Cavity Eye Smart Moulding Control User Manual

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1. Introduction

This guide will assist you in acquiring the knowledge about Cavity Eye Smart Moulding Control system and the Cavity Eye measurement software. If you need further assistance using our products, or on this guide, please refer to our website and feel free to contact our support team.

If you have any remarks, or you need support in troubleshooting, contact us on SUPPORT@CAVITYEYE.COM email address.

Please, only use Cavity Eye distributed products with our system. Cavity Eye Hungary Kft. takes no responsibility for any damage or expenses caused by using inappropriate products or ignoring this guide.

2. General overview

2.1. The application of Smart Moulding Control

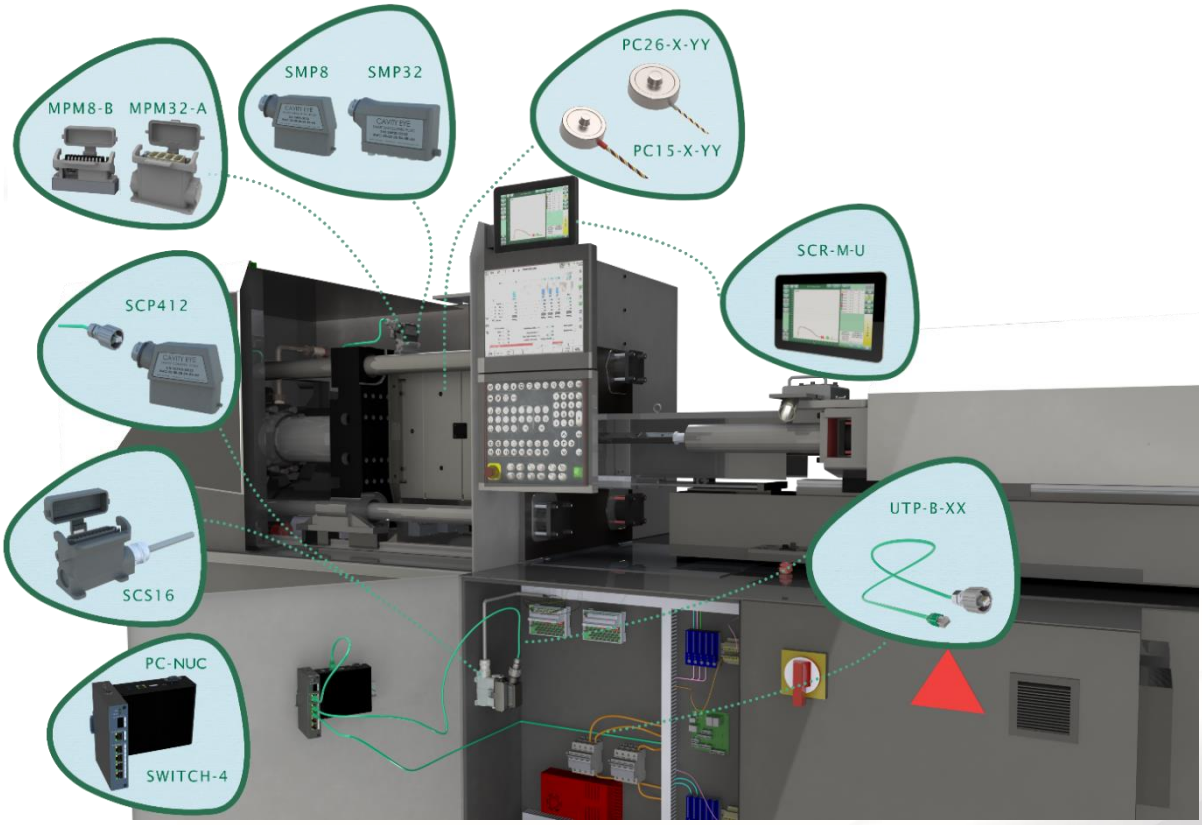
The Cavity Eye Smart Moulding Control's system grants you overall help in injection mouding. The system is easy to install and to use on every injection moulding machine.

The system assists you in the following areas of production:

- Following the injection cycle with the help of the pressure curves measured in the cavity
- Quicker production start- and restart process
- Injection moulding machine's (IMM) setting and parameters optimization, process stabilizing
- Switchover to holding by cavity pressure
- Locating filling inbalances, reaching filling balance
- New mould tests, new moulds reach mass production phase faster
- Automatic scrap product sorting
- Protection of the mould, prevention of core breakages by immediate stop or end-of-cycle stop of the machine
- Increase mould lifetime with optimizing the process based on cavity pressure measurement
- Product quality improvement using cavity pressure results
- Quicker production starting process based on previously saved data
- Automatic saving of production and cyclic dat, documentable production, statistical analysis

2.2. The system components

A Cavity Eye measurement system typically consists of multiple components. For further reference the most common devices and their abbreviations are listed here:



Item number	Description
SMS8-B or SMS32-A	Smart Mould Socket with memory, 8 or 32 channels, counterpart of SMP
SMP8 or SMP32	Smart Moulding Plug with 8 or 32 sensor channel
SCS442	Injection Moulding Machine socket with memory
SCP442	Smart Control Plug with 4 digital input and 12 digital output pins
PC-NUC/SWITCH-4	Data processing and storing unit
SCR-M-H	Touchscreen

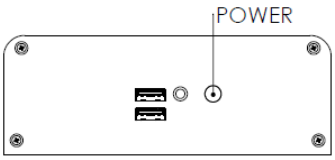
3. Commissioning

This manual contains the software's guide including all function's detailed description. It does not contain the Cavity Eye SMC system's installation nor how to put it in operation.

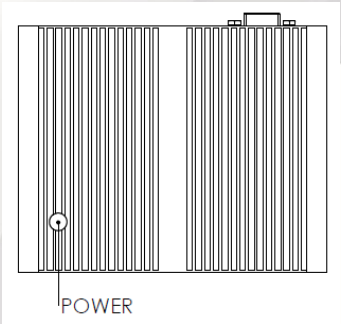
⚠ All devices of the SMC system must be connected properly in order to use the software. The information about system installation and device connecting can be found in the *Cavity Eye Smart Moulding Control Quick Start Guide*.

3.1. System configuration

After connecting the devices to power supply, the system automatically starts, and the operating system loads. In case of the system does not start, please push the 'power on' button on the PC. Before pushing the button, check whether it is glowing red or blue. Red indicates turned off state, and blue indicates turned on. In some older models, the PC swtich on button can be found on the top of the PC.



or

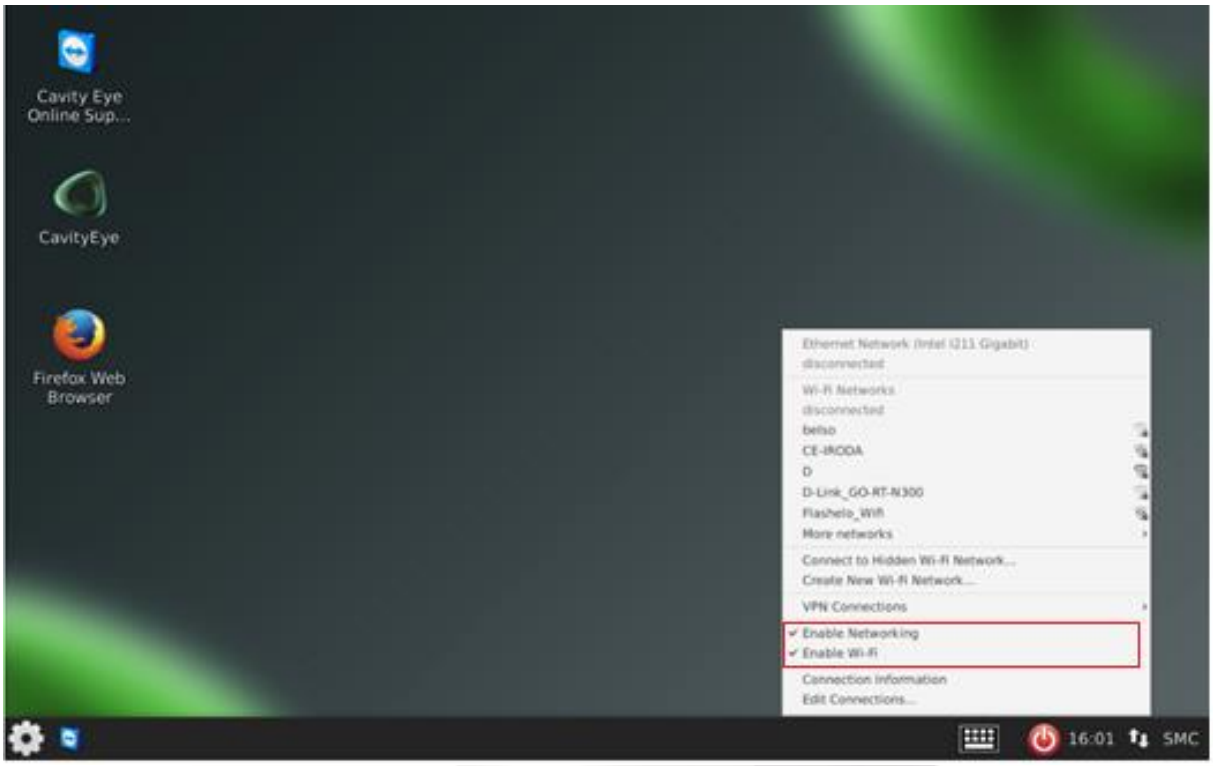


The system is configurated and all settings are ready as factory defaults. The Cavity Eye system's components - the SMP and SCP devices - communicate on UTP cable via TCP/IP protocol. Every device receives a network identification and address (IP and MAC address), which is provided by DHCP server installed on the PC, thus only network endpoints should be connected to the switch, other routers or switches do not.

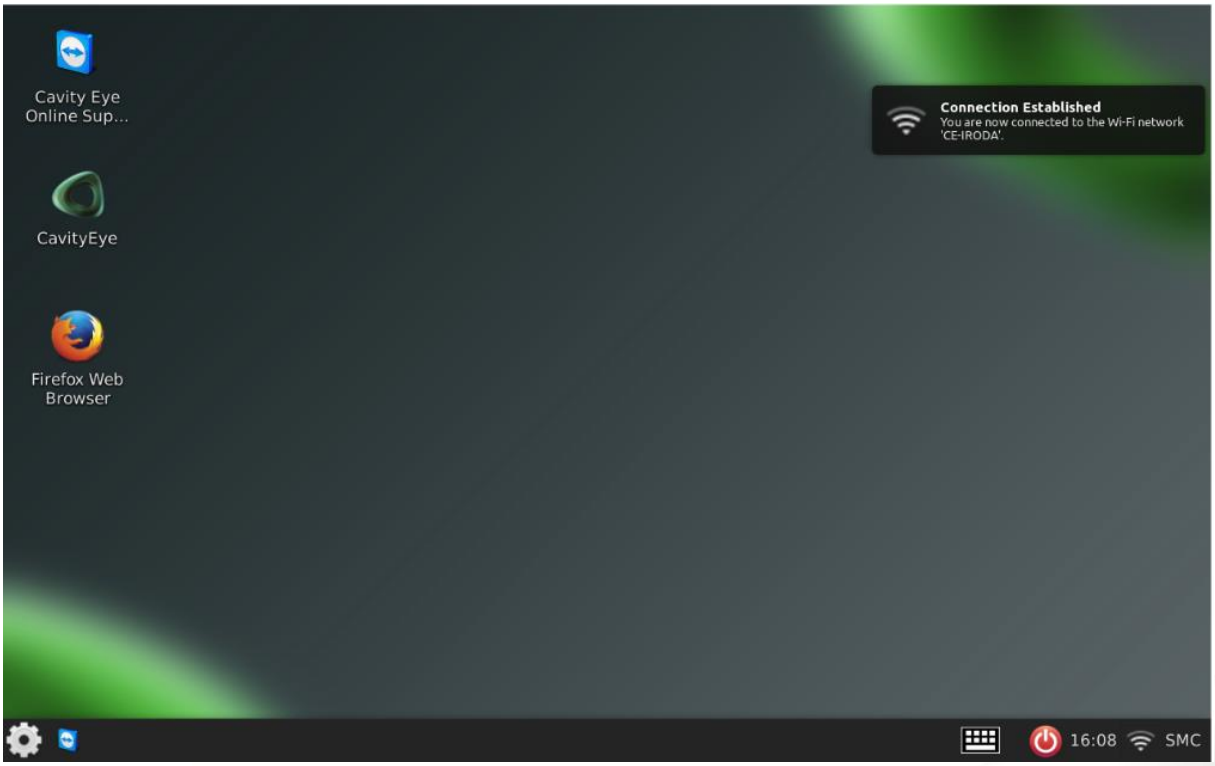
3.2. Connecting to WiFi network

If your system's PC unit contains WiFi module, then you can connect to the internet via WiFi connection. Inspect your PC whether it has 2 pieces of antenna to know, that can you connect via WiFi.

If no WiFi connection was connected previously, then click on connections icon (the up and down pointing arrows) in the right-bottom corner. Check if whether Enable Networking and Enable Wi-Fi options are applied. If not, please apply it, then select the network you want to connect to. Keep in mind, password might be required to connect.



If connection is established, a pop-up message will appear in the top-right corner, and the connection icon will change to Wi-Fi icon.



3.3. Software updates

All software components of the system are factory installed and working with the devices provided. The software requires periodic updates to ensure trouble-free operation and access to all new features, please consult our supporting colleagues about the update possibilities.

⚠ Before updating the Cavity Eye software or any system components always contact Cavity Eye support. Cavity Eye does not take any responsibilities on expenses caused by using wrong software.

3.4. Data saving modes

3.4.1. Local data storing

The system's local data collecting PC contains an SSD module for the data collected during production and for storing the saved settings. The stored data will only be stored locally on the PC mounted on the IMM, thus following the production with the Cavity Eye system is only available on the IMM on which the system is mounted on.

An external data storing device (i.e. pendrive) is necessary for collecting the data in this mode. Connect the external data storing device to the PC, and you can manually copy the data to your external device.

⚠ The system's local data collecting PC's storage may reach capacity. In this case, the data stored for the longest time gets overwritten automatically. In favour of not losing any data, the data should be stored occasionally on an external device.

3.4.2. Central server data storing

For the easy access of the stored data and settings, the Cavity Eye system's PC has the ability to connect to the local network of your factory. The system connects to the network via USB-Ethernet adapter (not accessory) in the system's PC. After that, the production data and settings can be saved directly on a central server. The other PCs on the network can reach these data directly on the server.

⚠ Never connect other network devices on the system's switch. The Cavity Eye's switch is only capable of communicate with the system's sub-units.

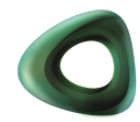
By connecting the SMC system to the local network, it is possible to share the screen and remote control each SMC systems with another PC via VNC (Virtual Network Computing) connection, so the possibility for the central production supervising is created. In this case, you can follow the production easily and quickly from anywhere with a PC using the network, and not only follow, but you can control, and/or interfere when necessary.

4. First steps

The Cavity Eye software is factory installed on the PC device of the system and ready for using. If you wish to use the system with other PC or laptop, then first you need to download the database, the running environment and the software from www.cavityeye.com website and install them according to our guides.

4.1. Start up

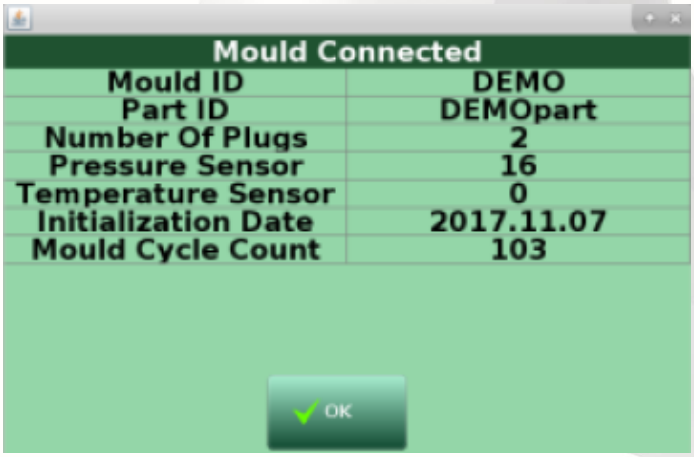
A Cavity Eye software can be started by clicking on the Cavity Eye icon once on the desktop.



The loading time usually takes 5-10 seconds.

Once the program loads the main screen appears. The left and right side of the screen consist of two columns of icons. These buttons navigate among the different panels and monitors of the Cavity Eye software. All panes are described further in this manual.

If proper number of SMP8 or SMP32 are connected to the mould with SMS8 or SMS32, then the program immediately reads the contents of the memory contained within. Once all data is read the following dialog summarizes the essential information about your mould:



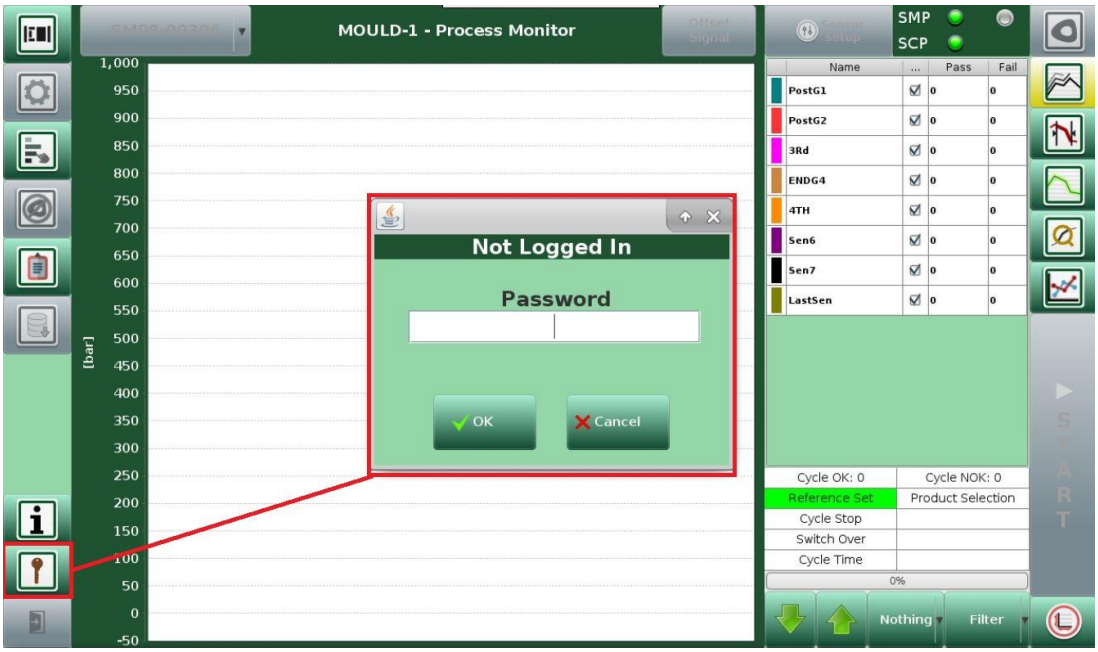
The information in the pop-up window is the following:

- Mould ID: The identifier of the mould
- Part ID: The identifier of the product
- Number of plugs: The number of plugs necessary
- Pressure Sensor: The total number of pressure sensors installed.
- Temperature Sensor: The total number of temperature sensors installed.
- Initialization Date: The configuration date of the memory unit.
- Mould Cycle Count: The total number of cycles performed by the mould

The dialogs above appear each time the measurement system is connected to a mould. When the SMP does not detect any memory connected, the following dialog informs about the separation:

4.2. Logging in, user permissions, logging out

Upon startup no user is logged into Cavity Eye by default. This is indicated by the blinking **Login** button:



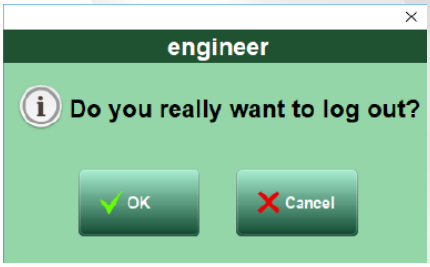
Without any user logged in most functions and settings are disabled. The **Log Monitor** is still accessible showing the latest production data.

By default, there are 3 user levels. Each user level has different permissions in using functions of the software. The three users are:

- Admin
- Engineer
- User

Selecting the user level only depends on the password typed in. The engineer's default password is **67890**. The user password is: **12345**. The default passwords can be modified later.

Clicking the **Login** button while logged in prompts a confirmation dialog before logging out.



4.3. The user interface

After logging in, buttons appear on each side of the screen.

On the left side:

	Mould manager	The mould and sensor data editing
	Settings	The settings of the software
	Event log	Tracking the actions and events on the software
	Production mode	Production without Cavity Eye supervision
	Device information	Inspection the connected devices and their condition
	Data export	Production data exporting into files
	Valve controller	Injection mould valves control settings
	Login/Logout	Logging in and logging out
	Software information	Software version, serial number information
	Exit	Exit the software

On the right side:

	Measure mode	Production control start/stop
	Process Monitor	Real-time visualizing the pressure curves
	Trigger Monitor	Setting the reference pressure curve
	Analisys Monitor	Setting the tolerances and control intervals
	Log monitor	Visualizing previous pressure curves
	Statistics monitor	Statistics of previous cycles
	Start/Stop	Data collecting start/stop
	Graph Scale Settings	Graph axes scaling

4.4. Mould manager

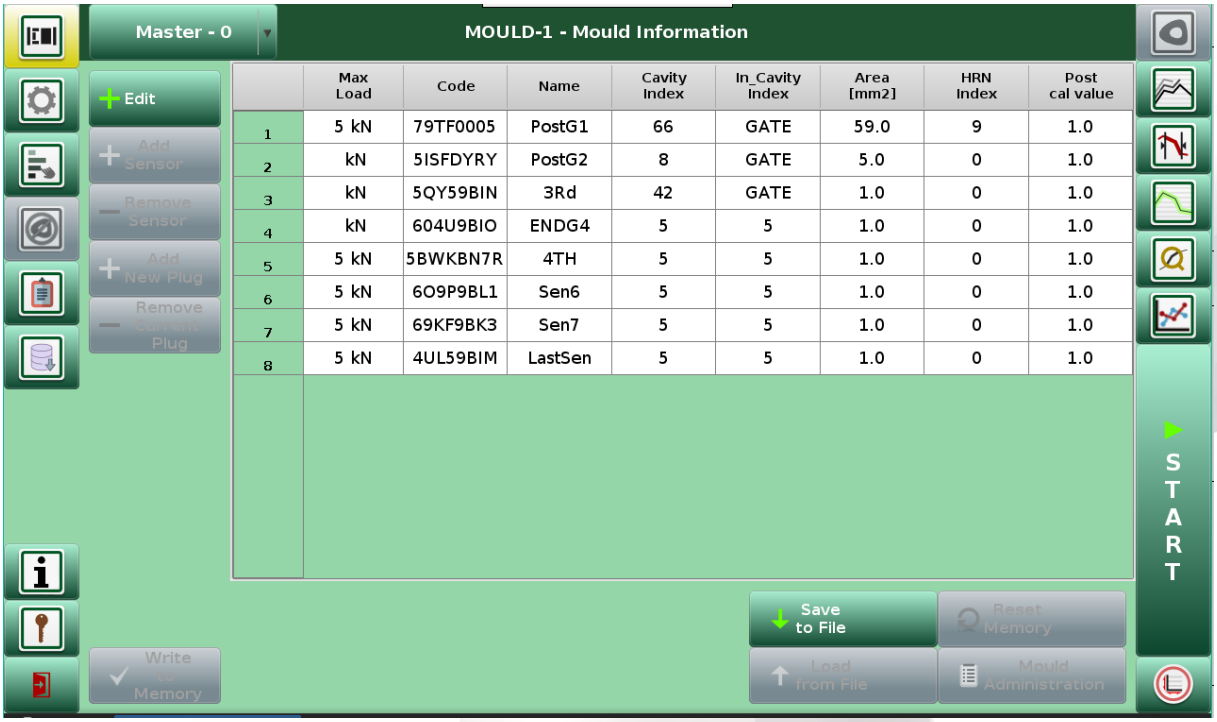
The mould informations and settings can be found in this menu.

All moulds fitted with Cavity Eye sensors expose an interface towards Cavity Eye. This interface is either a Smart Measuring Socket 8 (SMS8) or a Smart Measuing Socket 32 (SMS32). Both contains a memory unit which holds all the basic information related to the mould, like the mould and sensor identifiers and the sensor-calibration values.

In the Mould Manager window, the memory content can be reviewed and altered.

The mould's and sensor's data are loaded in the SMS after the sensors are installed. Changing anything in the memory is not necessary, until there are no changes on the mould, which would influence the measurement in any way, or new sensors are installed. The detailed description of the memory uploading process is included in the Cavity Eye Sensor Installation Guide.

The mould and the sensor informationd are loaded from the mould plug's memory. After editing, the software stores the data into the memory of the mould.



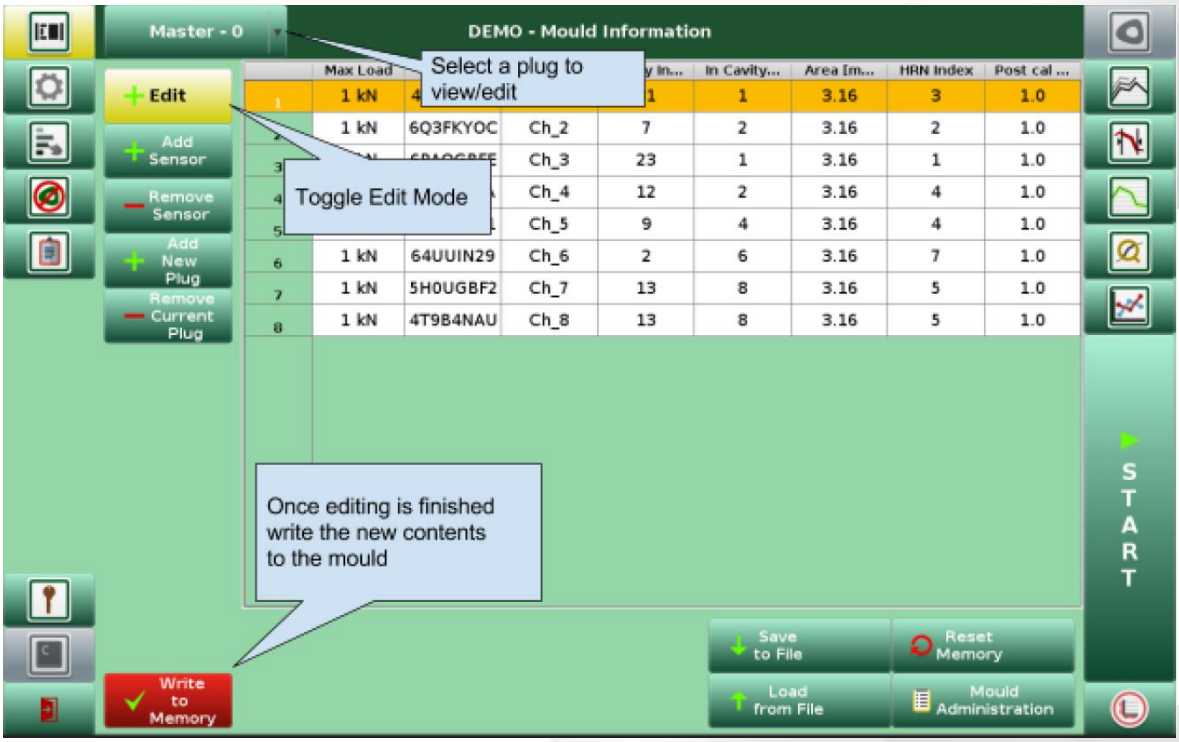
	Max Load	Code	Name	Cavity Index	In_Cavity Index	Area [mm2]	HRN Index	Post cal value
1	5 kN	79TF0005	PostG1	66	GATE	59.0	9	1.0
2	kN	5ISFDYRY	PostG2	8	GATE	5.0	0	1.0
3	kN	5QY59BIN	3Rd	42	GATE	1.0	0	1.0
4	kN	604U9BIO	ENDG4	5	5	1.0	0	1.0
5	5 kN	5BWKBN7R	4TH	5	5	1.0	0	1.0
6	5 kN	6O9P9BL1	Sen6	5	5	1.0	0	1.0
7	5 kN	69KF9BK3	Sen7	5	5	1.0	0	1.0
8	5 kN	4UL59BIM	LastSen	5	5	1.0	0	1.0

The pane above allows the editing of the sensors' attributes. The following attributes can be seen:

Properties	Description
Max Load	The maximum load a sensor can withstand. Comes from the sensor code automatically. Not editable.

Code	The code is provided by Cavity Eye Hungary Kft upon the purchase. Unique identifier of the sensor contains calibration values.
Name	The name of the sensor is used to identify it throughout the software. Free to choose.
Cavity Index	Index of the cavity that contains the sensor.
In Cavity Index	Position within the cavity.
Area	Surface of the sensor in mm2. (in 0.1 mm2 precision)
HRN Index	Hot runner nozzle index.
Post cal value	Post calibration value

By default, the Mould Manager opens in view-only mode. Users with at least engineer-level account can toggle the edit-mode simply by clicking on the Edit button.

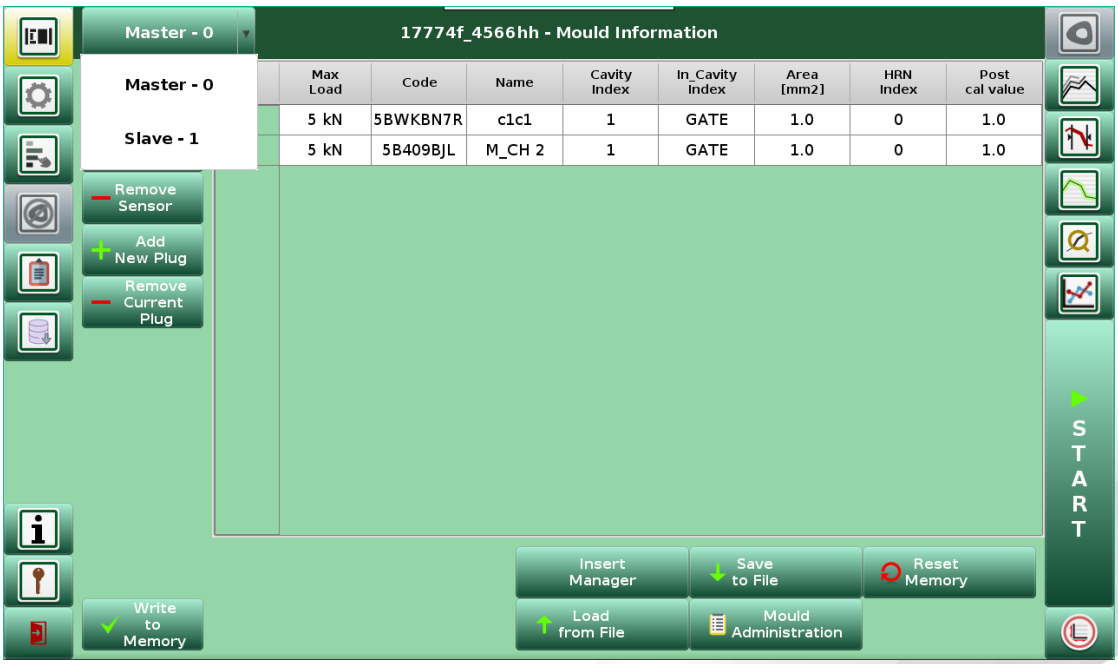


Add new plug/Remove current plug: In Cavity Eye sensors are grouped by plugs. In case the mould has multiple SMSs with attached sensors multiple plugs must be added and filled up with sensors accordingly. If more plugs are added then required, you can remove the unnecessary.

When adding new plugs, you have to add the first one as MASTER. The other plug will be added as SLAVE.

Add Sensor/Remove sensor: Add additional sensors to the currently shown plug or remove them.

The current plug is shown on the top left corner, pressing it switches among the plugs.



Save to file/Load from file: Save to file enables the current mould-settings to be written into a text-file. The Load from file feature reads these specific files and automatically fills up all mould settings editable in Mould Manager. Saves/loades the file on the PC or external device.

Reset Memory: Deletes the mould's memory.

Mould Administration: The Mould Administration button in the bottom-right corner prompts the Administration dialog where the mould's general attributes can be revised.

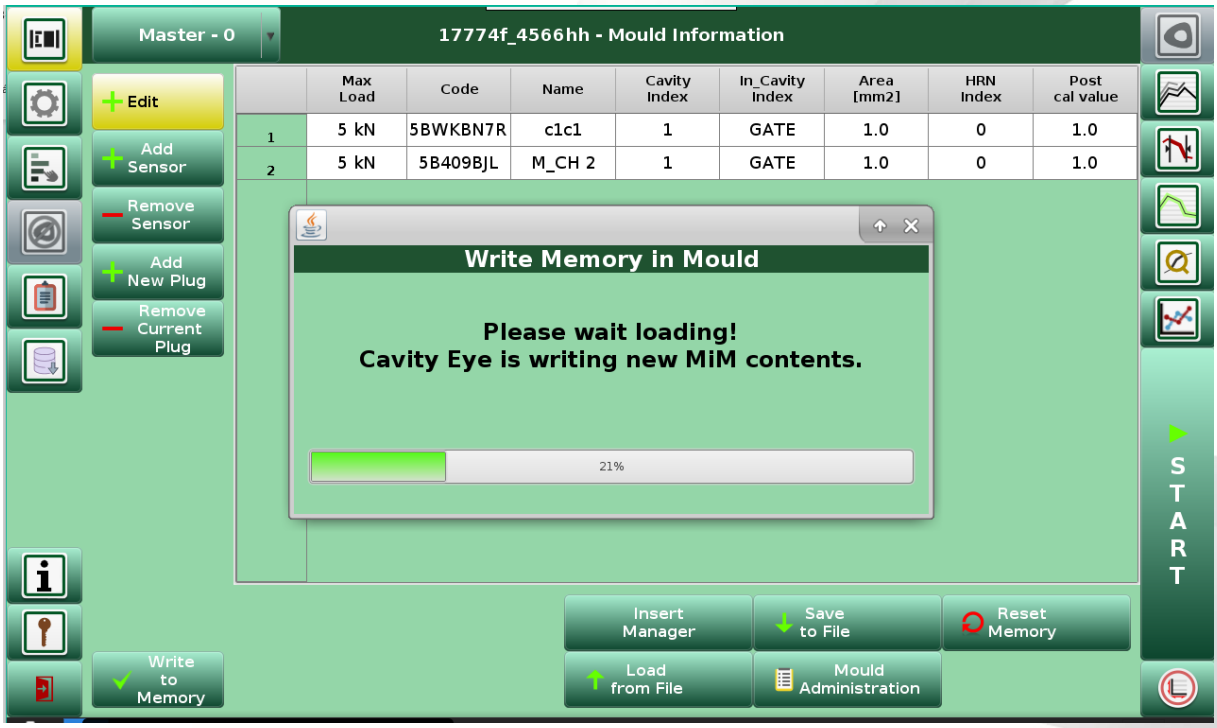
Protocol version: The memory's protocol version. Not editable.

Mould ID: Mould identificaiton code.

Part ID: Part identificaiton code.

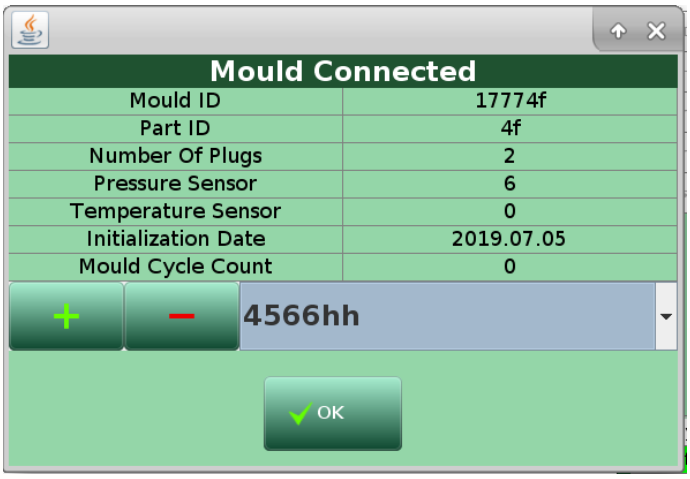
Mould Type: Standard or insert type mould.

Write to Memory: Upload data to the mould's memory.



4.4.1. Insert type moulds

If you set the mould type to insert in the mould administration window, a different dialog window will open at startup or mould connection.



The dialog requests to select the insert being currently used with the mould. Inserts play an important role in grouping, saving and loading production data and system-configuration.

⚠ If the insert type mould is set in the mould administration menu, then you have to choose or add an insert ID at every software start. You can not continue to the main menu, until there is an insert ID selected. The newly added insert ID is saved, when the first injection trigger is received on the device, and an injection cycle has been done

4.5. System settings

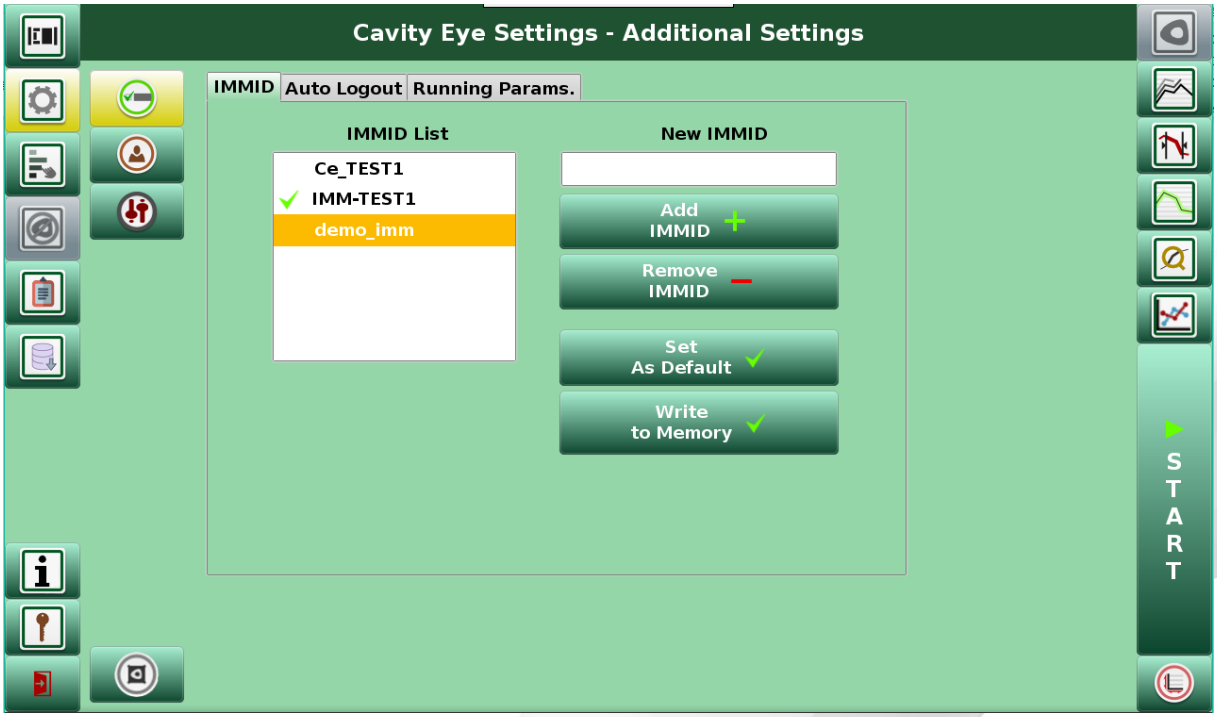
In this menu, you can find the general settings of the software. User accounts with engineer- and admin-level access have the right to edit the settings.

There are 3 submenus in the settings menu. The first is Additional Settings, which contains injection moulding machine identification (IMMID), the general running

parameters, automatic logout settings, product identification and you can check the SCP pin configuration as well.

4.5.1. Injection moulding machine identification (IMMID)

The IMMID submenu manages the injection-moulding machine identifiers. You can remove or add IMM-s and you can set the default to the machine currently in production.

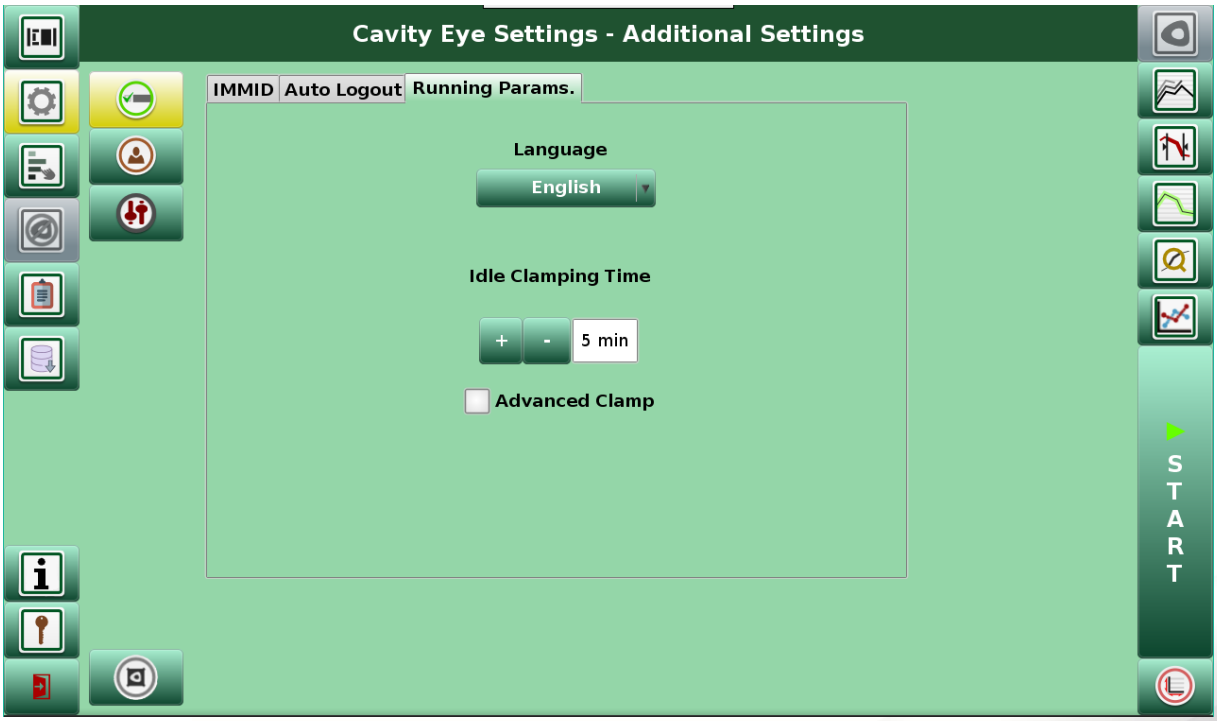


First, type the new IMMID in the textbox, then click on Add IMMID to add it to the list. If you select a default IMM, write it to the memory of the SCS.

The Injection Moulding Machine ID is automatically read from the machine socket's memory after the Smart Control Plug (SCP) is connected to the socket

⚠ When you first start the software after the system is installed tot he machine, you must create a new injection machine ID and set it as the default and then write it into the injection molding machine's memory. Measure mode can not be started until an IMMID has been added.

4.5.2. Running parameters and language



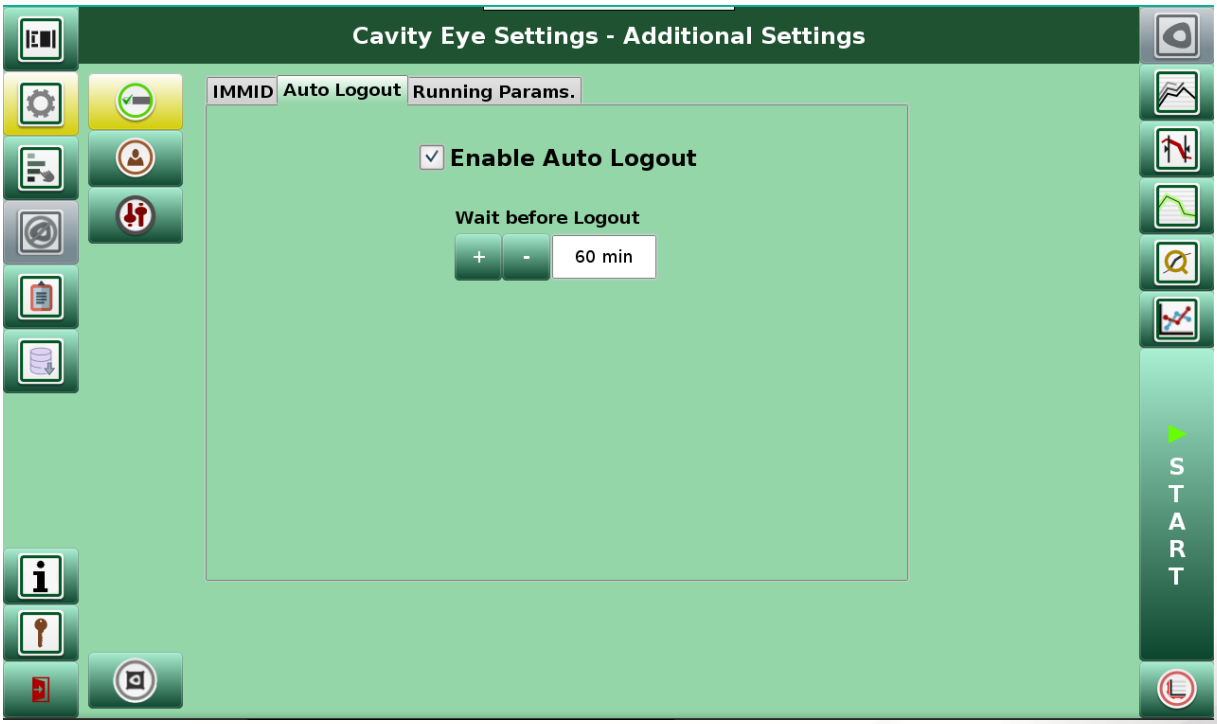
Language: You can choose the software user-interface's language. Cavity Eye needs to be restarted in order to load the selected language.

Idle Clamping Time: determines the amount of time need to pass before the system classifies the reattaching to the same mould to Cavity Eye as a new clamp. Meaning that passing this amount of time results in classifying the next connection as a change in mould and opens a new file (clamp) to save the data.

However, if you reconnect a mould to the system and start production before the Idle Clamping Time expires, the system will recognize this reconnection the same production period, thus avoding piling up a lot of clamp files.

Attaching different moulds consecutively always creates a new clamp

4.5.3. Auto logout



Enable Auto logout: can be enabled and disabled.

The Wait before logout: determines how much time must pass without user-activity before the system automatically logs the current user out.

Enable Screen Saver: Enables/Disables the screen saver.

Wait before turning on: The inactivity time, that activates screen saver

4.5.4. User manager

The User Management pane allows users to add and edit user information.

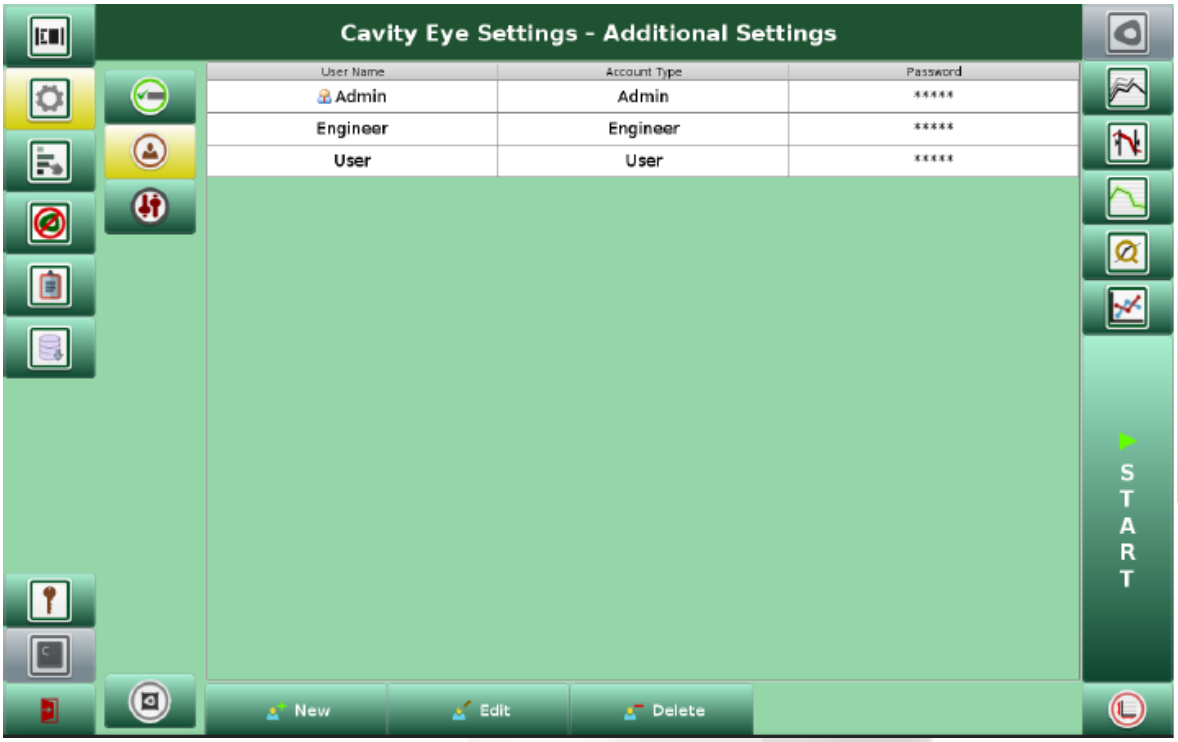
Cavity Eye handles three account types with different access-rights:

Type	Default Password
Admin	*„Ask Cavity Eye Engineers"*
Engineer	67890
User	12345

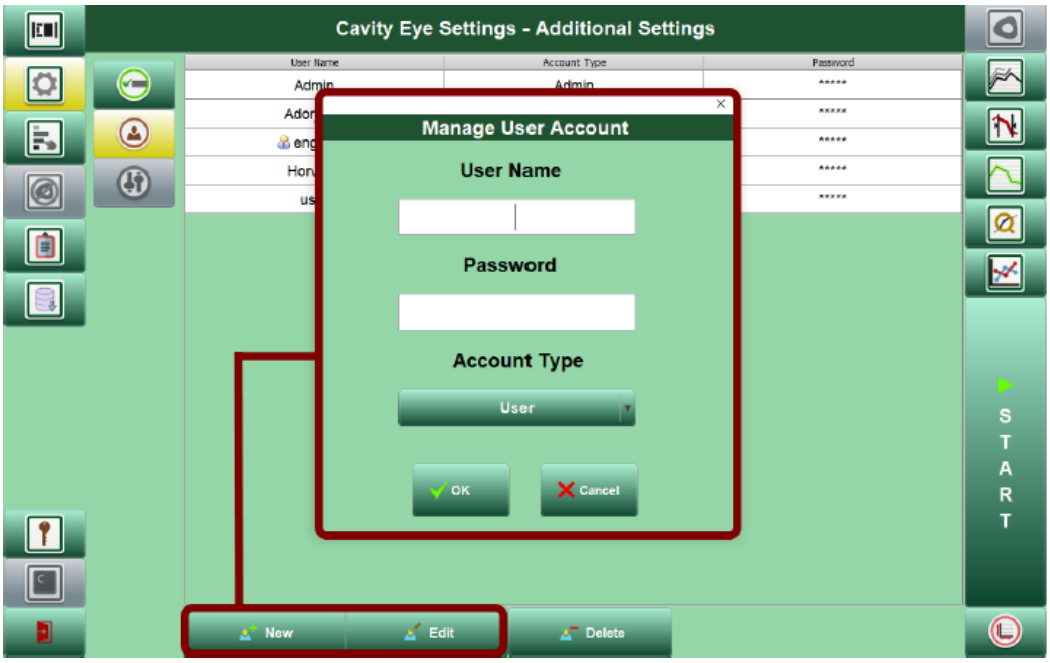
Admin user has access to every setting. Only Cavity Eye team can access.

Engineers have access to all necessary settings, and have the possibility to validate new reference data for production. Permissions are the same with admin without some extra settings, which are only available for admin users.

User type access has no permission for any production setting modification. Only the basic features are accessible, which are necessary to start production. Settings or parameters like reference curves and tolerances are not available. Users can start and stop data acquisition and production, overview the started production and the cycles' pressure curves



In this menu you can see the user names and their rights, and you can also manage the passwords here.

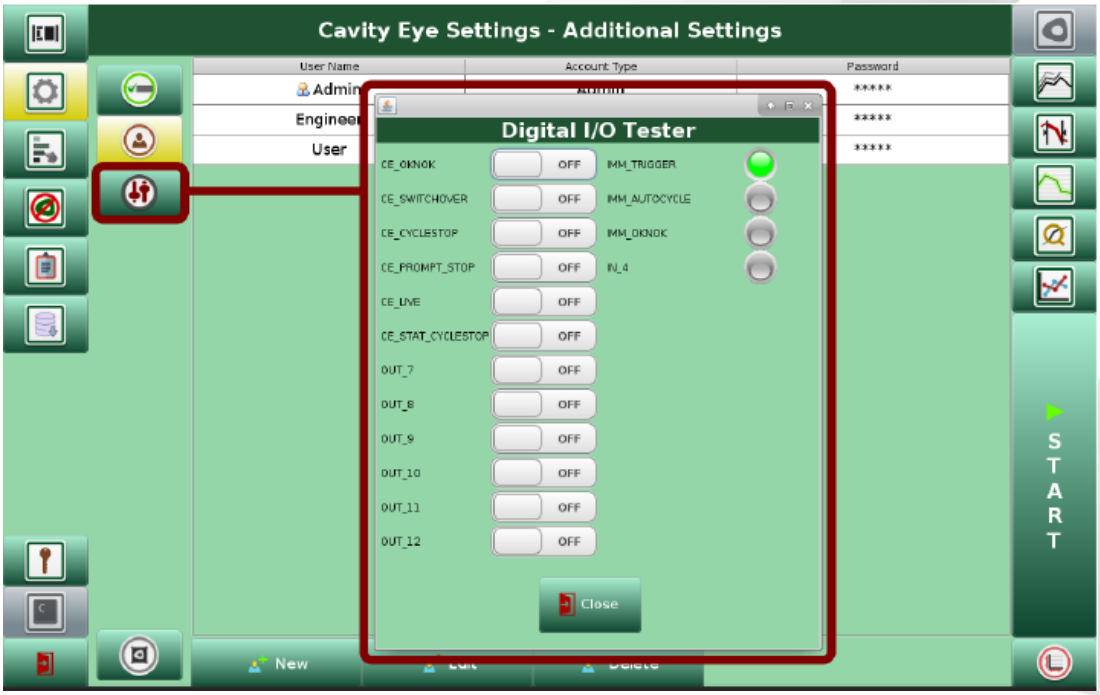


Adding new Users prompts the window seen in the figure above. You can set the Name, Password and Account type.

Only Admin and Engineer users has access to add new User or Engineer accounts.

4.5.5. Digital Input/Output testing

In the Digital I/O menu, a window pops up, where you can check the communication with the IMM, and other in and output signals.



Digital I/O tester dialog serves as a manual control for each output signal on the pins and also shows a green light feedback on each input pins. Each pin can be toggled or examined individually.

The Cavity Eye in- and output signals' name and description:

Output Signal	Description
CE_OKNOK	Selector signal in case of good part.
CE_SWITHOVER	External switchover signal to the machine
CE_CYCLESTOP	Stop the machine at the end of the cycle
CE_PROMPTSTOP	Machine stop immediately.
OUT_5 - OUT_12	Optional – Partial selector or valve controller

Input Signal	Description
IMM_TRIGGER	Injection start signal from the machine
IMM_AUTOCYCLE	IMM is in automatic mode signal from the machine
IN_3	Not used
IN_4	Not used

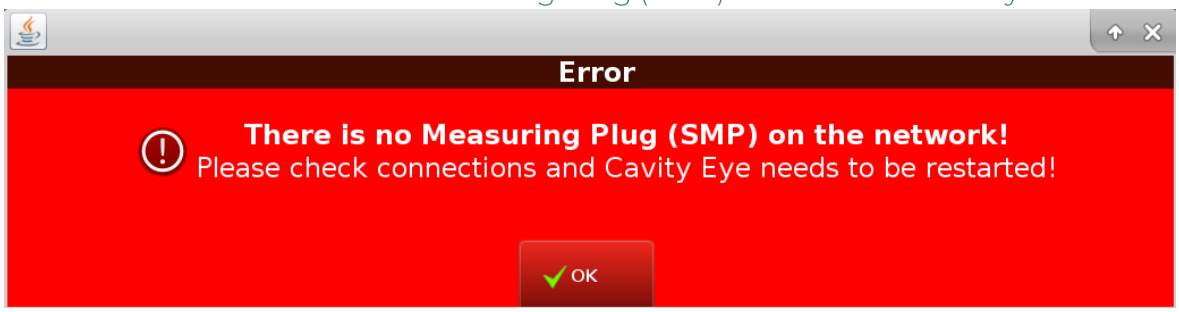
4.6. Softwareinformation

The software information window contains the actual software version and the serial number of the system.

4.7. Startup warnings

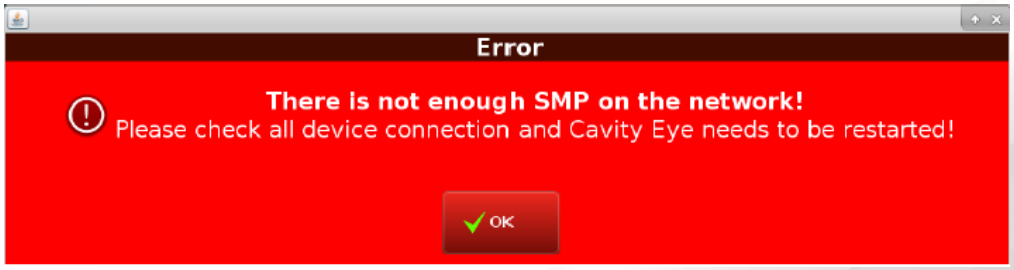
A list of error windows may appear upon system startup. This chapter will show the most frequent warnings. These windows contain information about the state of the measurement system and report any compatibility issues between the mould and current system.

4.7.1. There is no Smart Measuring Plug (SMP) connected to the system



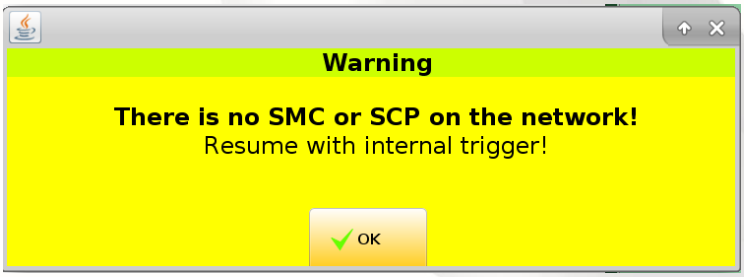
The data collection and most software features are not available without a connected Smart Measuring Plug. Please connect at least one Smart Measuring Plug to the system

4.7.2. There is not enough Smart Measuring Plug (SMP) connected to the system



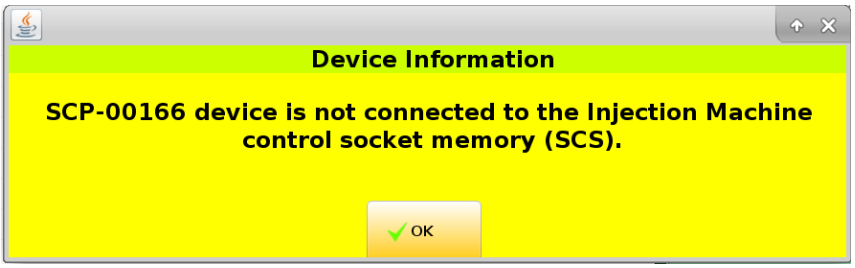
The amount of sensors stored in the mould's memory requires an appropriate number of Measuring Plugs connected to the system. If the system does not find enough Measuring plugs for the number of sensors, this warning will appear. The measurement will not start without enough Measuring Plugs.

4.7.3. The system did not found Smart Control Plug (SCP)



Although the system is able function without Control Plug, the data acquisition and storing are working normally, but Cavity Eye can not directly communicate or control the injection-moulding machine.

4.7.4. SCP connection to IMM



The SCP must be connected to the SCS socket installed on the IMM.

For more warnings and system errors, please see the Troubleshooting chapter in this guide.

5. Measuring with Cavity Eye software

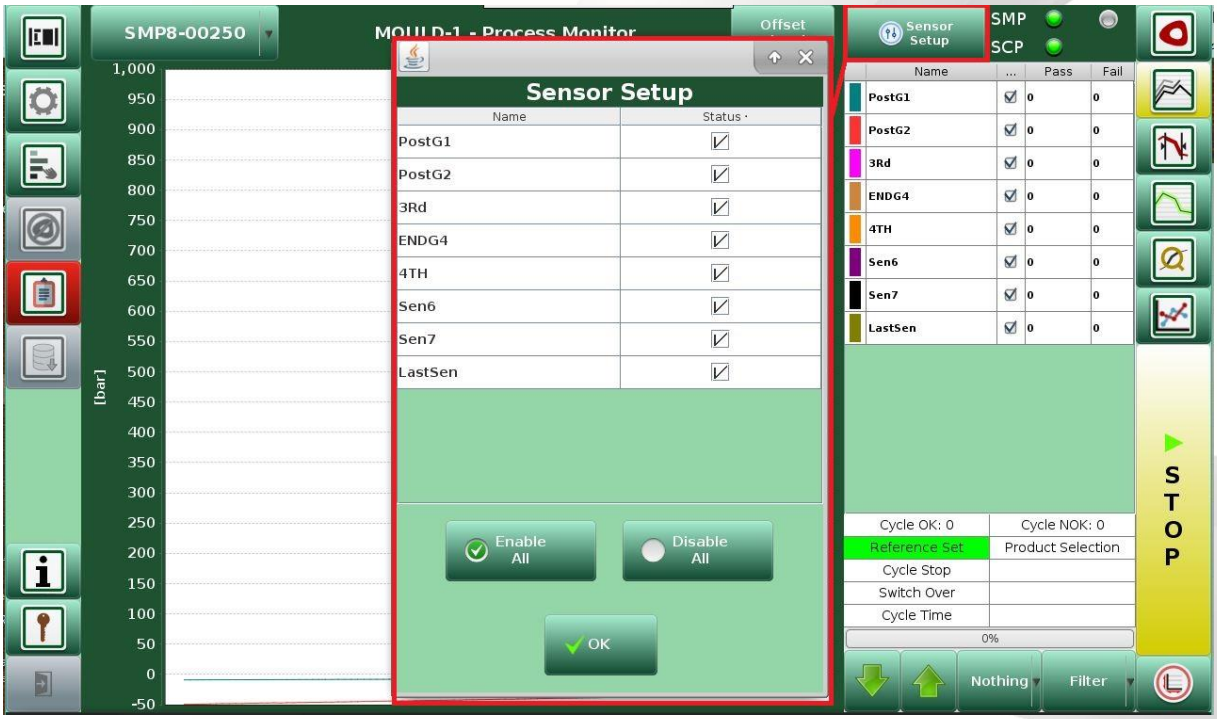
After starting the software, and if the mould is connected, the Cavity Eye software checks, if the database file stored in the mould's memory is compatible with the current system and whether the MouldIDs, PartIDs, IMMIDs and sensor IDs match. If the system was in production with connected mould before, then the last stored reference and production data is loaded automatically by the software. Previous reference curves and settings can be selected manually on the Reference Manager interface.

The reference curves and production setting are loaded from the files, so the Production parameters menu's setting are all set, moreover the reference curve and tolerances are loaded, thus the production starting process takes less time, you only have to set these data at the very first production start.

5.1. Starting a measurement

Once all settings are confirmed, launch the data-acquisition by clicking on Start button on the right side.

5.1.1. Sensor settings



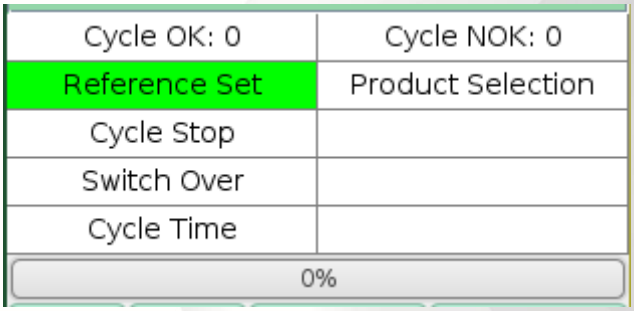
By untoggling the 'status' checkbox, you can disable the sensor, so the sensor does not take part in the analysis, the trigger or the switchover either. In case of faulty sensor or unused cavities, you can disable a sensor with this setting.

You can see the active, measuring sensors on the main screen's right side:

Colour	Each sensor has a colour assigned for identification.
Name	The Name assigned to a sensor in Mould Manager. If a channel is disabled the Name property receives a (D) prefix.
Visibility	Visibility of individual channels can be toggled. (Turning off the visibility of a channel does not result in stopping the measurement with that particular channel)
Pass/Fail	The **Pass** and **Fail** columns indicate the number of cycles during Measure Mode when a given channel was eligible for the tolerances set or not.

5.1.2. Information panel

The information panel can be found in the right bottom corner of the screen. This panel gives information about the Cavity Eye output signals. When the output signals are emitted, the adequate component of the panel changes to green background.



Ciklus OK: Counts the number of 'OK' evaluated cycles.

Ciklus NOK: Counts the number of 'NOK' evaluated cycles.

Reference set: Background color is green, if there is Reference curve set.

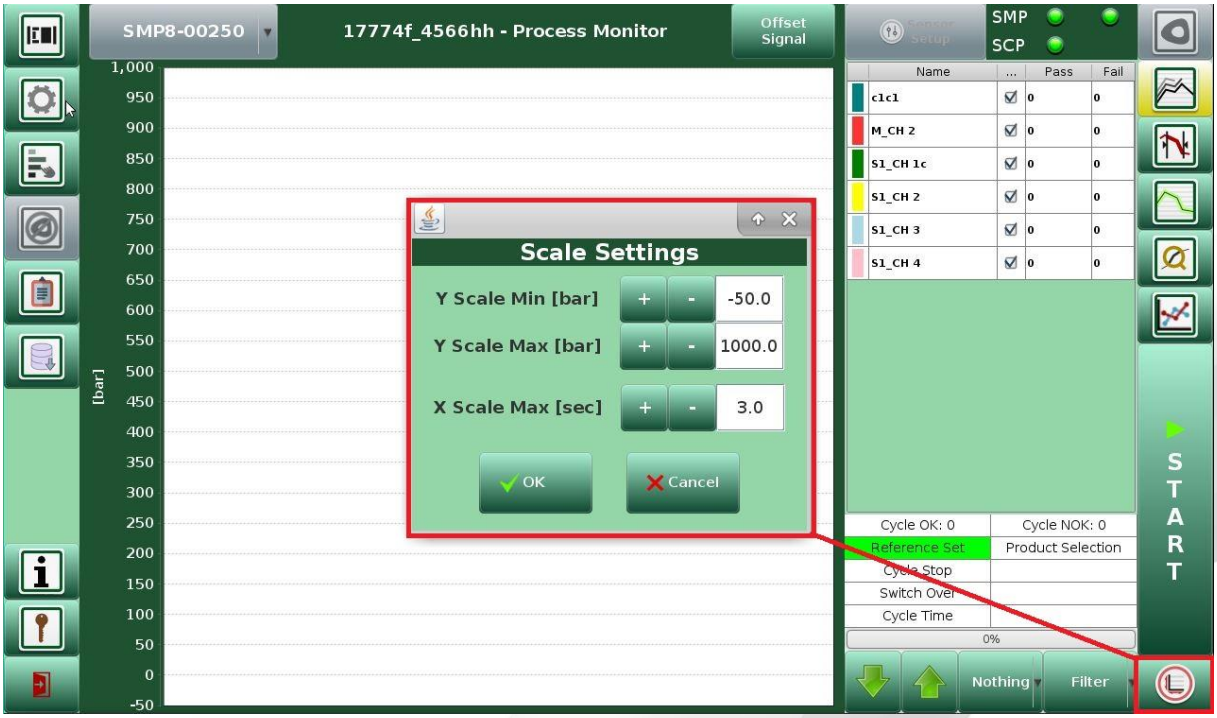
Product Selection: Background color is green, if the Selector Signal is on logical high output (24 V).

Cycle Stop: Background color is green, if the cycle stop signal is active, which is responsible for stopping the injection moulding machine at the end of the cycle.

Switch Over: If the Swicth Over to internal pressure setting is enabled, the background color is green, when the switch over signal is emitted.

Cycle Time: Shows the cycle time measured by the Cavity Eye in the cell to the right.

5.1.3. Graph axes scaling



Y Scale Min: The setting of the vertical pressure axis minimal value.

Y Scale Max: The setting of the vertical pressure axis maximal value.

X Scale Max: The setting of the horizontal time axis maximal value.

5.1.4. Using of the filter

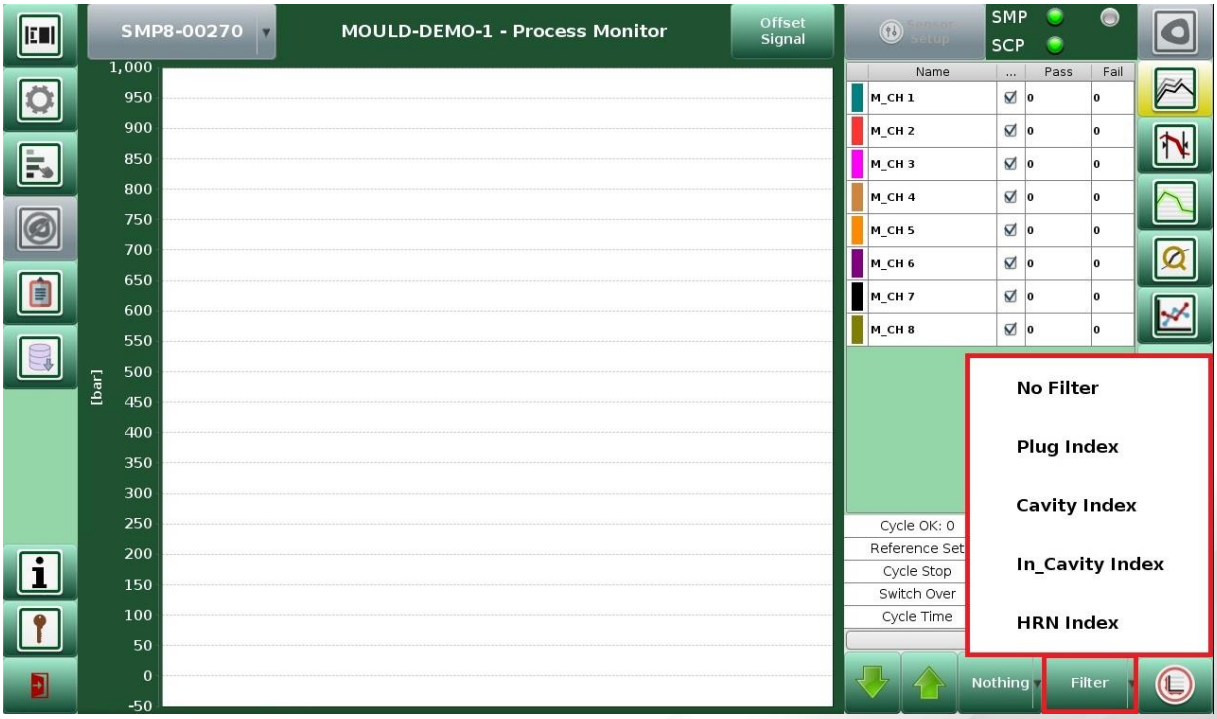
The sensors and the diagrams generated by the sensors could be filtered by a pre-definied filter.

Plug index: It shows the sensors of the given socket.

Cavity index: It shows the sensors of the given cavity.

In_Cavity index: It shows the sensors by their position of the cavity.

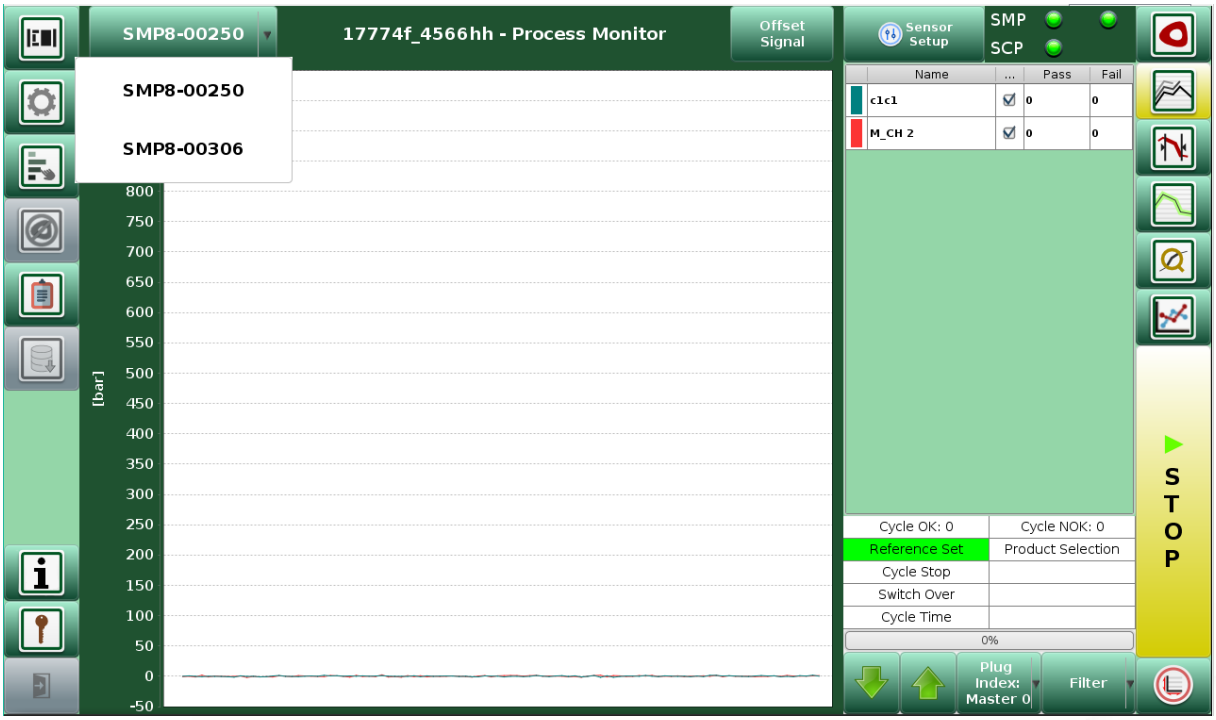
HRN index: It shows the sensors of the given nozzle.



5.2. Process monitor

After starting the data-acquisition, the **Process Monitor** shows the real-time pressure data by individual SMPs. The right side of the screen shows the list of sensors belongs to the selected SMP plug that provide measurement data.

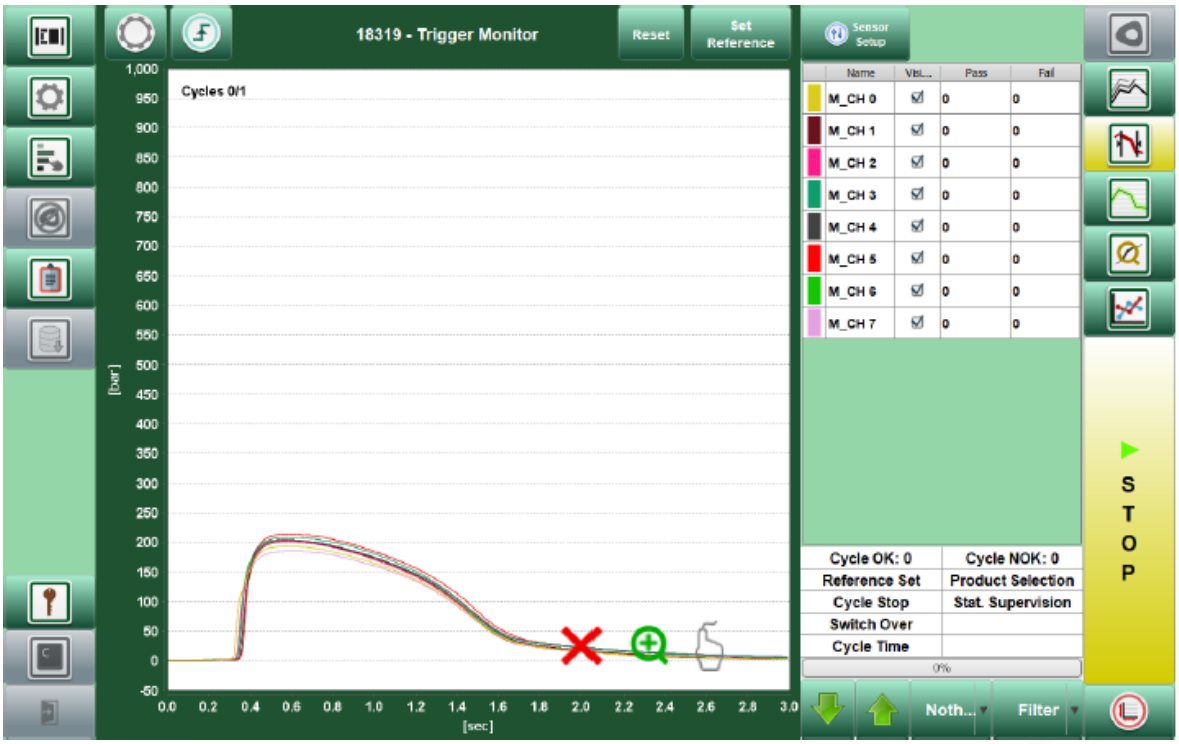
Switching among the connected SMP plugs is possible by clicking drop-down menu on the top left corner.



If the sensors are not loaded, you can set the pressure curves to 0 by clicking the ‘Offset Signal’ button.

5.3. Trigger monitor and triggering

Trigger Monitor shows the pressure curve data acquired under a full cycle. It is the main component of Cavity Eye to determine cycle-related settings, the data acquisition time interval and the reference data that serves as the base of validation later in the production.



The measured cycle is a key concept in Cavity Eye. The cycle has a starting point and a time interval, which together set when the data acquisition has to stop.

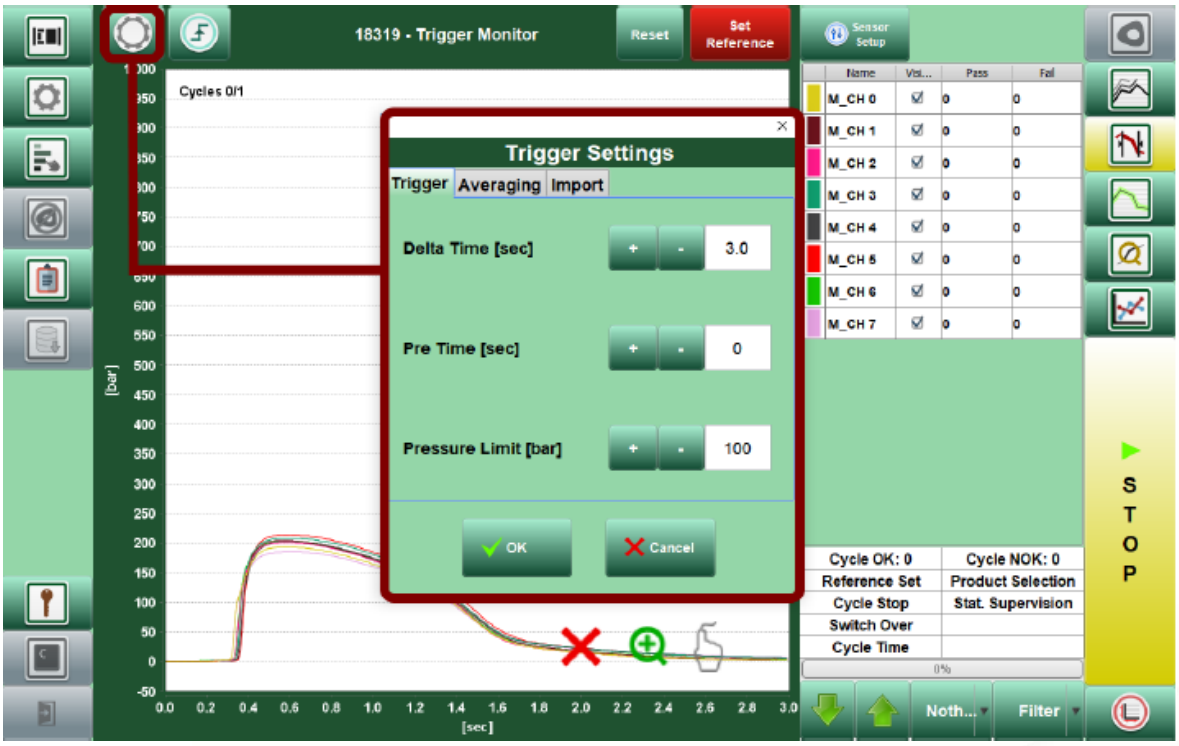
The starting point of a cycle is can be determined in two ways:

External triggering: the default triggering process supported by Cavity Eye. If the Cavity Eye can communicate with the injection moulding machine through an SCP this method is possible. The cycle starts when the injection moulding machine emits the IMM_TRIGGER signal on the appropiate input signal of Cavity Eye.

Internal triggering: Internal triggering is a supplementary function used, when SCP-based triggering is not possible. The cycle-start is triggered, when the pressure-value measured by any channel reaches the Pressure Limit.

5.3.1. Trigger settings

The trigger settings menu can be found in the top left corner (gear icon):



⚠ If you have a reference set, you can only change the Trigger settings if the actual reference was reset. Until a reference is reset the Trigger settings button will be inactive.

Delta Time: The time span of data acquisition in seconds measured from trigger-start.

Pre Time (internal triggering only): Adds the time-specified amount of data to the cycle from before the internal trigger start period. Effectively moves the starting point of a cycle with seconds you set, before the pressure limit condition is satisfied.

Pressure limit (internal triggering only): Passing the pressure limit on a channel provokes trigger-start in internal triggering mode.

⚠ The Cavity Eye software start evaluating good or bad part and giving output signal corresponding with the part's evaluation right after the data-acquisition time (Delta time) passes.

5.3.2. Setting a reference

After setting the optimal technology, if the quality of the products is good, the current pressure curves can be set as reference. You have the possibility to average more cycles data to get a reference curve.

You can set that you want a single cycle to get a reference or the average of more cycles as you can see in the figure above.

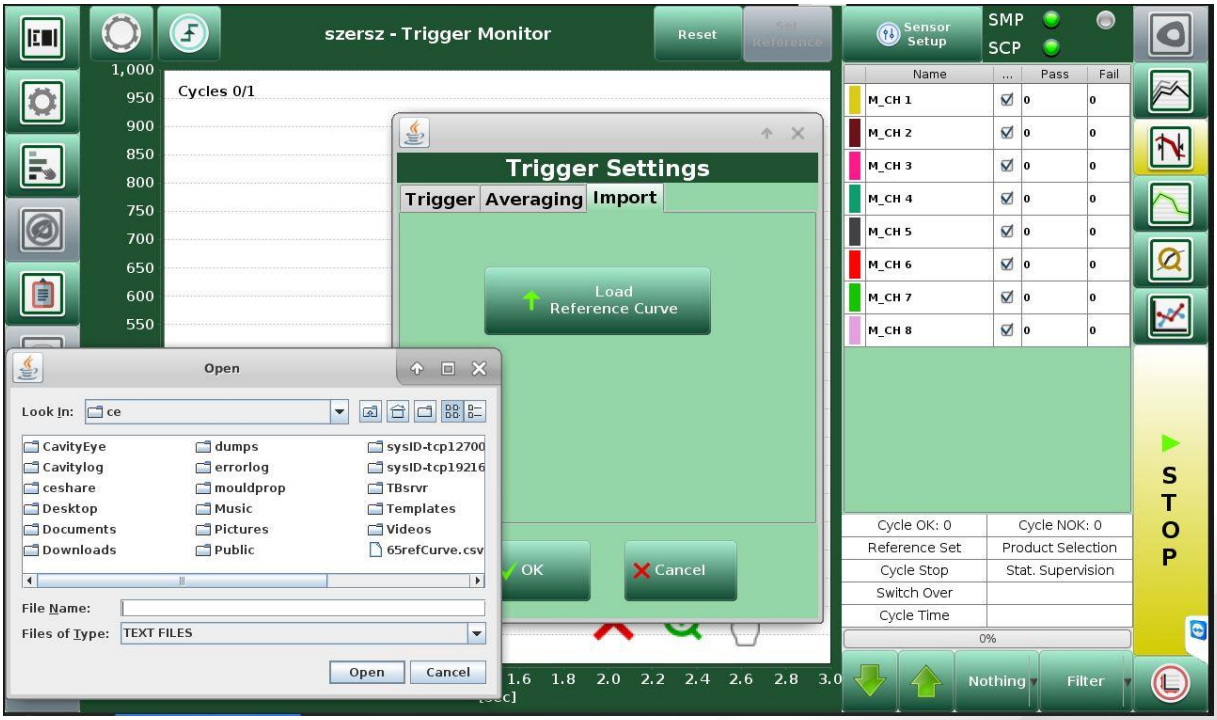
You can follow the pressure curves of injections cycle by cycle in the trigger monitor. After setting the optimal technology and finding the part good, then you can set the the pressure curves as reference.

You can set the reference with the blinking **Set Reference** button on the top.

You can remove the actual reference curve by clicking on the **Reset** button.

> ⚠ The reference will be saved and stored only, when the Measure mode is started using the reference, and an injection cycle has been done.

With the **Import** function, you can use reference data from external files. Importable files are created using the **Reference Manager's Export** function, which is discussed later in this manual.



5.3.3. Switch Over Settings

The Cavity Eye system is able to give out switch over signal to the injection moulding machine from the measured cavity pressures.

The system starts switching over by cavity pressures once the **Enable Switch Over** checkbox is toggled. You can set which sensors you want to take part in switching over by toggling checkboxes at each channel. Moreover, you can set the **switch over pressure,** which is the value of pressure passed that triggers the CE_SWITCHOVER output signal.

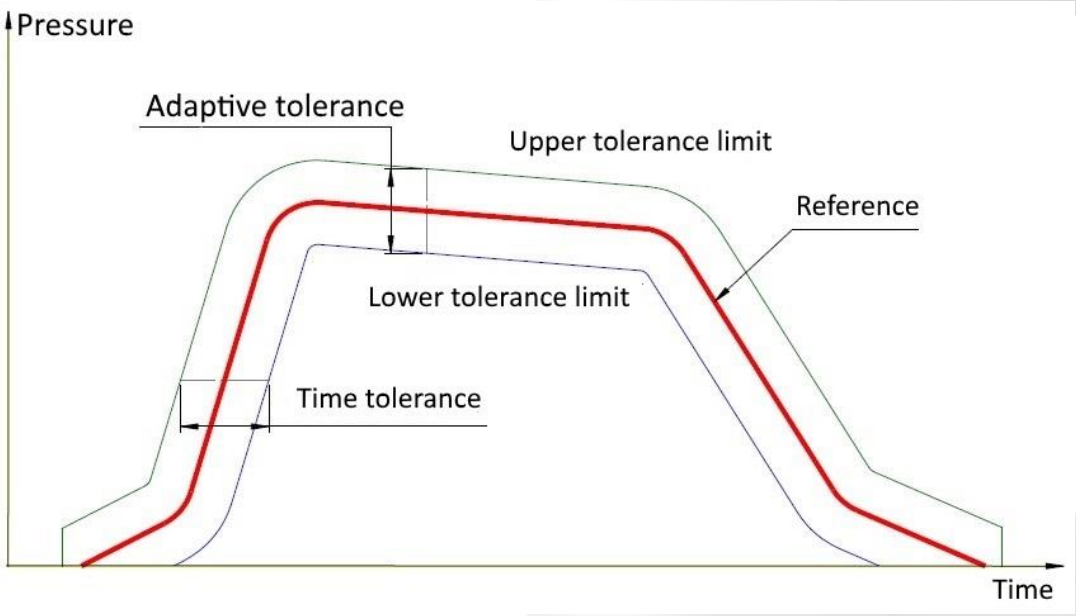
> ⚠ The Cavity Eye switch over by measured pressure function operates only, if the previously installed SCS socket's CE_SWITCHOVER output is connected to the adequate IMM input signal.

5.4. Analysis Monitor and tolerances

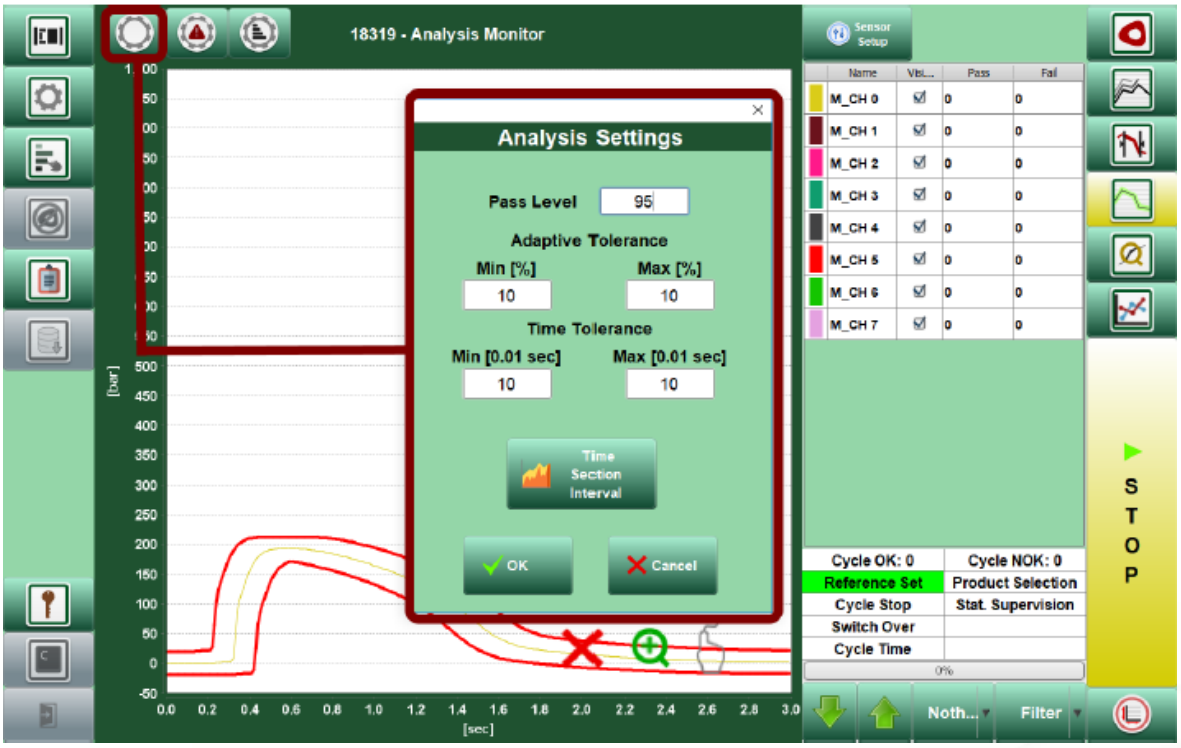
After setting a reference, the analysis monitor automatically opens. The analysis monitor shows only one selected channel's cycle-data along with it's upper and lower tolerance. The default tolerance is ±10%.

5.4.1. Tolerance settings

The following figure helps you visualize the tolerance settings:



Opening the settings in the top left corner (gear icon), you can set the tolerances of the reference curve.

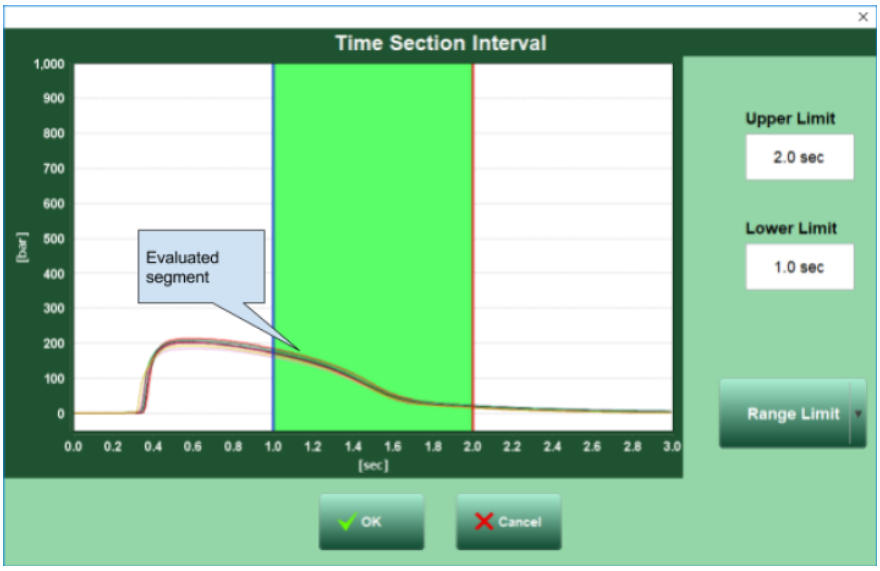


Adaptive tolerance: The Min and Max values position the upper and lower tolerances along the vertical axis (in %)

Time tolerance: The in and Max values broaden or narrow the upper and lower tolerance along the horizontal axis (in %)

Pass level: determines the minimum amount of points in percentage of the cycle total, that are required to fall between the two tolerances for a channel to be evaluated as OK.

Time Section Interval: Narrowing the interval in the cycle, which gets evaluated. Only the highlighted area is evaluated, the rest of the pressure-values is ignored.



5.4.2. Cycle stop settings

The Cycle Stop function allows Cavity Eye to stop the injection moulding machine at the end of a machine cycle if the pressure reaches the upper or lower limit.

Enable max limit: If any of the sensors reach the set maximum pressure limit, the machine stops at the end of the cycle.

Enable min limit: If any of the sensors does not reach the set minimum pressure limit, the machine stops at the end of the cycle.

You can also set the Statistical cycle stop in the Analysis monitor.

> ⚠ The Cavity Eye machine cycle stop function operates only if the previously installed SCS socket's CE_CYCLESTOP output is connected to the adequate IMM input signal.

With the **Cycle Averaging**, you can set how much cycles you want to be averaged and evaluated. **Mean limit** and **Deviation limit** creates the possibility to statistically supervise your production. You are able to set limits of the given parameters in percentage of difference, thus reaching beyond these limits will stop the machine at the end of the cycle.

Pressure Maximum: The supervision of the mean and deviation of the pressure maximums.

Pressure Integral: The supervision of the mean and deviation of the area under the pressure curves.

Filling time: The supervision of the mean and deviation of the time when the pressure curves reach the preset pressure value.

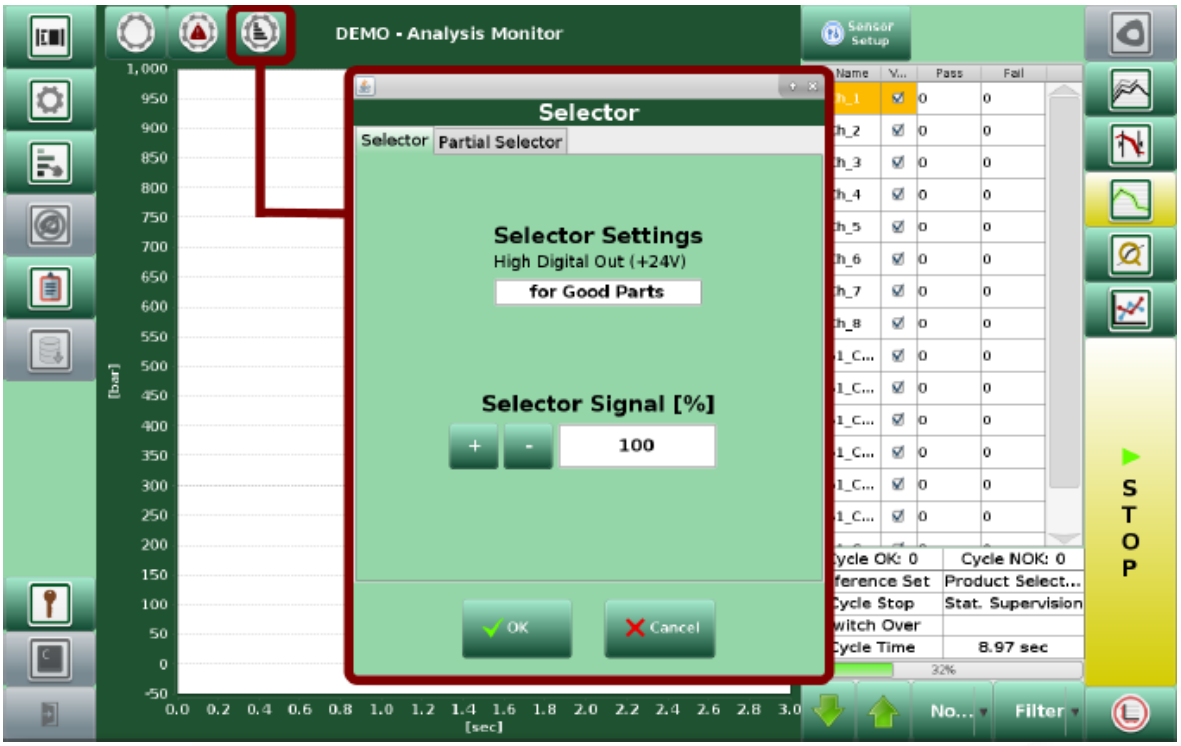
5.4.3. Product sorting

Cavity Eye system can sort bad parts based on the evaluation of the reference curves and their tolerances.

Cavity Eye supports two types of part selector:

For Good Parts: When a cycle passes as OK, Cavity Eye emits the CE_OKNOK signal given an SCP is connected to the measurement system.

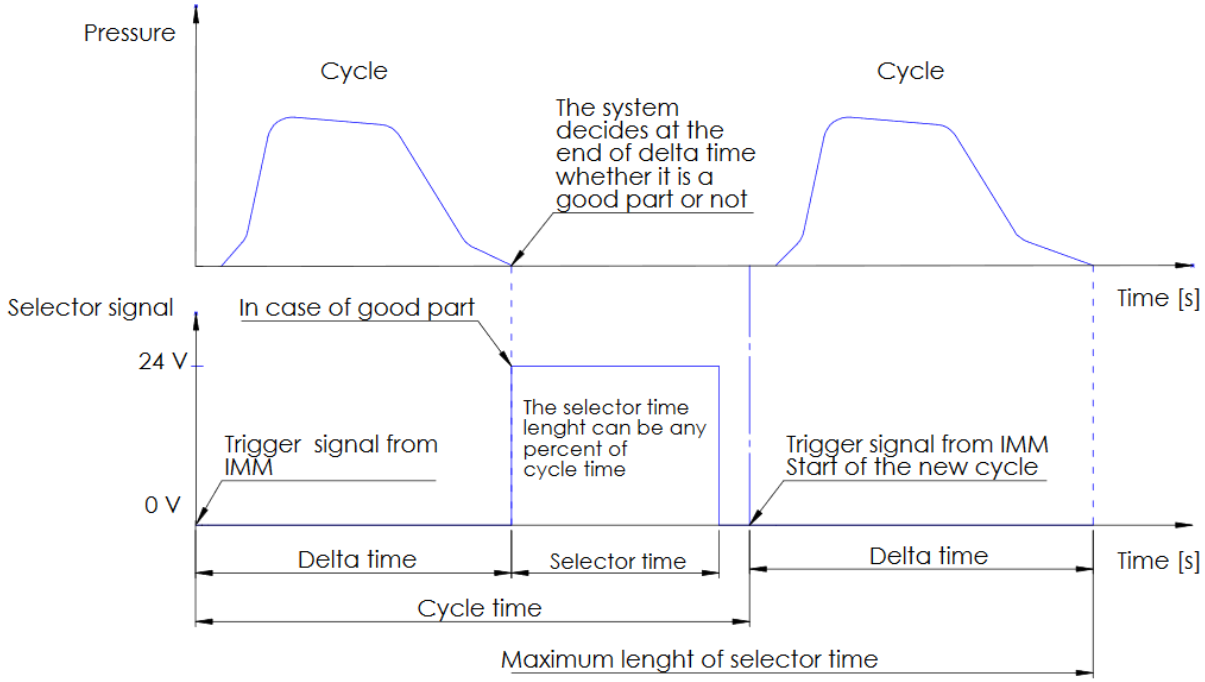
For Bad Parts: When a cycle passes as NOK, Cavity Eye emits the CE_OKNOK signal given an SCP is connected to the measurement system.



Selector Settings: The system can emit logical high (24V) signal either for Good parts or Bad parts. Administrator-level setup, please contact our staff to modify.

Selector Signal [%]: Determines the length of the selector signal in percentage of the machine cycle length.

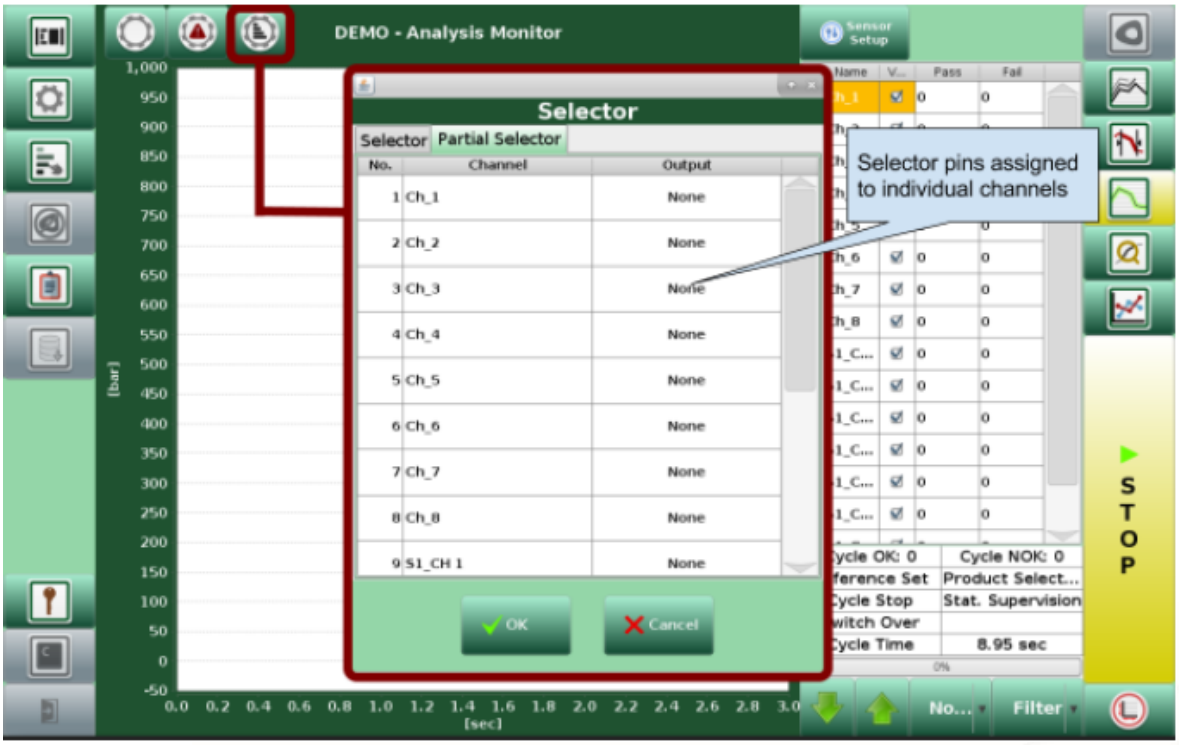
The following figure shows how the selector signal works next to a cycle's pressure-time graph:



The maximum length of selector time is reached, when the next cycle's selector signal is starting, even when emitting the selector signal for more, than 100% of cycle time.

⚠ The Cavity Eye part selector functions only, if the previously installed SCS socket's CE_OKNOK output is connected to the adequate IMM or robot input signal. The system emits selector signal in case of good parts by default. Changing to emit in case of bad part can be applied, if an Admin access right user is logged in. However, changing this setting will result in the Cavity Eye system not emitting bad part signal, when it is shut down, so every part will be evaluated good.

The Cavity Eye system supports partial selection by each channel individually, thus in case of a multiple cavity mould, only those cavity's parts will be thrown, which are not sufficient to the selector condition.



In the **Output** column individual output pins on the IMM controlling socket (SCS) can be assigned to individual channels. The same pin can be allocated to multiple channels' selector signal.

6. Starting the production

Before starting to use the injection machine with Cavity Eye system, you need to check the sensors and the input and output signals, in order to start production safely.

6.1. Sensor checkup

In case of the first time mounting the mould to the injection moulding machine after installing the Cavity Eye sensors, a thorough checkup needs to be done before closing the mould on the machine.

The sensors placed in the mould go through a so called “dry test” after installation. In the dry test, a check of all the connections are performed, and an inspection whether the sensors are preloaded, or put under stress with the placement. After mounting the mould on the injection machine, you should check whether all sensors provide signal by pushing the ejectors. While pushing the ejectors, proceed to the Process Monitor on the Cavity Eye software to see the real-time pressure curves.

If you find all sensors functioning well, then you can close the mould for the first time. This should be done in manual mode with the lowest closing force possible. You have to simultaneously check the pressure curves on the Process Monitor while closing the mould. If any of the sensors got preloaded during closing, meaning that the pressure curve rose from the zero level significantly, then the system is working properly, and the sensors may damage.

⚠ If the pressure rises significantly on any sensor’s pressure curve, you must stop closing the mould, because the sensors may get damaged.

6.2. Checking the IMM’s signals

Before starting the Cavity Eye’s production supervision, make sure that the Cavity Eye system gets the input signals from the IMM, and the IMM gets the output signals from the Cavity Eye system.

The easiest way is to go to Settings (left side gear icon) and select **Digital-Input/Output tester**. If the IMM sends signals to the adequate input, a green

indicating light will glow. You can also emit the signals to the IMM manually, and you should check at the machine whether the signal is received.

6.3. Measure mode

If the technology is optimal, the machine parameters are set and the IMM is in continuous production mode, then the Cavity Eye production supervision can be started by clicking on the Measure Mode icon.

Turning measure mode on results in data acquisition and analysis, production supervising and emitting the selector signal to sort the parts not eligible for the selector conditions. By default, the system emits the selector signal in case of a good part (pressure curve between tolerances). In case of a bad part (pressure curve out of tolerances) no signal is emitted, so the scrap parts are automatically sorted.

⚠ Turning measure mode on disables all settings of data acquisition.

The Cavity Eye system does not emit good part signal before turning the measure mode on, so the production before goes to waste.

Measure mode saves are set as default in case of attaching the mould later, if they have not been stored in the memory beforehand. The system will reset from these data: loads the cycle start settings, tolerances and refence curve.

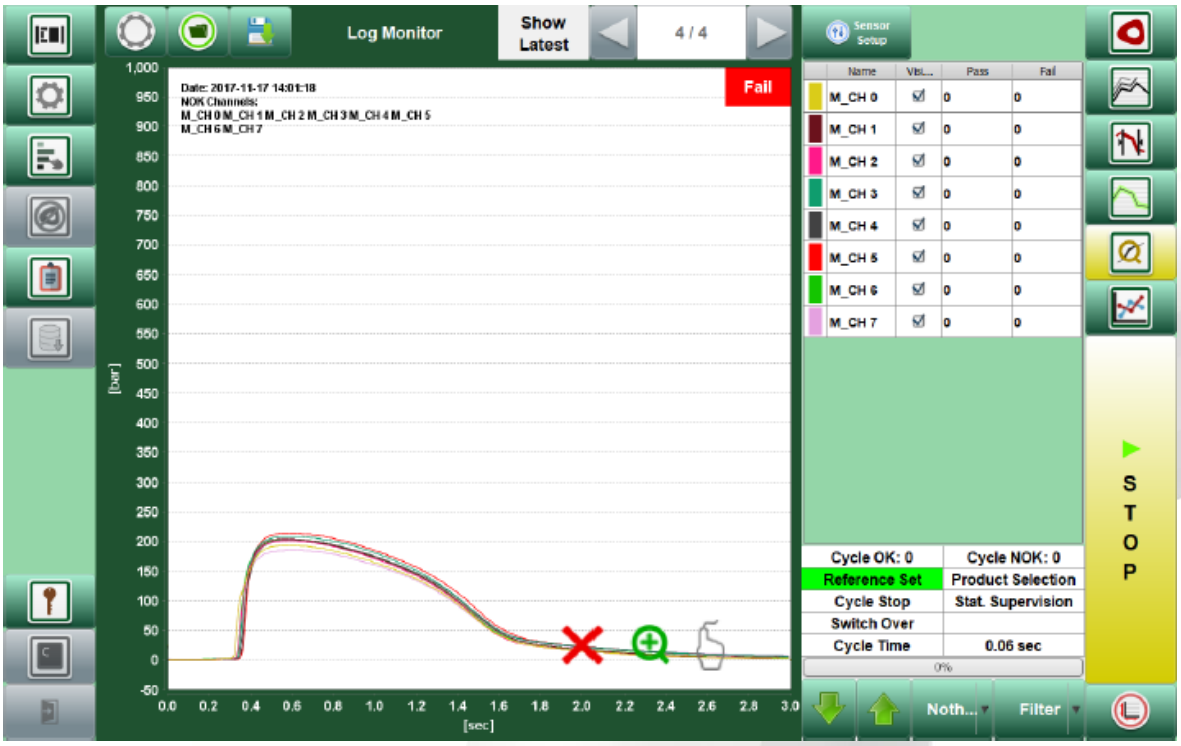
After turning measure mode on, make sure that the IMM can receive the Cavity Eye's selector signal.

7. History management

The software provides the opportunity to see the data of the previous production periods with current, and previously connected moulds as well.

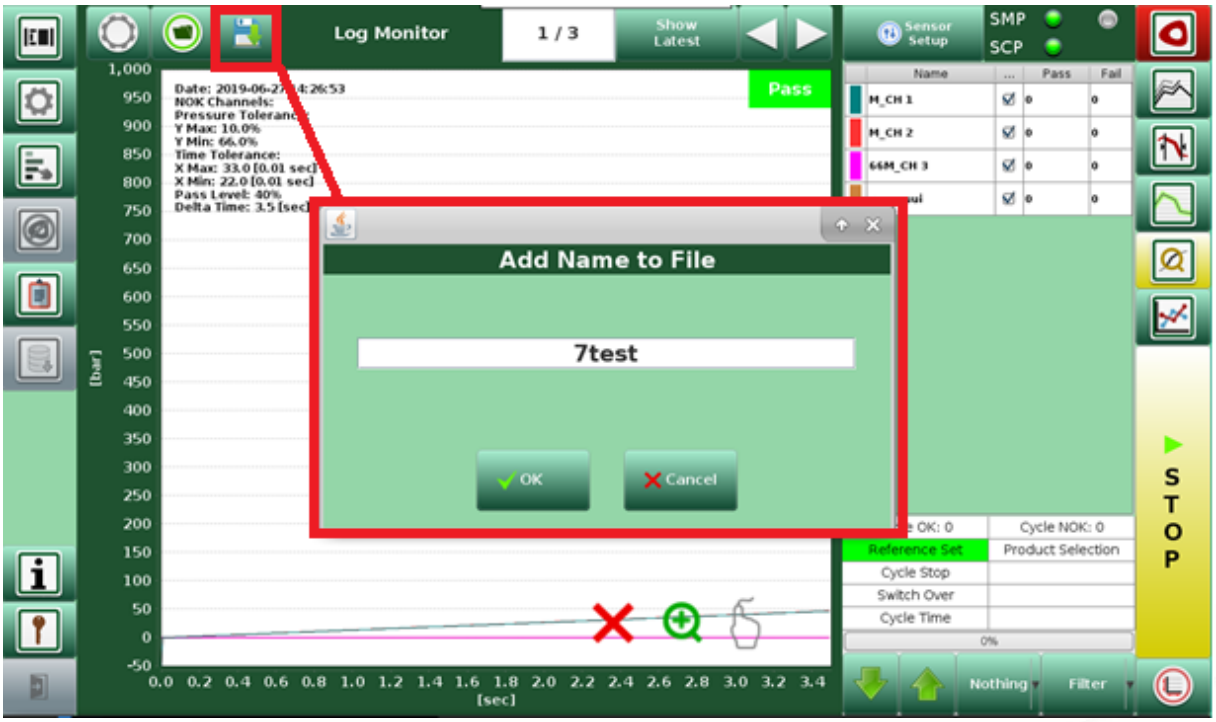
7.1. Log monitor

You can find the Log monitor icon on the right side of the screen, where you can monitor and manage the data of the latest cycles. In this menu, you are able to see the actual measurent's result. If there is no measurement running, you can see the current mould's previous productions' data.

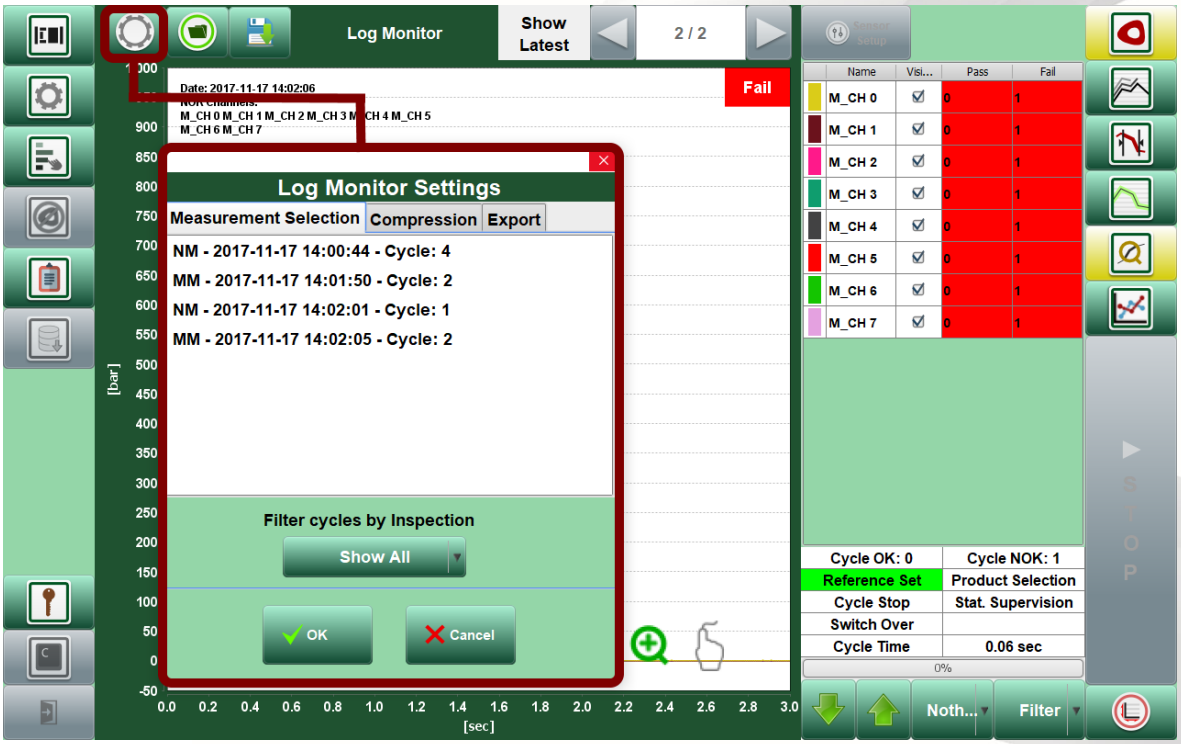


By clicking on **Show Latest**, the pressure curves of the latest cycles appear. You can choose to see earlier cycles by clicking on the arrows next to Show Latest.

You can save the actual pressure curves in .csv format to the PC, or any external data storing device by clicking on the **Save** (floppy) icon. A window will pop-up and ask for a file name. Click OK, and the curves are saved.

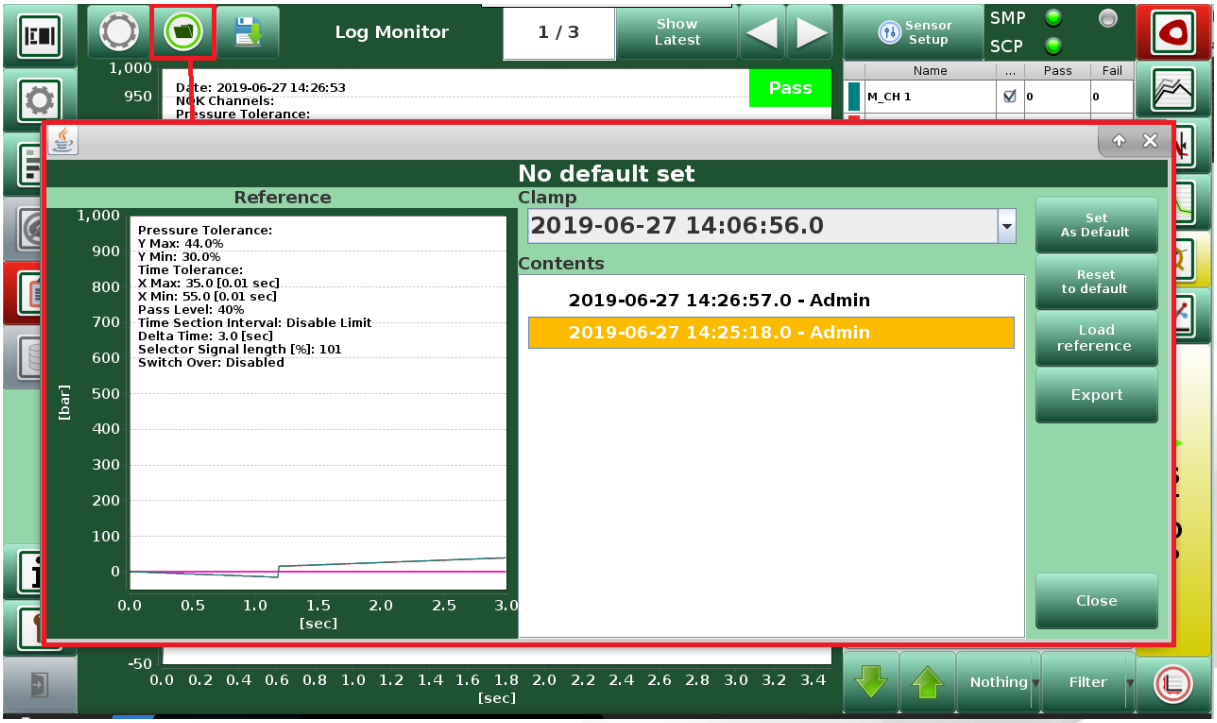


In the Log Monitor **settings**, you can choose which earlier measurement you want to see on the screen. The production periods are marked with time stamps, and you can see whether the production was in measurement mode (MM) or non-measurement mode (NM). Moreover, you can also see how many cycles the measurement contains.



The **Filter Cyces by Inspection** gives you an option to filter the cycles, for example to only see the NOK evaluated (scrap product) cycles.

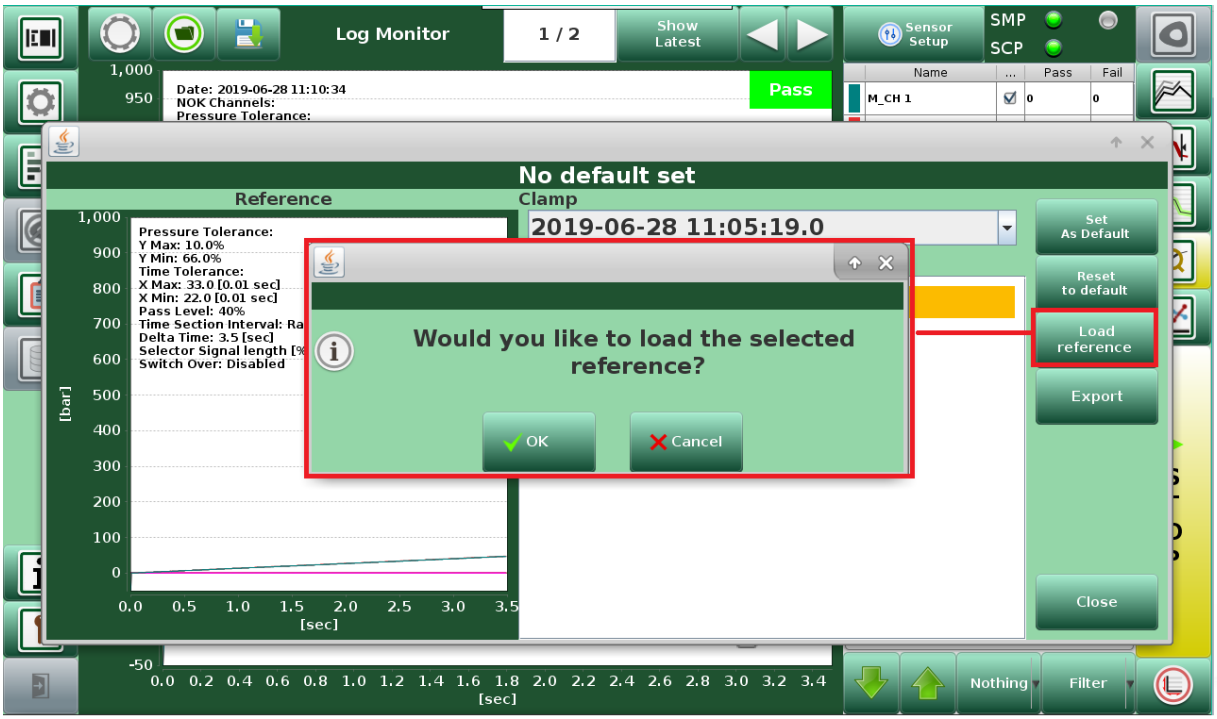
7.1.1. Reference Manager



You can load Clamps of previous productions and other moulds in the History Manager. You are also able to see the reference data and you can set a default reference with the **Set as Default** button. The Cavity Eye will always load the reference set as default at the start.

The choosen reference data can be saved in .csv format with the **Export** button. The file saved with this function can be imported later at the Trigger Monitor import function.

The **Load reference** button can load the reference of the selected production. It will only load the reference if the reference is **resetted** on the trigger monitor, and the START button is on.



After the software has finished loading the reference, it will automatically guide you to the trigger monitor, and you can push the Set as Reference button for the loaded reference. This feature will automatically load back all the reference settings and parameters:

- Delta time,
- Selector signal length,
- Tolerances and limits
- Switch over values
- Pass level

7.2. Statistics monitor

The Statistic monitor will appear, when clicking the statistics icon at the right side of the screen.

The upper left corner button is a drop-down menu, where you can choose which parameters do you want to analyse:

- Maximum pressure
- Pressure integral
- Filling time

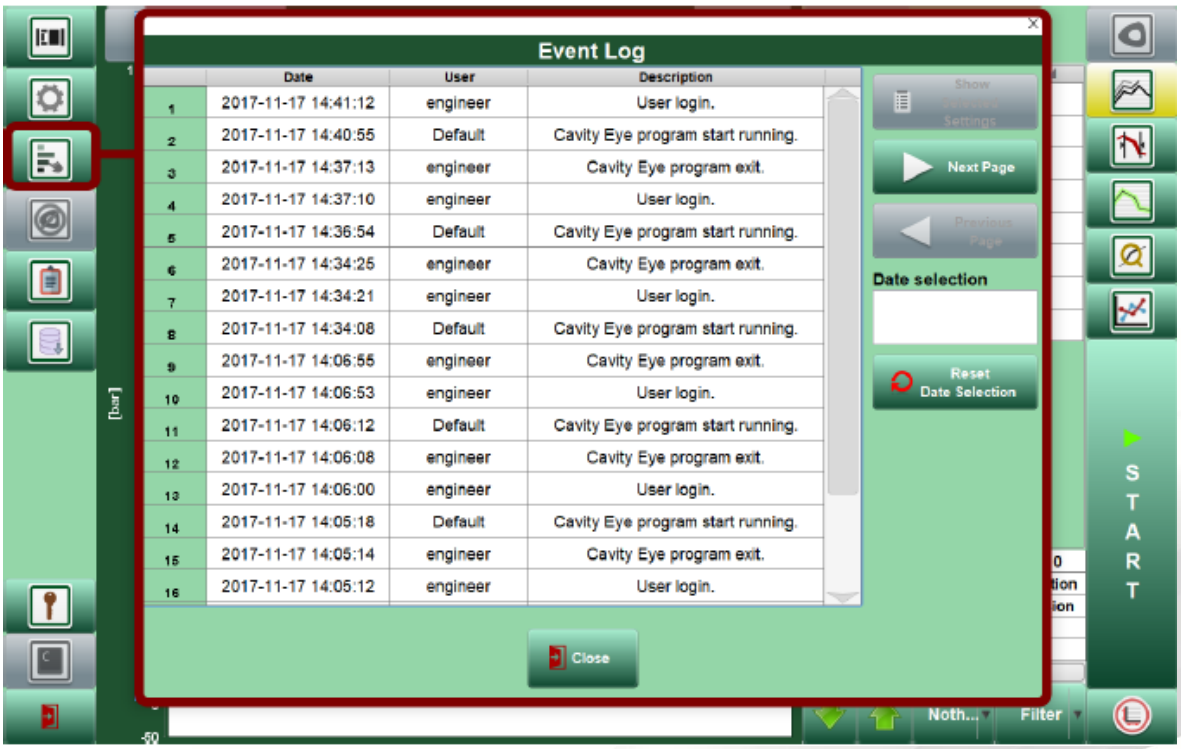
The statistics monitor creates the opportunity for the fine adjustment of the statistical production supervising.

⚠ Only the cycles which measured during activated Measure Mode can be seen in the Statistics Monitor.

8. Auxiliary functions

The useful and practical functions of the software will be listed in this chapter.

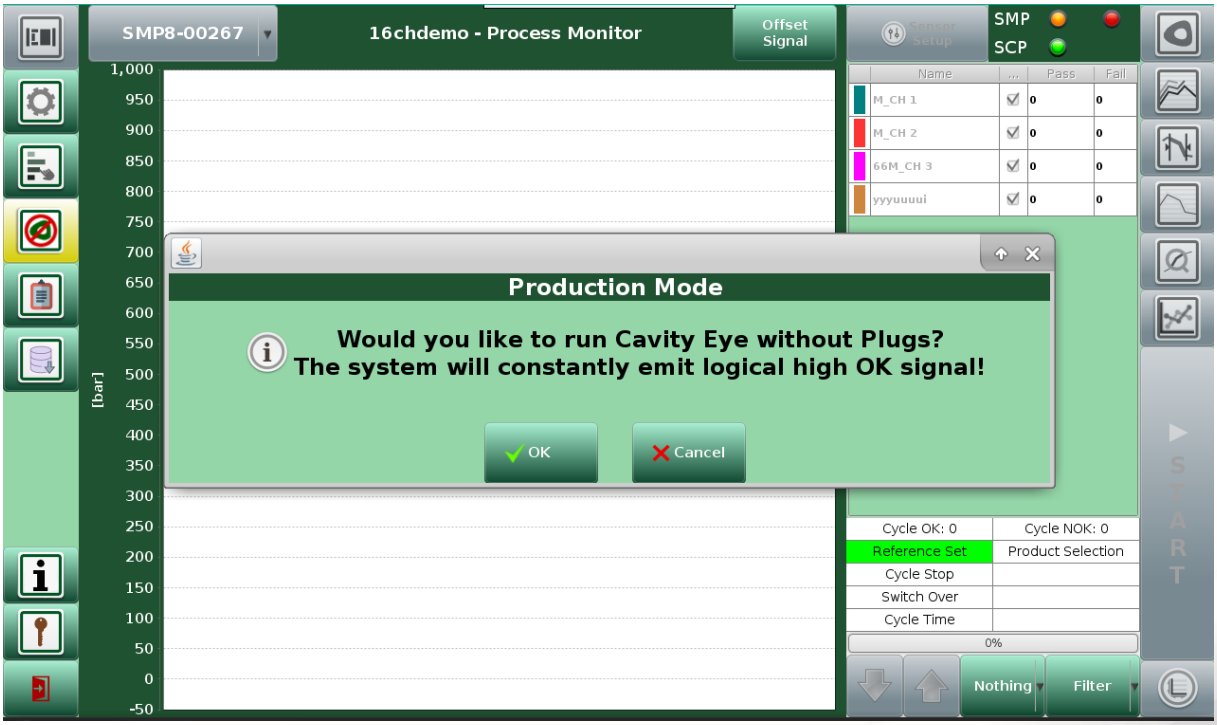
8.1. Event log



The **Event Log** promotes retracability of all measurement-related actions. It holds all user activity performed on Cavity Eye. The Event Log also contains a few non-user-related actions for example Cavity Eye start up.

Records whose **Description** holds the Settings changed expression, that indicates user-activity, that affected settings on either data-acquisition or product-selection. The Show Selected Settings reveals the exact nature of the changes made.

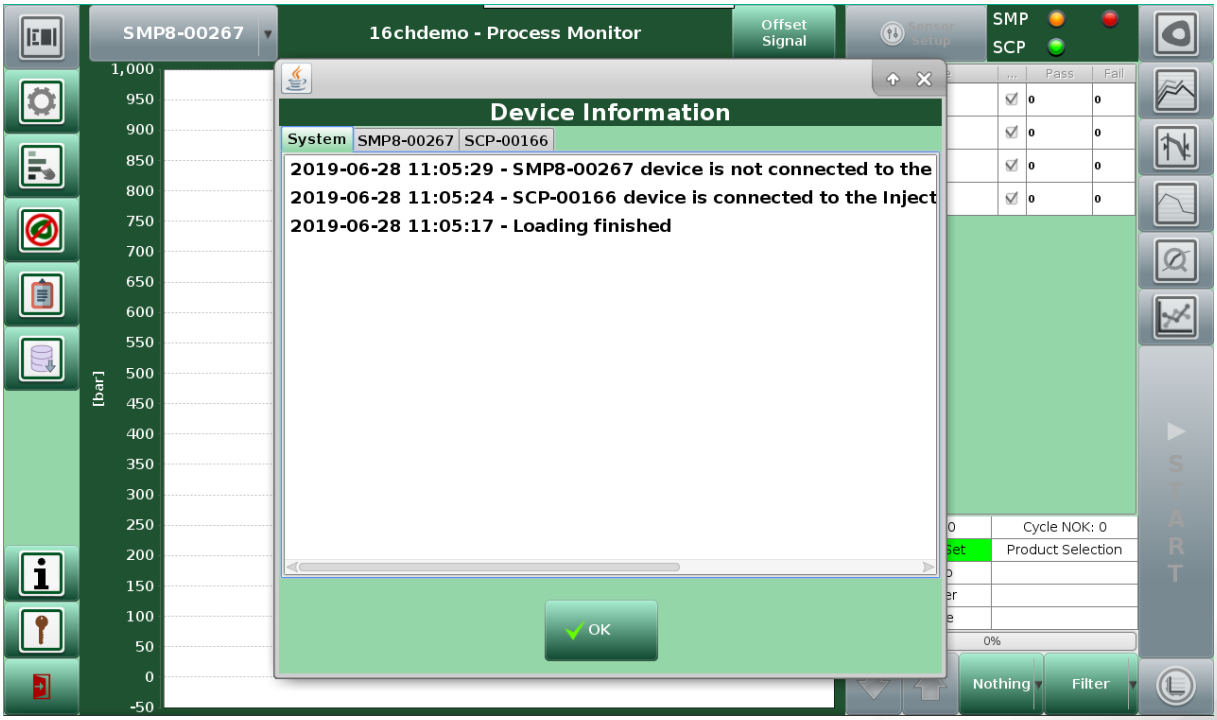
8.2. Production mode without Cavity Eye supervision



You can turn off the Cavity Eye supervision manually. The Production mode button permits the injection moulding machine to operate without Cavity Eye supervision. The system constantly emits the product selection signal (CE_OKNOK) when the production mode is on. This can be useful, if the IMM is in production with a mould, that has no Cavity Eye system equipped, or if you do not want to use Cavity Eye for any specific reason.

⚠ Production without Cavity Eye mode is only available, if there are no measuring plugs (SMP) connected to the mould.

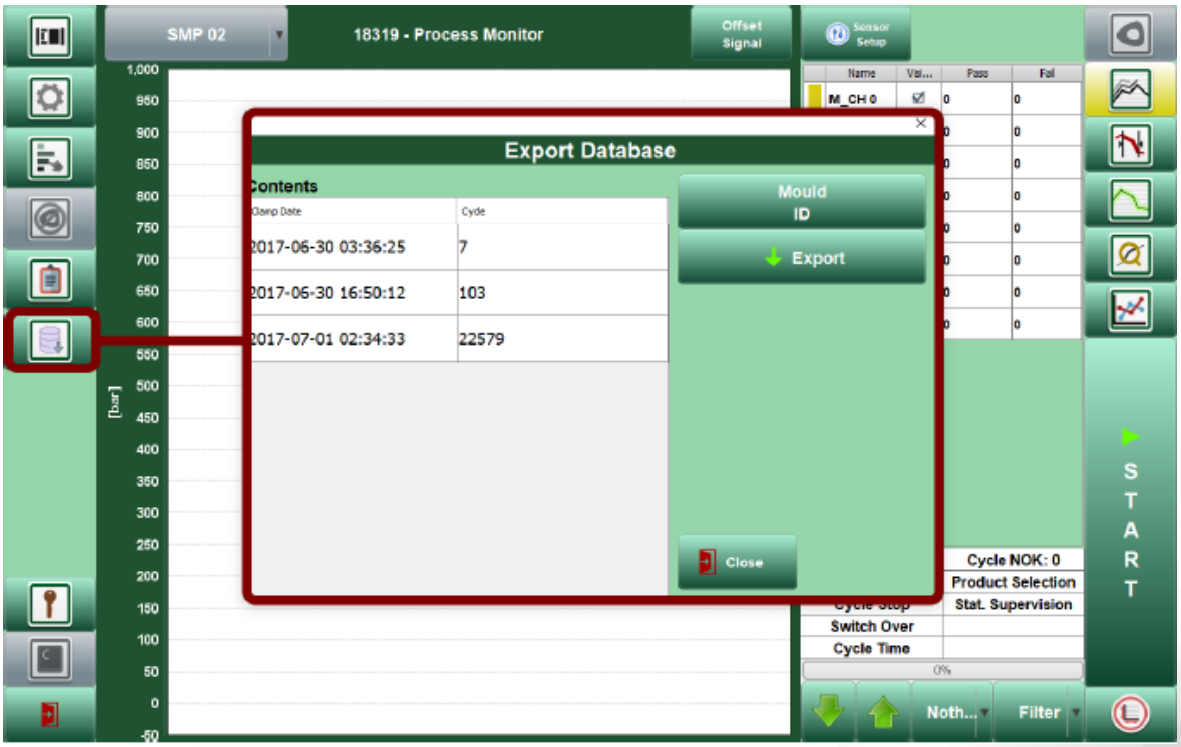
8.3. Device Information



The Device Information dialog holds the network- and hardware related informations of the devices (SMP, SCP) connected to the Cavity Eye measurement system, each opens on a different tab.

If you suspect that one of the plugs are not connected properly, this information dialog lets you check it. Moreover, if there is no Control Plug (SCP) connected, then the button will indicate that by blinking red background.

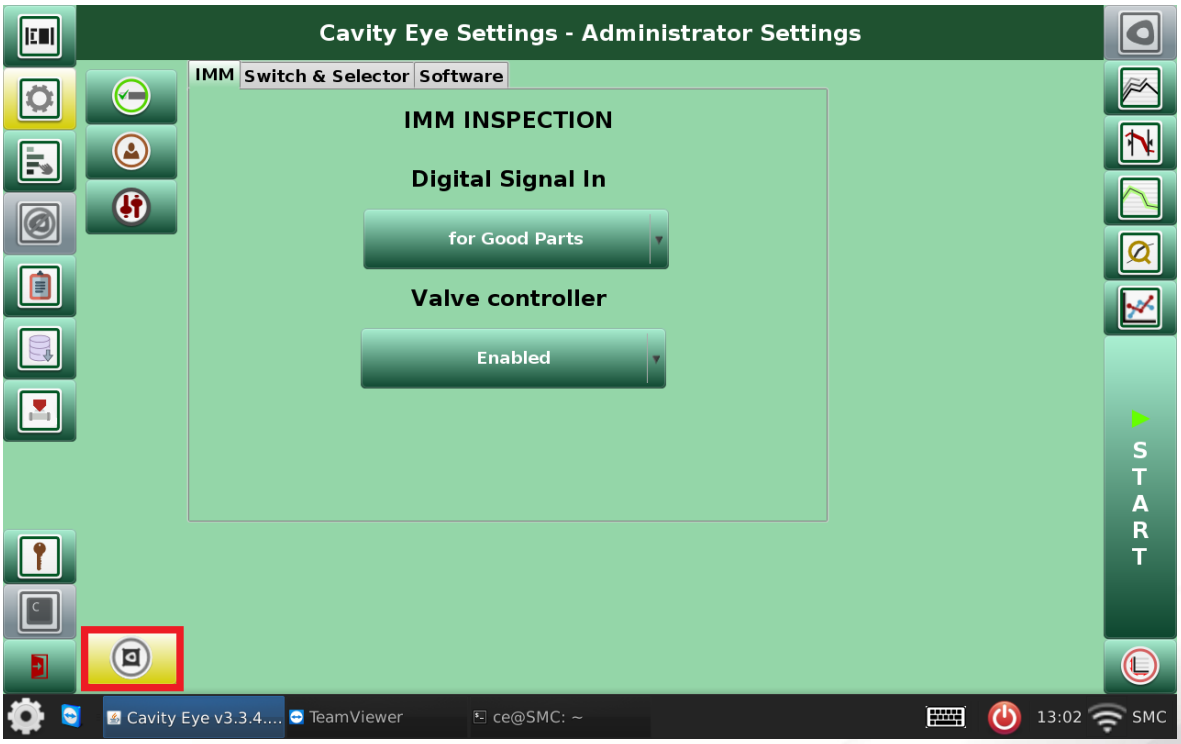
8.4. Export data



The Export Database function provides data for ASR, Cavity Eye's analysis-module. Choose an IMMID, then the Export button saves all data associated to a single clamp into a sole, portable file. The saved file can be moved to the computer running ASR for it to import it into its own database for further analysis.

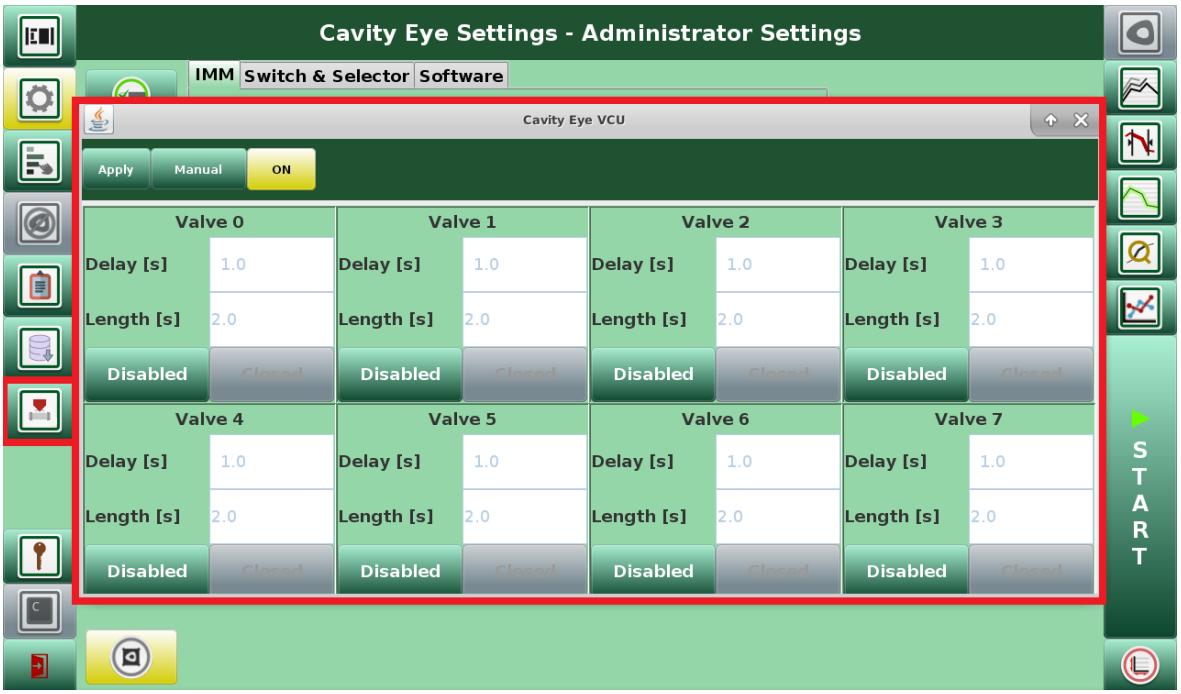
The dialog holds the information of each period of production with time stamps, and the number of cycles in that period.

8.5. Valve control



The Cavity Eye system has a valve controlling feature. The system can emit valve controlling signals during the injection cycle. You must enable this feature in the Administator Settings (shown in the figure above), to be able to see the plus icon on the left side column. This feature is only accessible for Admin users.

⚠ The valve control feature is only accessible for Admin users. Please contact Cavity Eye support, if you need access to this module.



The Valve Control dialog contains the settings of 8 independent valve. The ON button starts the valve controlling automatically with the given parameters.

Delay [s]: How many seconds to delay the valve open signal after the start of the cycle (trigger signal).

Length [s]: How long is the valve open signal.

Next step is to apply the changes with the Apply button.

You are able to use this feature as a test of valve opening/closing, by clicking on the Manual button.

9. Troubleshooting

Failure	Solution
The system does not start.	Check the power and the connection of the power supply. If the ON button of the PC is glowing red, press the button, and it should turn to blue light with the PC starting.
The PC starts, but the screen is black.	Check the connection of the display and the PC (USB cable).
The system does not recognize the SMP and SCP devices after connecting them.	Close and restart the Cavity Eye software. Check the Device Information in the software, make sure all the devices (SMP, SCP) can be seen in dialog tabs. If the problem has not been solved by this, please switch off the PC and the Switch from power supply and wait a few seconds before reconnecting and restarting them.
The system does not recognize the mould memory after connected once.	Reconnect the Smart Measuring Plug (SMP). If needed, restart the Cavity Eye software.
The system does not recognize the mould memory after connected multiple times.	Check the memory in the mould socket (SMS), tighten the screws if needed. If the problem has not been solved by this, the replacement of the memory or the plug insert might be necessary.
No signal on the screen, or some sensors does not react to the pressure, the pressure curve is flat.	Check the Mould Plug's insert and the sensor wirings. A malfunctioning sensor or a broken wire could be the problem.
The signal does not return to zero. (Signal has offset)	Please check the ejectors and pins movability. If they are tight or hardly moving, then mould maintenance is necessary.
The system does not receive the trigger from the IMM.	Check if the SCP is connected to the SCS on the IMM. Open the Digital I/O tester menu in the software settings. Check the in- and output signals.

	If the signal is not received, check the IMM's output signal settings, and the wirings in the machine.
The IMM or the robot does not receive the Selector Signal (good or bad part signal) from the Cavity Eye system.	Check whether the SCP device is properly connected to the SCS on the injection moulding machine. Open the Digital I/O tester menu in the software settings. Check the in- and output signals. If the signal is emitted by the Cavity Eye system, but the IMM does not receive it, check the wirings in the IMM, set the adequate Selector signal length in the cycle time's percentage. Check when does the IMM monitors for selector signal, and when does Cavity Eye emits the signal by comparison.
The sorting unit or the robot throws the parts to scrap, which were evaluated to be a good part by Cavity Eye.	Check the selector signal settings, whether the Cavity Eye emits the selector signal in case of good or bad parts, and the sorting unit or robot monitors the signal in case of good or bad part. If all settings found to be OK, the robot or the sorting unit may not receive the selector signal. In this case, please check the connection of the SCP device, and the wirings.