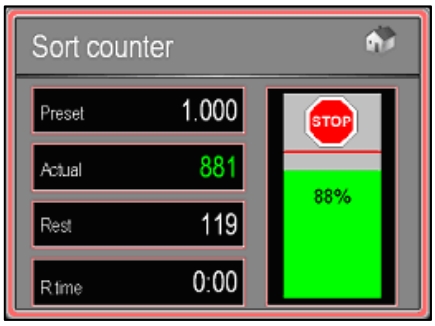
After the check interval has lapsed, the machine operator is notified with a message window that a measurement is due and must then actively confirm that the check is to be performed. If no check is performed within the set buffer time, the machine is stopped (depending on whether stop function is active or not).

7.1.5 SPC counter linked to Quipsy, Babtec und Böhme & Weihs (EUROPE ONLY)

In addition to the SPC counter described above, there is alternatively also a SPC counter linked to a CAQ system. If no positive SPC check signal is sent within the preset check interval for the linked SPC counter, production is locked and a SPC message appears on the machine. If the SPC check has a positive completion, the machine again gets clearance for production.

Interfaces to the CAQ-linked checking system exist for systems from Quipsy, Babtec and Böhme & Weihs, QSC and CAQ AG (status 2012) **(EUROPE ONLY)**

7.1.6 Sorting counter



The maximum quantity in the scrap container can be checked with the sorting counter. When scrap totals exceed 90%, there is automatic instruction reminding the operator to change the scrap container.

7.1.7 Multiple tool counter

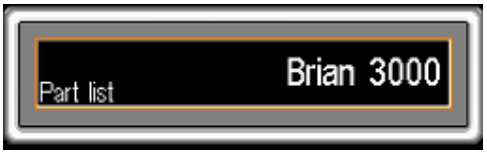
The Multiple tool counters can manage and control up to 32 tool-specific individual counters[6]. The counters are listed according to Tool I.D. numbers or the remaining residual idle time. The tool counters can be named using the drop-down keypad.

The number of tool counter is set in the menu:
Configuration / Counter / Tool counter

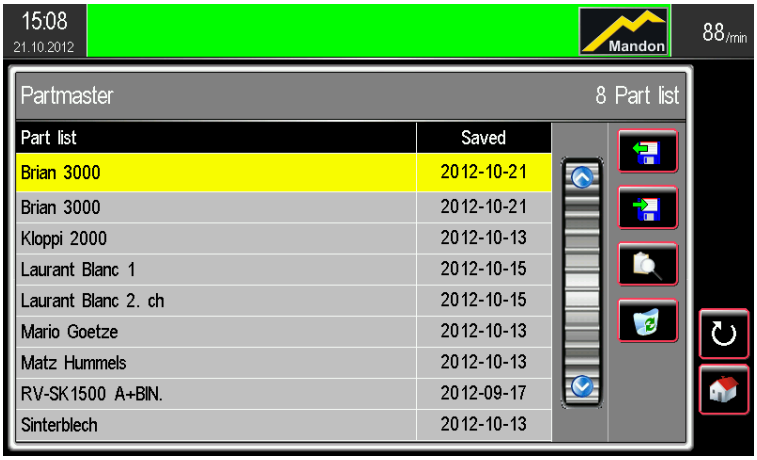
Activating the control LED activates the stop when reaching scheduled quantity

[6] The Multiple tool counter is optionally available and can be released via a code.

7.2 SKPart*master* with target curve memory



Via **SK**Part*master*, monitoring and set-up parameters can be saved and re-accessed on a part-specific basis.



Yellow = active part (very top)

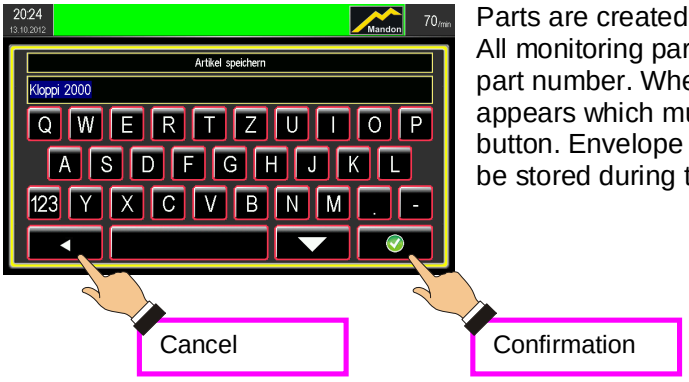
It is possible to search for a certain part via the filter function.

←Load part

←Save part

←Search part

←Delete part



Parts are created, saved and loaded via **SK**Part*master*. All monitoring parameters are saved with each stored part number. When saving, an alphanumeric keyboard appears which must be completed with the green "Enter" button. Envelope curves for set-up assistance can only be stored during the automatic green mode.

OVERWRITE PARAMETERS YES / NO

If you wish to save new data for an existing part (e.g. because you have found improved settings for the current part), the previously stored data can be overwritten.

By calling up stored part data:

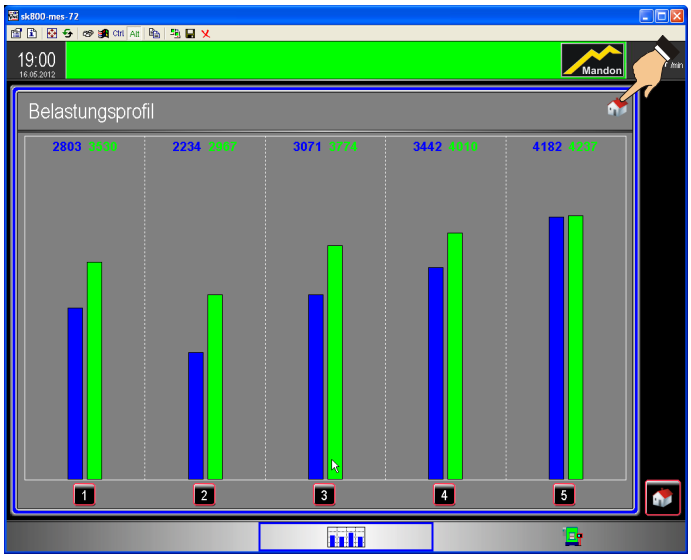
- All relevant monitoring parameter values are set to the previously stored values (measurement window size, monitoring limited, activated special functions, monitoring puzzles, expert programs etc.)

- The current envelope curves are saved as a target curve as a set-up aid; the saved set-up envelop (in grey) can be used as a set-up aid when re-accessing the part. (Reference the section on target curves for information on the set-up aid)

- Saving the current maximum peak force values as a target specification (green bar) in the load profile (as a set-up aid, see section on load profiles below)

7.3 Load profile and SKProtection*master*

Stress profile
The screen shows the current maximum peak force values for each measurement channel (blue bars left) compared to the saved target values (green bars right). When saving a part, the current values in blue are saved as target values in green. By touching on a green target bar, you go to the corresponding target curve (expanded set-up aid).



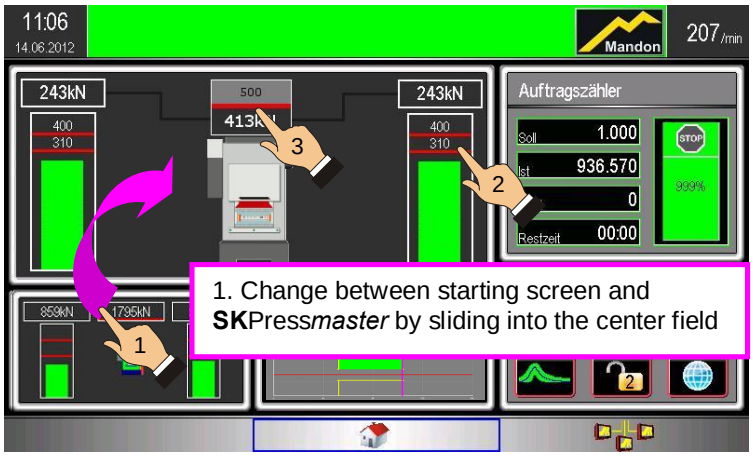
Activates/deactivates the load profile in the home cockpit. During deactivation, access occurs via the menu

SKProtection*master* is a level-specific overload safeguard. Here the forces of the load profile are also monitored with an absolute upper limit. For example, an overload condition can be recognized in set-up mode, and great damage can be prevented. The protection limits are created per level on an article-specific basis.

The absolute force values may be calibrated when using Protectionmaster

7.4 Absolute force monitoring with SKPress*master*

Overall force display with overload limits.
The display screen shows the overall press load (tons/kN) along with the left and right side individual frame loads (2 or 4 locations). In addition to the overload limit, a smaller warning force limit can be activated. If the force exceeds one of the warning limits, a machine stop occurs with an error message in plain text.

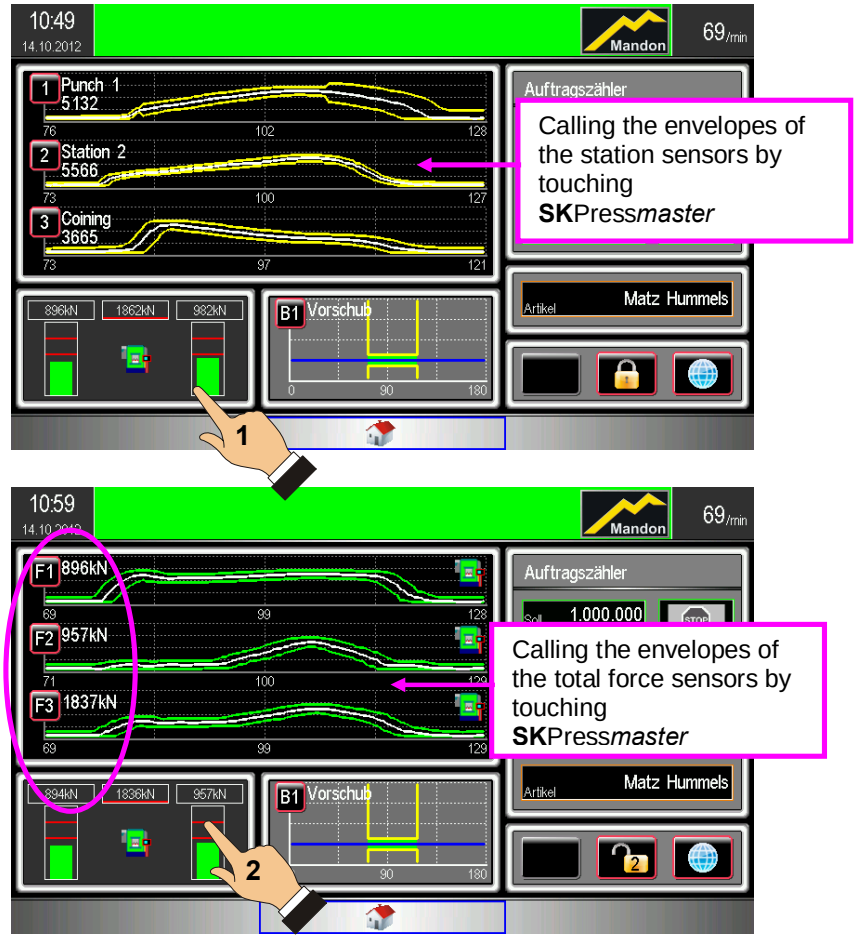


Further options in **SK**Press*master:*

2. Adjust peak force limit per sensor

3. As total force limit

7.4.1 Calling the envelopes of total force sensors (SKPress*master*)



7.5 DMI and DMA track monitoring for thread rolling machines*

7.5.1 The die match indicator (DMI) for a track position check

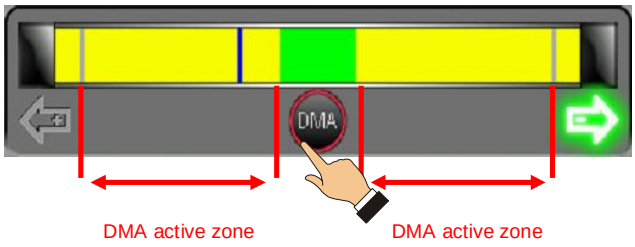
The DMI reflects the track position of the tools for flat die machines with an electric ram advance feature. It is the goal to set up the roller dies in such a way that the indicator (blue line) is as close as possible to the green center zone. If the blue indicator line is to the right of center, the operator is notified with a message to adjust eccentricity (machine advance) to the left and vice versa.

Condition for correct DMI operation: Parallelism of the rollers (vertical and horizontal).

The setting parameters for DMI are code-protected and should only be changed in coordination with trained personnel.

7.5.2 Die Match Automatic (DMA) adjustment circuit

For DMA, the optimum eccentric position is determined by the sensor and passed on to the machine controller. After DMA mode is activated, the SK device interfaces with the machine controller to provide automatic die match adjustment. **If the DMA (blue line) is located in the DMA active zones**, this is detected and the machine automatically adjusts into correct position after activating the DMA button.



Pressing the DMA button activates the DMA. Automatic adjustment occurs when the display bar is located in the DMA active zone.

With the active DMA, the DMA button is visible and bordered in red.

If the machine is located in the adjustment cycle, the DMA button is white.

When the DMA is deactivated, the button is replaced with the **Die Match** Indicator.

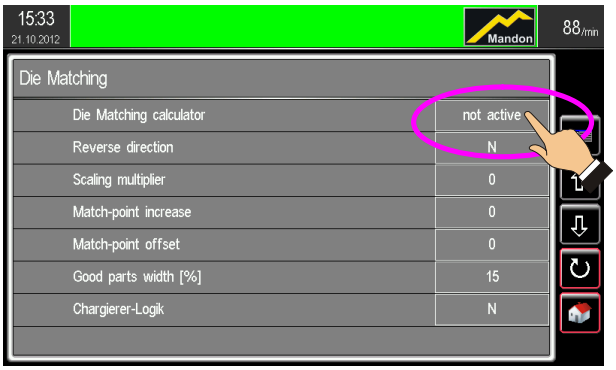
DMA is not possible in the following situations:

1. The machine control is not linked to the SK device.
2. If the DMI bar is already optimum
3. The DMI bar is located in the outer ranges

If the adjustment attempt fails several times, the machine switches off with the error message: **"DMA not possible".**

* NOTE: DMI and DMA upgrades are only applicable to machinery that is equipped with control logic capable of electrically adjusting the position of the Ram.

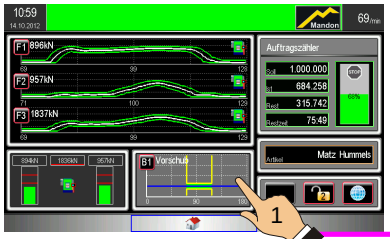
The condition of the roller dies and the basic settings of the machine should be checked. A new DMA test can only be re-started following the production of at least one part. Activating DMA during or directly following idles runs is not permitted. [7]



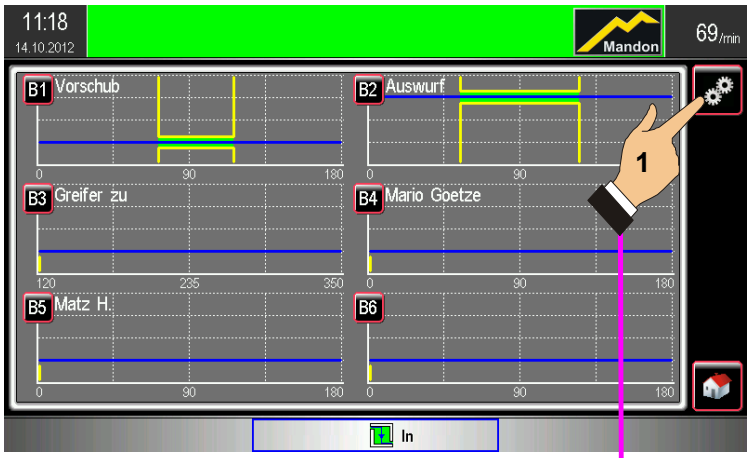
The DMA function is activated or deactivated in the service menu / Die Matching / active or not active

[7] Deviations are possible according to the interface definition of the machine manufacturer.

7.6 Binary (Digital) monitoring for ejection, feed, etc.

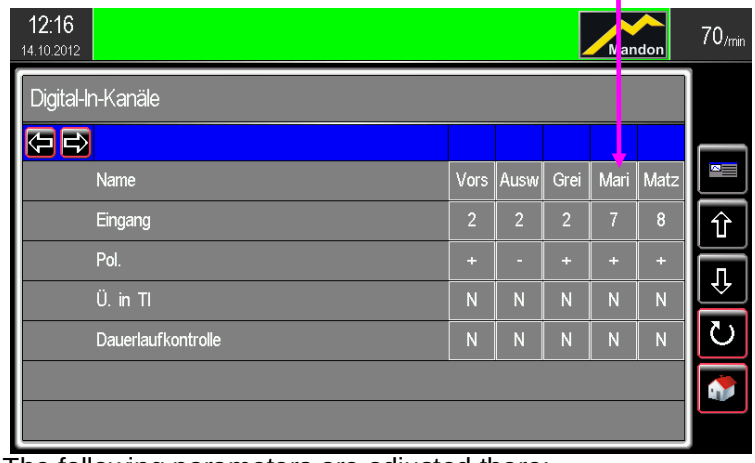


1. Accessing the Binary (Digital) Setup



In this setup, signals from digital sensors and ejection/position optical sensors, or magnetically inductive sensors can be monitored using the SK device in addition to the analog force signals. A number of different monitoring options are available depending on the sensors used and the evaluation software installed. Operation is through activation in the home cockpit.

7.6.1 Digital-In Configuration

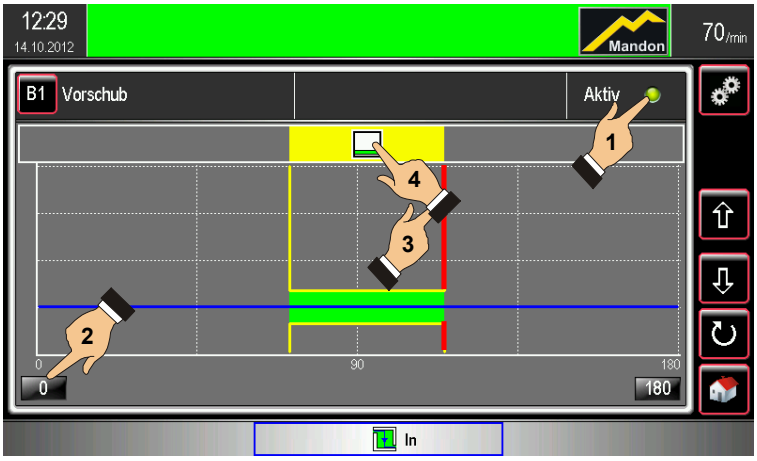


Access to the Binary (Digital) configuration by touching the edit button

The following parameters are adjusted there:

- Individual naming of each binary (digital) input channel
- Assignment of signal input (INI 2, INI 3, etc)
- Polarity of the signal (Positive or Negative)
- Monitoring of the teach-in (Yes or No)
- Input possibilities code-linked (Yes or No)
- Continuous run control

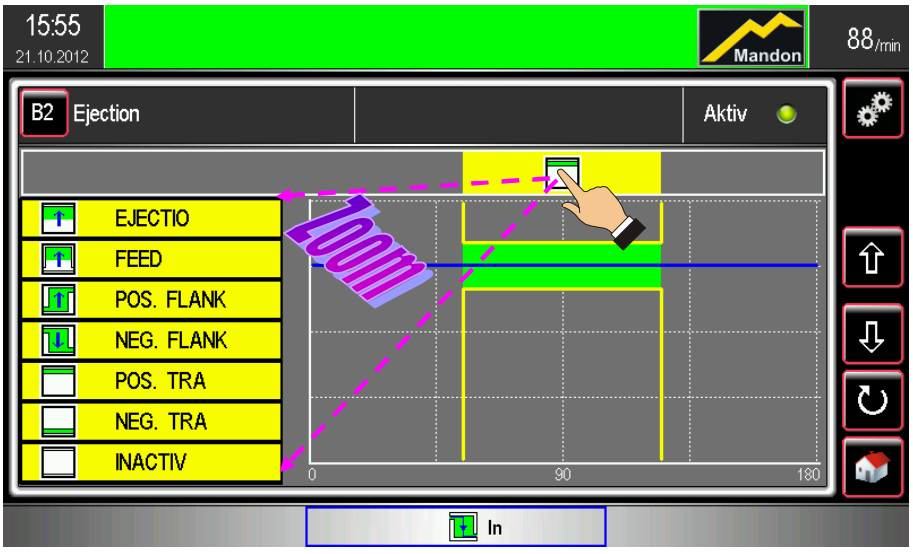
7.6.2 Binary basic settings (Digital Inputs)



Monitoring active
By switching off the green active LED (1), the monitoring can be switched to inactive. For example, this may be required to temporarily accommodate defective sensor inputs. In the display, the binary channel which is shut off is identified by the omission of the green monitoring area.

Basic measurement window:
A timing window is established for an expected binary (digital) event to occur (2). The passive ñreadyòstate of the sensor output is shown as a blue line. The active monitoring area (in green) is moved by touching the borders (3). If the logic does not see the appropriate digital signal within the green band, it assumes an error has occurred and an immediate stop signal is generated. The red line indicates where in the cycle the stop signal is initiated.

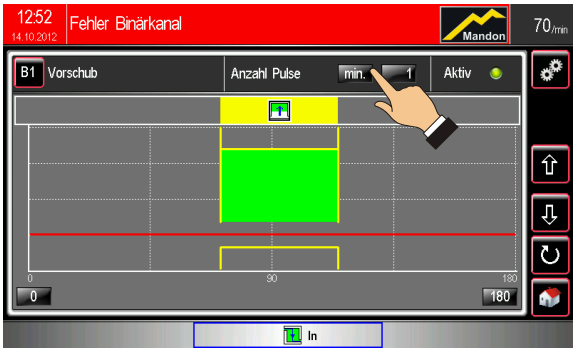
7.6.3 Selection of binary monitoring puzzles



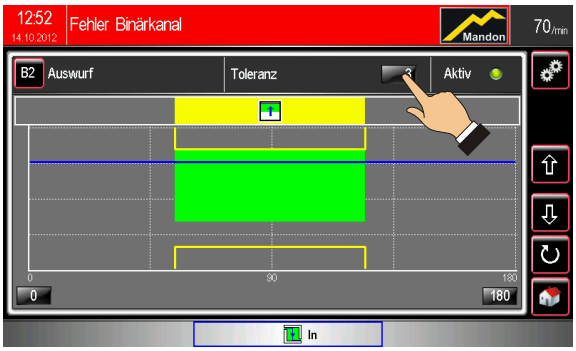
By "touching" the monitoring symbol (4), you are shown a range of possible functions.

TIP: To avoid false stops, the "Monitoring Active = No" can be set in advance. Once all monitoring functions are verified, the control logic can be activated: "Monitoring Active = Yes".

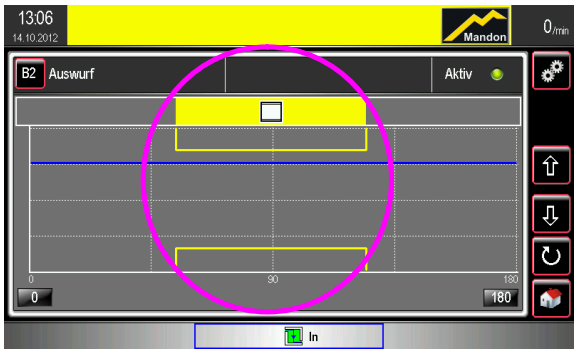
7.6.4 Special binary monitoring puzzles



Feed Puzzle
To verify the proper feed conditions for each cycle, the blue signal must enter into the green monitoring area according to the pre-set stroke position. With the parameter **Number of pulses min or exact (=)** signals with multiple pulses can be monitored. The Red (Error) Line indicates that the required signal from the feed sensor was not received.



Ejection Puzzle
To verify proper part ejection for each cycle, the blue signal must enter into the green monitoring area. The **Tolerance** settings can be used to accommodate special ejection conditions. A Tolerance setting of 3 would require that some sort of ejection function must occur every three strokes (i.e., scrap).

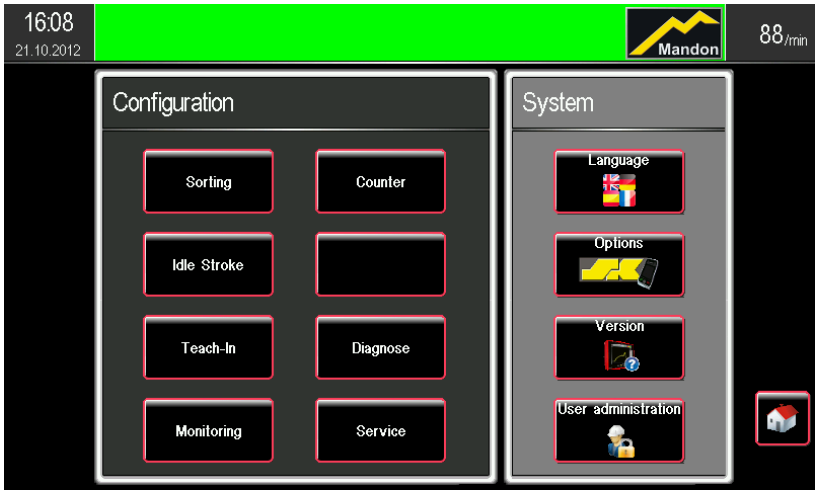


To switch off monitoring, depress the ñActiveò button so the green light is off. You can thereby temporarily by-pass the channel.

8 Menu access

The menu is divided into 2 or 3 blocks:

1. Configuration = Setting the monitoring parameters
2. System = Device settings
3. Features (Not Shown) For applications which cannot be reached by the cockpit or were deactivated)



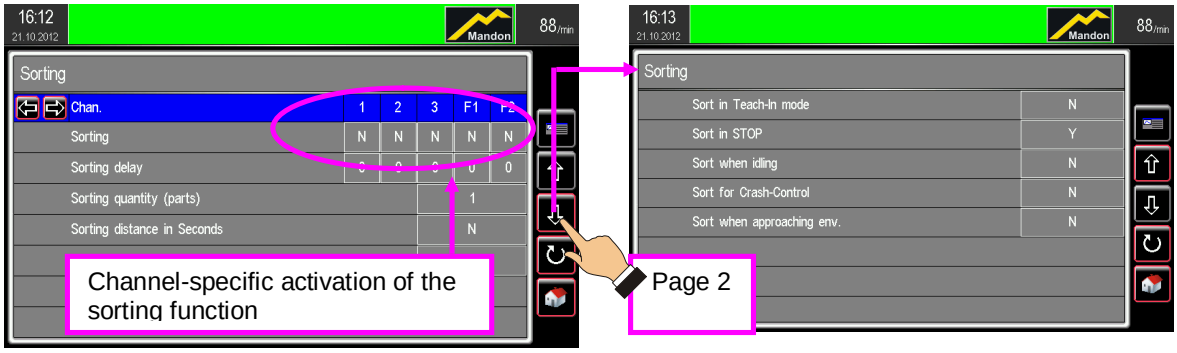
8.1 Configuration

In the configuration menu block, the different parameters and functions of the monitoring system can be called up and set. The service window is protected via an access code.

8.1.1 Sorting

All SK monitoring systems can be used to control appropriate sorting devices, such as diverters, in order to separate faulty parts from the acceptable material production. It is recommended to simultaneously stop the machine so the faulty part can be inspected by experts, and if necessary, the appropriate measures can be taken.

Alternatively, the machine can continue to produce parts while random faulty (errors) parts can be automatically sorted. When too many faulty parts occur in succession, the machine will be stopped. This number can be set via the "Tolerance" parameter.



Setting the sorting functions

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

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 prevents too many acceptable (good) parts from being sorted. Enter the delay in number 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, then a certain number of ñgoodòparts are also sorted out.

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 before window end (Y/N):**
   The sort pulse is generated immediately after a value outside the envelope is detected, so that the sort gate can be operated more quickly. (Certain monitoring functions such as **SK**Q-master and Automatic Puzzle cannot be combined with fast-sorting).

Page 2 of the sorting menu

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

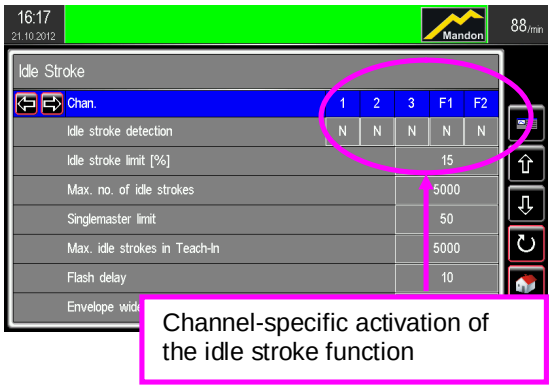
2. **Sort in Stop (Y/N):**
   This function allows the operator to set the sorting device permanently to sort while the machine is in stop mode.

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 feed problems and are detected as idle strokes and not as faults by the monitoring device. It is possible that non-conforming parts (e.g. bolts that are too short or too thin) are produced with force signals similar to those of idle strokes and are normally ignored. As a precaution, it is possible to sort with each idle signal to prevent any possible undersized part from reaching the production bin.

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). For example, this can be the case in situations where standard envelope monitoring is to be suspended as parts are deliberately dropped from the transfer mechanism.

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

8.1.2 Idle stroke detection



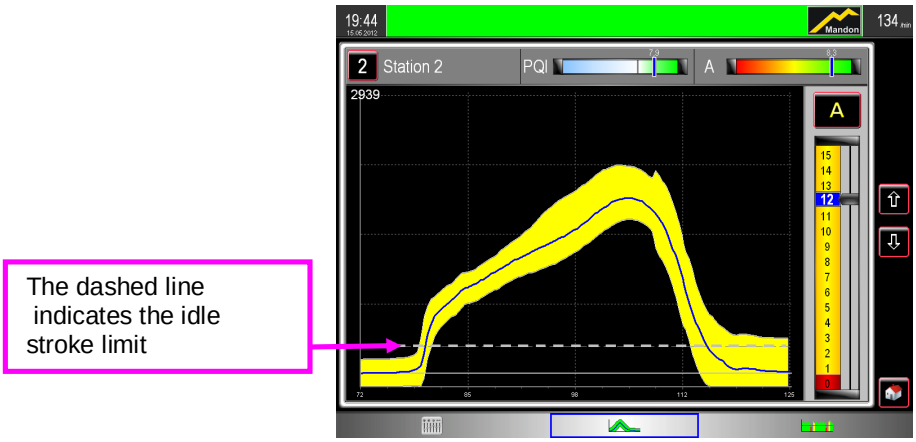
Certain machine types such as thread rolling machines tend to experience frequent idle strokes due to bottlenecks in the part feed. Normally, an idle stroke is considered an error, and the monitoring system would switch off the equipment.

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. The system only stops the machine if the number of idle strokes is exceeded or a legitimate high or low force error is detected. Here the following parameters can be configured:

Setting the idle stroke detection

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.



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 if connected.

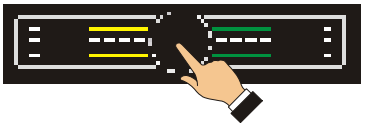
4. **Singlemaster limit**:
   Absolute idle stroke limit. This value determines that very small force signals (whose maximum value is smaller than the entered value) are registered as idle strokes. This ensures that sporadically occurring idle strokes, that are common in applications such as thread rolling, are not included during the ñteach-inòphase.
   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 idle stroke signals from being included during teach-in).

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.

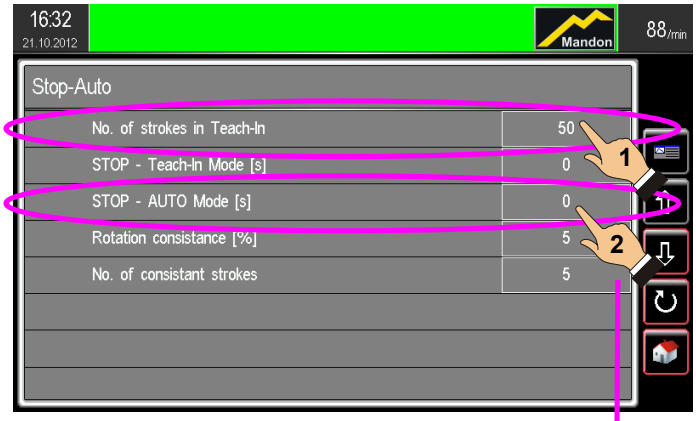
7. **Envelope widening after idle strokes:**
   Indicates by how much in percent the envelope is to be widened in order to prevent unnecessary stops after idle stroke is complete.

8.1.3 Teach-In phase and Stop-Auto mode



Teach-In button on device front:

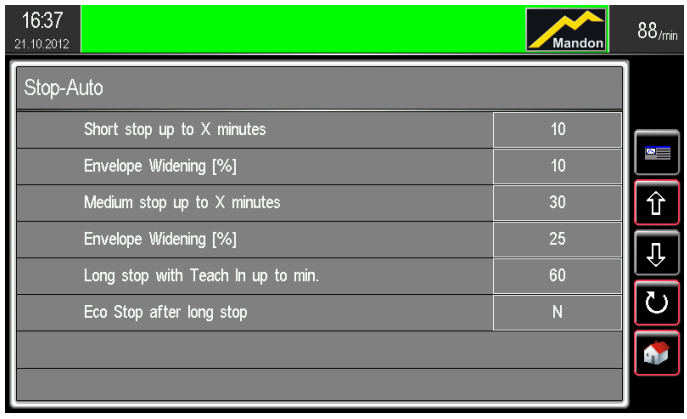
Press the **Teach-In** button to start the teach-in process for the calculation of the envelopes and to automatically activate monitored operation after the teach-in process is completed. The number of teach-in strokes is set in the ñ**Strokes in Teach-In"** section of the service area of the configuration 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 taught envelopes are retained so that it is not necessary to complete another Teach-In phase



Strokes in Teach-In
After the number of strokes entered in the Teach-In mode has been reached, the system switches to monitored operation.

STOP-AUTO mode retains the established envelopes after a machine stop. Here a value is entered in seconds after the system switches to Auto mode with a system failure. Recommended setting: between 3 and 4 seconds.

Stop-Auto fine setting



STOP-AUTO transition allows different stop-auto phases to be defined. During a brief machine stop of 3 minutes, for example, the envelope curve expansion (in percentage) is significantly less than for a long stop of 60 minutes.

Eco Stop after a long stop
To save energy, you can select Eco Stop. If Eco Stop is set to **Yes**, it turns off the main power supply circuit after expiration of the set time of 60 minutes. The Eco Stop must be hard-wired, and manually reset by the operator.

8.1.4 Counter basic settings

Basic settings of the counter and configuration of a SPC counter.

The basic counter settings are:

- Parts per stroke
- Count in Teach-In Yes/No
- Number of counters (for the multiple tool counter)

The entries and stop functions are activated in the counter screen.

8.1.5 Diagnosis

Check of the hardware and connection components.
(Please consult SK or your SK agency prior to any service action.)

8.1.6 Service

Monitoring parameters may only be modified by trained personnel.
(Code-protected)

8.2 System

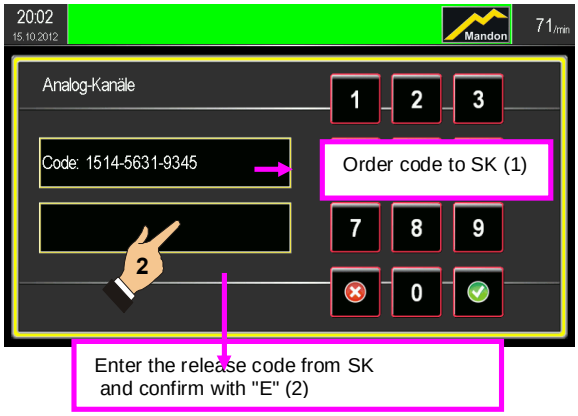
8.2.1 Language

Select the appropriate system language by touching the national flag.

8.2.2 Device options Buy and Test

Software options can be installed or tested for 30 days if the selected option for the respective device model is supported. Both the test and the purchase of options are via the code system.

You can access the options via:
Menu / System / Options.
The installed options are identified in the option menu with a **"Y"**.



A window appears with an order code when you tap on the desired option:
With this order code, SK or the SK agency can issue a release code to the customer, and it needs to be entered. When communicating the order code, please inform us whether you require a release code for an option purchase or for a 30-day trial period.

After 30 days, a trial code automatically expires.

8.2.3 Version

Overview of the installed device software and access to the update area.

8.3 Access authorization (Codes) / RFID and user administration

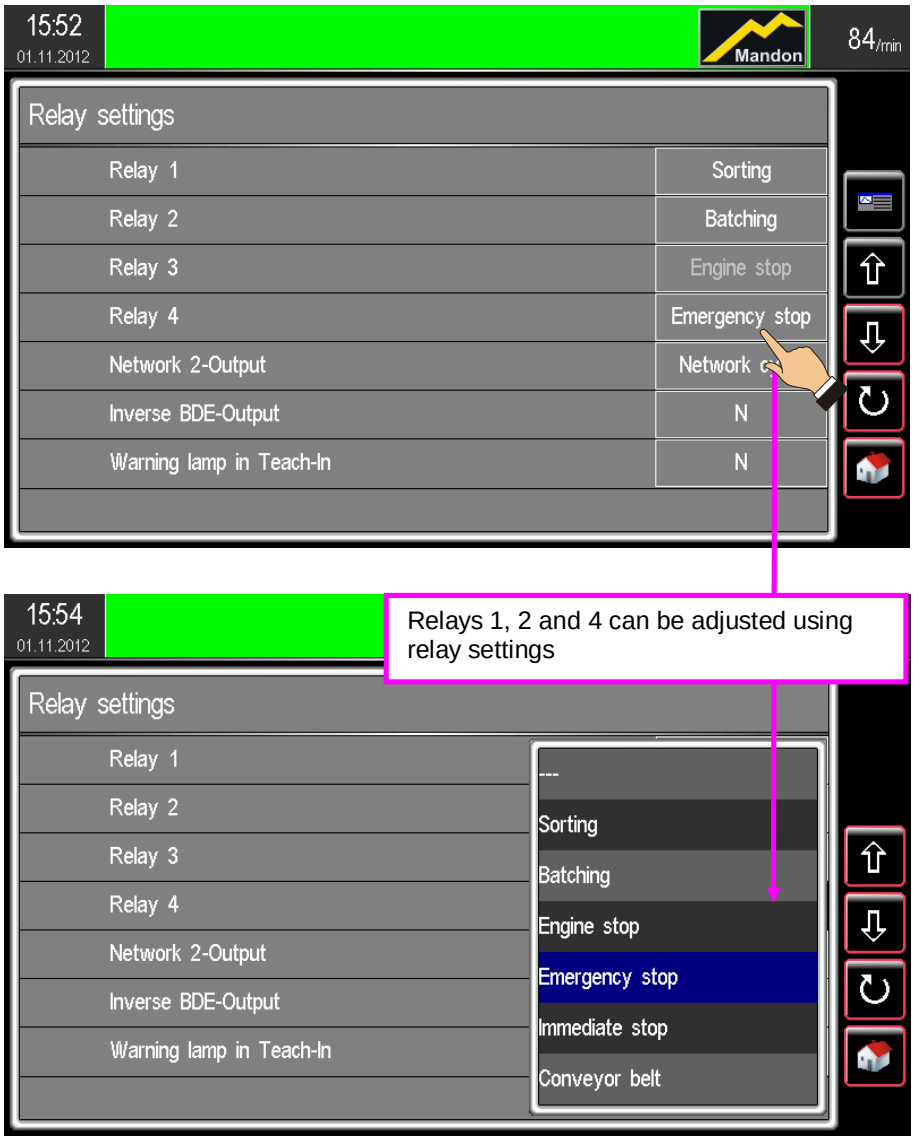
An employee could ñLog-Inòvia a code on the monitoring system by tapping on the Access Rights button or the menu button. If the monitoring system has a RFID recipient, the log-in can be via a RFID chip on the device front. The lock indicates whether a code is currently active and with which rights level. If a code is active, it locks automatically after 5 minutes with no input. You can lock by tapping on the lock symbol and confirming without a code.

There are 3 different access levels. Access, i.e. which level is authorized or what can be accessed without a code is controlled in the user administration area in the server window. You can also switch the access codes in the user administration section if a change should be necessary.

If the master code (i.e. level 3 to change user administration) is no longer available, it can be regenerated by SK.

8.3.1 Relay settings

Relays are assigned in the Service menu. In the standard configuration, **relay 3**, motor stop (= rear or top dead point stop) has a fixed position. Other relay outputs must be hard-wired to the machine using the Interface board.



BDE2 output: Output using the opto-coupler (potential-free) for direct connection to the machine controller (very fast). In this field, the "**watchdog**" function can be activated.

Standard relay configuration:

Relay 1: Sorting

Relay 2: Batching:

Relay 3: Motor Stop

Relay 4: Immediate stop

Other possibilities:

- Immediate stop
- Conveyor belt
- SPC exceeded
- Watchdog

9 Mandon (option)

The term originates from Japan and stands for screens which reflect the consolidated key productivity figures of machine departments. A department or an entire plant is the focus.

Mandon® (**M**achine **Andon)** is derived from Andon. Mandon® is an information and control system for performance and quality data integrated in the monitoring system which provides support to a worker directly on the machine with suggestions for improvement.

9.1 Activating and deactivating Mandon messages

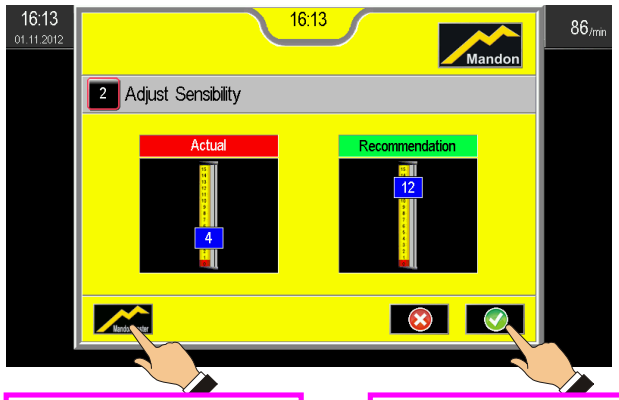
Performance and quality parameters are assessed, checked and adjusted if necessary by Mandon® and are saved in tabular form in the **SK**Mandon*master*. Here the threshold values and the repetition intervals are created on a user-specific basis.

It is the goal of Mandon to systematically monitor the performance and quality resources of a machine.

9.2 Mandonmaster: typical applications

Here the parameters of the monitoring system are recorded, assessed and, if necessary, are assigned a Mandon reaction. Typical tasks for the Mandon App parameter:
- One or more monitoring parameters are not optimally set (Sensitivities, Timing Windows, etc.)
- A process changes more than the average (PQI and Trend)
- The target speed of the machine is exceeded

9.2.1 Typical Mandon reaction



With a poorly set sensitivity, the Mandon reports and suggests an improved setting. Here the Mandon has calculated an optimum sensitivity of 9 in the background.

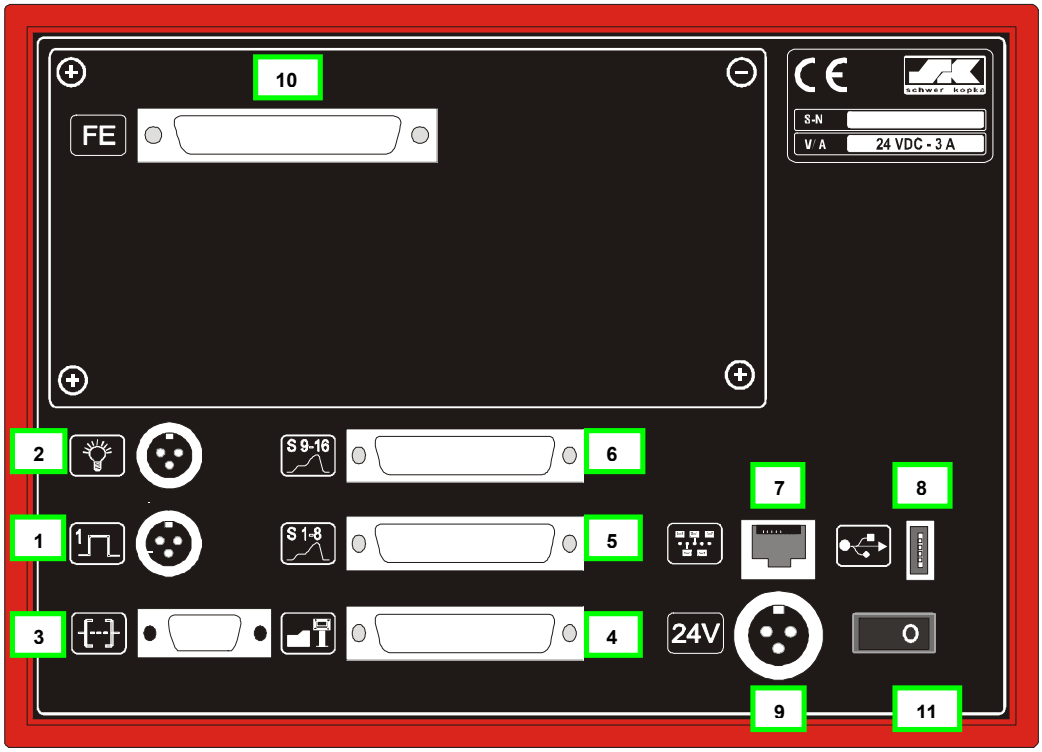
The suggestion can be accepted or rejected by the operator. Management can switch to **SK**Mandon*master* via a code to change the Mandon settings.

10 Error messages and faults

Description / Error message	Cause	Action
Message: External stop	Device has no timing (start) pulse.	A circuit or sensor other than the SK system has initiated the stop.
Message: Crash	Increase in the measurement signal by more than 50%	Crash limits can be adjusted in the service menu
No measurement signal in the measurement window	1. Timing signal or 2. Cable/plug or 3. Measurement window or 5. Sensor	Check: - Timing signal available? - Speed constant? - Size of measurement window - Signal polarity - Cable - Plug (solder point) - Sensor
Red LED blinks in continuous mode	Device in bypass	Turn key in interface (horizontally)
Device is counting incorrectly or not at all	Parameter setting	Counter settings in the Counter menu (configuration) Check. Note idle stroke limit (when rolling)

11 Technical data

11.1 Plugs connections (rear panel)



Features:

Connections	SK 400
1= Cycle	X
2= Warning lamp	X
3= Interface serial RS232	X
4= Interface	X
5= V-box 1 / Channels 1-8	X
6= V-box 2 / Channels 9-16	X
7=1 x Ethernet (DSP)	X
8=1 x USB (DSP)	X
9= 24V plug STAK 200	X
10= Front end and digital extension plug	
11= Switch ON / OFF	X

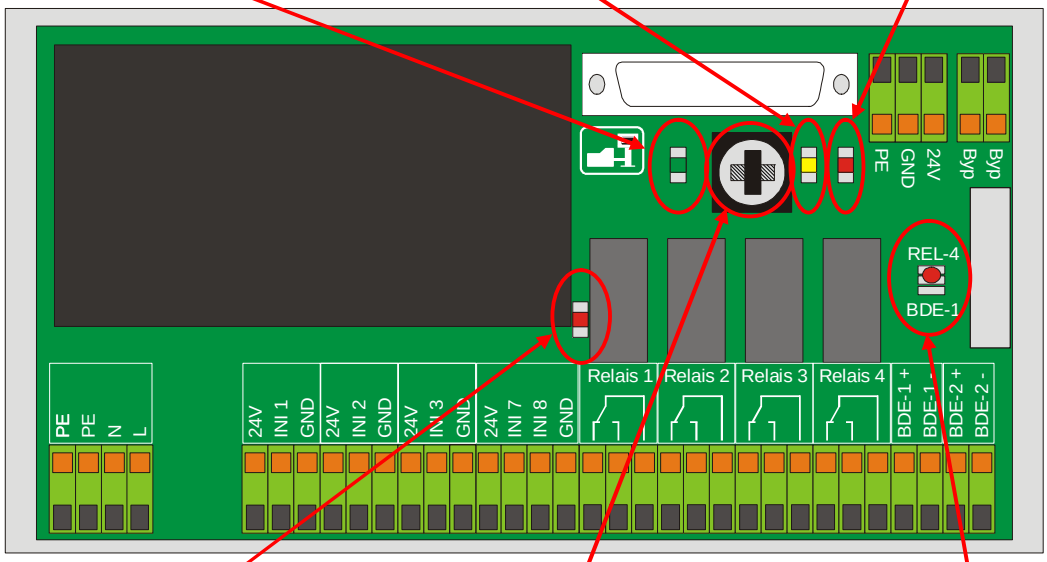
11.2 Interface indicators and bypass switch

The following indicators are mounted on the interface board:

Green LED on:
➔ 24V OK

Yellow LED on:
➔ Bypass switched. Relay disabled.

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



Yellow 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)
Top solder point:
BDE1 active

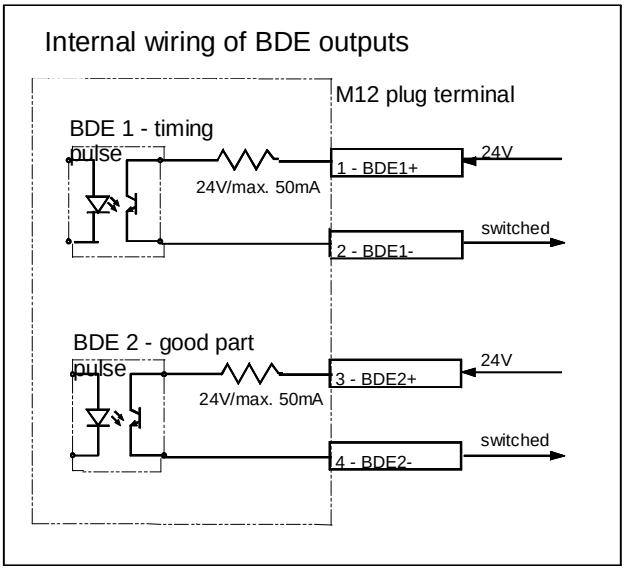
11.2.1 Standard assignment of relay outputs

Relay no.	Function	Description
1	Sorting	Control of sort 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 belt at 1st machine stroke after restart (in STOP Teach-In or STOP-AUTO mode)

11.2.2 BDE outputs



Other possible BDE output assignment:

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

12 Notes

Date	Description/ special settings	Signature