CoMo Injection

Monitoring Injection Molding Processes
CoMo Injection

Benefits and Areas of Application

100% quality injection molding requires highly transparent processes. This requirement cannot be met by the injection molding machine alone. Mold cavity pressure is the most informative parameter of the injection molding process. Measuring the mold cavity pressure with piezoelectric pressure sensors and evaluating the results with CoMo Injection assists molders when it comes to optimizing, controlling, monitoring and documenting the production process.

The quality of most injection molded parts is decided in the mold cavity. The mold cavity pressure arising during each cycle is an indicator of the development of the mold filling process in terms of time and quality. This development is not only useful for evaluating the process quality, but also allows an assessment of quality compliance of the emerging part during each individual active cycle. Measurement and analysis of the mold cavity pressure therefore ensures error-free production.

CoMo Injection is Kistler’s new process control monitor for cavity pressure-based optimization, monitoring and documentation of injection molding processes. It was developed for molders wishing to achieve one or all of the following objectives:

- Process optimization
- Cavity pressure-based process control in real time
- Cavity pressure-based process monitoring with bad part/good part separation or
- Quality documentation

CoMo Injection is compact and suitable for industrial applications. The system is easy to configure and connect and has a user-friendly operating mode. It integrates flexibly into different production and customer-specific IT environments and offers high value for the money.

CoMo Injection provides all relevant process and quality data for process monitoring and for good part/bad part separation. CoMo Injection’s web browser allows remote access to process data on the current cycle as well as statistical production data of injection molding facilities from all over the world.

CoMo Injection’s mold cavity pressure-based optimizing, monitoring and documentation features assist molders throughout the entire injection molding process.

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<th>Technical benefits</th>
<th>Economic benefits</th>
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<tr>
<td>Purposeful optimization</td>
<td>Shorter optimization periods, lower machine and staff costs</td>
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<tr>
<td>Error-free production</td>
<td>Reduction of production and quality assurance costs</td>
</tr>
<tr>
<td>Automatic documentation of quality data</td>
<td>Reduction of quality assurance costs, improved QM documentation</td>
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CoMo Injection is a compact and suitable solution for industrial applications. The system is easy to configure and connect and has a user-friendly operating mode. It integrates flexibly into different production and customer-specific IT environments and offers high value for the money.
CoMo Injection

1. CoMo Injection for good part/bad part separation: Configuration and visualization of a few measuring channels via display Type 5629A1; without data storage.

2. CoMo Injection for good part/bad part separation: Configuration via display Type 5629A1 or network-integrated PC for visualizing up to 8 measuring channels; data storage via network.

3. CoMo Injection for good part/bad part separation and process optimization: Configuration, set-up, operation and viewing of up to 8 measuring channels via network-integrated tablet PC, notebook or other PC; data storage via network, server technology option.

At a Glance

CoMo Injection

- analyzes the development of the mold cavity pressure during injection molding,
- uses the results to evaluate molded parts and for good part/bad part separation,
- provides all required process optimization and cycle time reduction tools,
- offers innovative process control even for special processes due to real-time functionality,
- can be configured easily with process-oriented steps,
- speeds up mold installation times with the help of pressure sensors and the new multi-channel cable technology,
- communicates with MES systems via Ethernet options and interfaces,
- provides extensive, standardized basic equipment,
- operates independently / does not need a PC,
- can be supplied with a display monitor if required,
- can be supplied with extensive production and quality statistics,
- offers good value for money,
- and has an attractive price.

Typical System Configurations with CoMo Injection
Configuration, setup and operation of the CoMo Injection system are intuitive. These procedures can be carried out on the system’s touch-screen display or on a PC. Your benefit: the operation of CoMo Injection does not require any special software.

With its step-by-step approach, the operation of the CoMo Injection follows every-day injection molding machine installation and setup procedures. The setup is followed by process optimization, large-scale production and finally, quality assurance. Process and quality data are stored and managed according to order and batch.

Some system configuration and utilization sequences are protected by a graded password system, e.g. only machine setters, foreman and supervisors have access rights. CoMo Injection allows easy and fast switching between production sequences such as “setup”, “start-up” and “production”.

CoMo Injection assists molders in every phase of the injection molding process. The system set up is parallel and analogous to that of the injection molding machine.

**Logical, Process-Oriented Operation**

1. Basic system configuration
2. Mold and product definition
3. Order and batch definition
4. Process start-up
5. Fully automated production
6. Statistical analysis / quality documentation

**Basic Configuration of CoMo Injection**

Basic configuration of CoMo Injection is required only once. Its purpose is to adapt the system to customer-specific definitions and nomenclature, the network etc. and to integrate it into the existing operating environment. The basic configuration of the CoMo Injection is analogous to the basic configuration of injection molding machines prior to start-up.

**Mold and Product Definition (Once Only)**

Only a few control screens are sufficient for configuring the system for one specific monitoring task. Analogous to the initial setting of the clamping force, opening strokes, injection speed etc. of an injection molding machine to suit a specific mold and the production of a specific product, both the mold and the produced products are defined once only. This information is stored in the CoMo Injection system or on a network server and can be accessed whenever required. Every machine function is defined on a separate screen page.
Mold Definition
The basic mold setup is completed on only two screen pages. First, mold data and the definition of mold cavity pressure sensors used within the mold are entered. Based on the pre-defined pressure maximum and the sensitivity of the sensor type used, CoMo Injection then automatically selects a suitable measuring range from the four available levels of 2,000 pC, 5,000 pC, 20,000 pC and 50,000 pC.

Product Definition
When various products are processed in the same mold, they can differ in material specification, coloring, required inserts etc. The procedure allows the definition of different settings, e.g. the values for monitoring different products. The system is ready for operation and acquires the incoming process data as soon as the measuring time and scan rate (optional) as well as the real-time control functions of the product setup have been defined. Different monitoring functions can be defined on clearly presented individual screen pages and then transferred to other channels at the touch of a button. Monitoring functions can also be determined in a graphical display of the current mold cavity pressure measurement curve.
Order and Batch Definition
During this procedure, CoMo Injection is set up for the production task at hand. For molds mounted on injection molding machines with the CoMo Injection system, the process is identical to mold and product definition, only the order and batch numbers must be entered. The order and batch number function can be disabled. If a production task is repeated, CoMo Injection will retrieve the existing mold and product data from memory or from the network server.

Process Start-Up
As with any production order, the start-up process is activated and operates until the process has stabilized. During this phase, the flippergates are set to “bad part” and the all parts produced during start-up are separated.

As long as the real-time functions of the CoMo Injection system are active (analog to injection molding processes such as switch-over to holding pressure), both the monitoring functions and the process documentation functions are disabled (analog to injection molding machine start-up and optimization vs. production proper). During start-up, the system does not store any quality and process data.

Defining real-time thresholds with CoMo Injection
Fully Automated Production

During fully automated production, CoMo Injection’s monitoring functions, flippergate and process data documentation functions are active – analogous to large-scale production on an injection molding machine. Quality and process data are stored during production.

Statistical Analysis / Quality Documentation

CoMo Injection determines the average value for every process parameter and shows the standard deviation as well as cp and cpk values. Moreover, the total count of good parts produced (green) and the total count of separated bad parts (red) are displayed.

Kistler’s statistical software Type 2829A is a versatile tool for analyzing injection molding processes and for creating quality documents. The software is PC-based. The acquisition of one license will permit any number of installations in the corporate environment. The statistical software accesses the database server, where all measuring data and/or all values calculated by monitoring functions such as information on bad part or good part production are stored.

CoMo Injection shows the development of the mold cavity pressure in relation to a reference curve. This graphical display is particularly helpful when the process is re-started until it reaches the optimum cavity pressure profile.

CoMo Injection displays the trend development of characteristic process values across several cycles.

CoMo Injection displays the development of the mold cavity pressure and evaluates the quality of the emerging parts.
CoMo Injection
Communication and Interfaces

Digital Communication with Injection Molding Machines and Downstream Equipment

CoMo Injection offers more than 12 isolated outputs and 5 isolated inputs to enable its integration into machine control systems.

Communication with Injection Molding Machines
CoMo Injection has three digital inputs for communicating with the injection molding machine, one of which is for “start cycle” and another for “event”. The cycle trigger transmits the signal for activating the measuring process. This signal can also be used to terminate the measurement process. The new system automatically adapts the measuring time to changes in the cycle time, for example when the holding pressure phase is optimized. The “event” signal can be used to automatically generate the limit values of calculation functions. For example, the signal “switch to holding pressure” sent by the machine can be used to start calculating the holding pressure interval.

CoMo Injection has four digital outputs for communicating with the injection molding machine, one of which is used to “clear for measurement” and for synchronizing the CoMo Injection with the injection molding machine. Three threshold outputs can be connected to the machine and used as real-time outputs for processes such as switching from injection pressure to holding pressure based on threshold values, for cascade control during the filling phase for parts with long flow paths and for process control during fluid injection processes such as GIT and WIT. Other processes can also be controlled with the help of mold cavity pressure measurement.

Communication with Downstream Equipment
CoMo Injection has one output for “outputs valid” which is used for synchronizing the system with the good part/bad part separation system, the handling device or the machine input for external signals. Eight good part/bad part channels can be used to signal to the downstream device whether the active shot processed by the injection molding machine complies with the quality requirements (good part) or not (bad part). These eight channels can also be reconfigured for deployment as real-time outputs to support even highly complex molding processes.

The quality separation flippergate or the handling device can carry out predefined actions to separate bad parts. The inputs are interconnected in a way that allows errors such as malfunctioning connection cables to result in automatic separation and treatment of all molded parts as “bad parts”.

CoMo Injection compiles a list of messages sent to the digital outputs for the injection molding machine.

CoMo Injection forms a closed loop with the mold cavity pressure sensors and the injection molding machine and communicates with downstream equipment.
Networking Capability
CoMo Injection can be integrated into the network via Ethernet (TCP/IP). Used within protected corporate intranets, the system offers a monitoring and support option for both process and production, independent of location and across continents. In this way, professionals can access the system from their facility to support their colleagues in another facility with the troubleshooting tasks at hand and help them optimize production processes. As standard software, Internet Explorer or Mozilla Firefox can be used in combination with Java (license-free standard). Data stored in CoMo Injection can be integrated in Manufacturing Execution (MES) Systems via API (user interfaces) or interfaces with the Kistler database.

With its open architecture, CoMo Injection can be integrated into different production and company-specific IT environments.

Manufacturing Information System
The database-based Manufacturing Information System Type 2829A-01-0 provides access to all CoMo Injection devices installed in the production setup as well as all relevant production data of active and completed production orders via web browser. In this way, all required information is available in a transparent form and can be accessed from anywhere. During active production processes, the status of the active cycle and the results of the last 20 cycles are displayed. A link from the list of all installed CoMo Injection systems provides direct access to one particular system with all current information of the selected production processes. The list of all production orders and batches can be used for accessing data on completed orders. Users are also able to use the Manufacturing Information System to create process and quality statistics as well as quality documents.
Compact Design
With dimensions of 208 x 65 x 173 mm, CoMo Injection is a very compact device which can be integrated into different production environments and injection molding machines.

CoMo Injection is available in two hardware designs:
Model 1: System without terminal
Model 2: System with display Type 5629A1 (5.7” color touchscreen).
Both models can be configured and operated directly or in a network via:
1. Tablet PC
2. Notebook
3. PC

Full Functionality without PC
CoMo Injection is a stand-alone, independent system. As such, it can be used without a PC. The system is operated via a 5.7” color touchscreen Type 5629A1 with its set of functions. When used without a monitor, it requires a PC and a web browser for configuration and visualization.

If viewing of process data is not required during production, the PC/notebook can be disconnected from the CoMo Injection system.

At a glance
CoMo Injection as a stand-alone system without display (top) and with 5.7” color touchscreen Type 5629A1 (bottom)

Even when it is integrated into a network, the CoMo Injection can be configured and operated via tablet PC, notebook or any other PC.

Standardized Configuration
All CoMo Injection models have eight channels which may be configured in a variety of ways:

1. 8p: 8 pressure channels (Type 2869A2…) on one multi-channel connector
2. 4p+4p: 4 pressure channels each on two multi-channel connectors for merging connections of the moving and the stationary mold half
3. 4p+4u: 4 pressure channels on one multi-channel connector + 4 analog voltage channels for 0 … 10 V (Type 2869A1…) e.g. machine signals such as hydraulic pressure

The status of the CoMo Injection is displayed on different LEDs located at the front of the device. The degree of protection is IP65.
Multi-Channel Cable Technology for Easier Connection

The new multi-channel cable technology bunches the connection wires of several single-wire sensors into one single multi-channel cable. This accelerates and simplifies the connection of multi-cavity molds to monitoring systems. As only one single connector needs to be accommodated, the new connection technology uses less space within the mold cavity and the hazard of a potential mix-up of sensor connectors is eliminated while the time and effort used for the set-up is reduced. The new technology is more cost-efficient as it requires the connection of only one cable and one plug compared with the previous systems, which used up to eight cables and plugs. Multi-channel technology is now available for all UniSens single-wire sensors with uniform sensitivity.

Benefits

- Faster
- Easier
- Promotes safety, as it prevents cable mix-up and
- More cost-efficient

Order Key

<table>
<thead>
<tr>
<th>Type</th>
<th>2869A</th>
</tr>
</thead>
<tbody>
<tr>
<td>2x4 charge inputs</td>
<td>0</td>
</tr>
<tr>
<td>1x4 charge inputs and 1x4 voltage inputs</td>
<td>1</td>
</tr>
<tr>
<td>1x8 charge inputs</td>
<td>2</td>
</tr>
</tbody>
</table>

- No control panel | 0
- Control panel Type 5626A1 | 1
- Control panel Type 5629A1 with mounting joint | 2

| 24 VDC power supply 100 … 240 V Type 5779A3 | 0
| Plug IP67 | 1
| Cable for 24 VDC power supply from machine Type 1500A45A7 | 2
| Cable for 24 VDC power supply from machine Type 1500A45Asp | 3

CoMo Injection above the mold space of an injection molding machine with multi-channel cable

CoMo Injection has interfaces for communicating with the injection molding machine and downstream equipment as well as for network integration.
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