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The responsibility to ensure that everything runs smoothly

Many moulders today operate three shifts, some on 365 days of the year – this calls for a maximum of availability of the machines, spare parts, and service support.

Backed by highly skilled service teams, advanced spare parts logistics, and multiple service levels to address a customer's specific needs, we provide total support world-wide: from straightforward inspections through comprehensive maintenance, and extended warranties for high capacity utilisation levels to emergency hotline support, and training of your personnel. Full documentation and a digital catalogue ensure that spare parts are delivered to you in a minimum of time, usually within a few hours. Users of older machines can have them upgraded by our retrofit service at fair prices, for instance, by state-of-the-art control software or for specialised injection-moulding processes. In short, the Sumitomo (SHI) Demag Service provides you with whatever support you need to complete your jobs efficiently and to schedule.

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The logo consists of a blue diamond-shaped icon with a white cross inside, followed by the word 'Sumitomo' in a large, bold, blue sans-serif font. Below 'Sumitomo' is 'SHI' in a smaller, blue font, and 'DEMAG' is in a large, bold, orange sans-serif font.

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Logically organised touch colour screen

The extra large colour screen provides a clear picture of the machine conditions at a glance. The screen is designed as a touch screen allowing the operator to make entries directly on the screen. The easily legible screen font facilitates the work and reduces operator fatigue. Despite displaying all the necessary details, the screens are logically organised for ease of use and efficiency. The NC5 offers a choice of 19 languages, two of which are defaults and can be selected at the press of a button. All values and units can be displayed both in the metric or imperial units of measurement.

Additional screen forms for different processes

Specialised processes, such as gas injection technology (GIP), decorating via back injection, and the numerous variants of multi-material injection moulding and other specialised processes are becoming increasingly common place. The NC5 control system comes prepared for these techniques and provides the necessary additional screens based on the familiar operating philosophy.

Two components, one operator interface

For two-component injection moulding, the NC5 control incorporates a complete second function keypad for the second injection unit. The same operating terminal can be used to program special equipment, for example, a rotary table for transferring products in multi-moulding.



Faster setup using hot keys and symbol buttons

On the new operator terminal, the user can choose between a touch screen or the traditional integrated keyboard for data input. Using convenient hot keys and symbol buttons with internationally accepted pictograms, the operator can select additional screens in all logically connected process phases.

USB interfaces for fast data exchange

Using a USB stick, the operator logs on at a defined access level and, in addition, is able to store data and screen pages via another two USB interfaces.

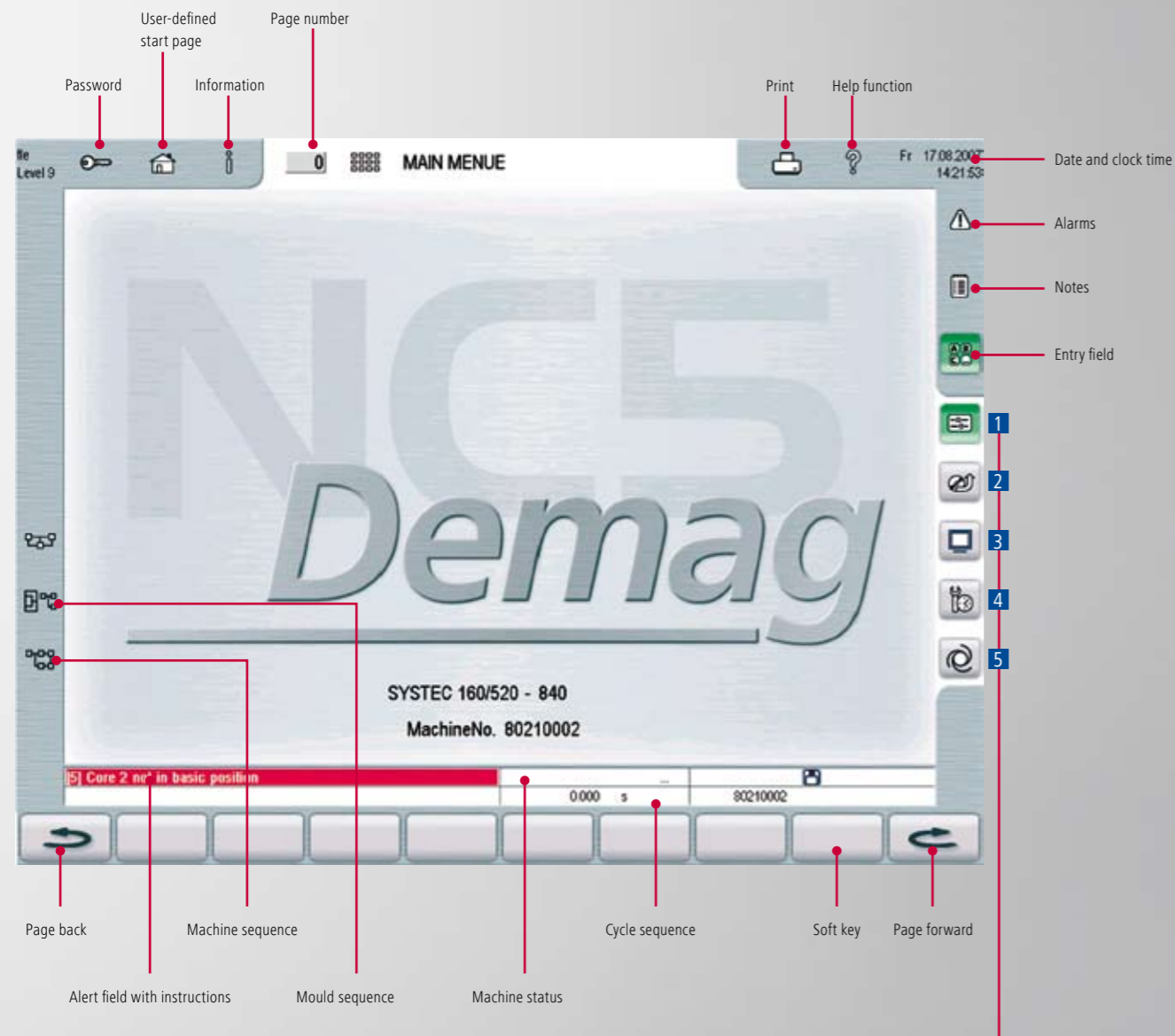
Documenting, printing, storing

The integrated thermal printer allows the operator to have selected statistical process parameters or even complete screens documented by defined time periods or number of shots. The NC5 permits convenient management of machine settings, mould data and storage via USB interface on to any data carrier, for instance, mould and automation data as well as the complete setting of the machine. Where frequent product changes occur, this will save time and money. Of course, it is also possible to store all quality-relevant process parameters locally or to transmit them to a central computer.

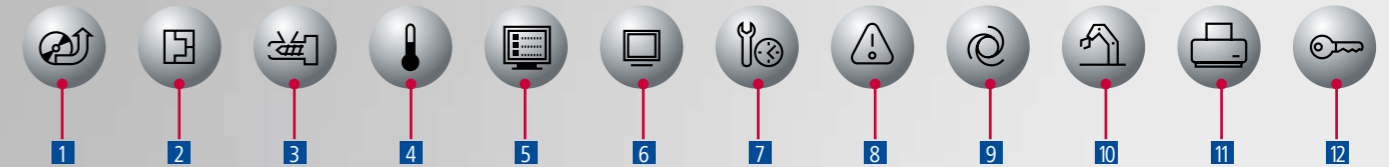
As the communication interface between the injection moulding machine and the operator, the machine control system plays a crucial part in the production process. In order to provide easy access to and manipulation of the capabilities of a machine, an ergonomic production means needs a functional and logically organised operator environment. This was the starting point for the further development of the proven Sumitomo (SHI) Demag controller. The result is the NC5, a high-performance machine control system of the latest generation which is even more closely tailored to operator needs and so further enhances the ergonomics of the Sumitomo (SHI) Demag machines. Every Systec and IntElect, whether small or large and from whichever series, comes equipped with the new NC5. The operator is conveniently and logically assisted in all steps from setting up and proc-

ess optimisation through to production and documentation. Intelligent modules of the control system provide valuable, application-orientated assistance in setting up the machine and starting the system matched to the individual needs and skill level of the operator. A host of new and onward developments in operator assistance and process documentation enhances the performance and value of the NC5 control for the operator. The NC5 control can also handle all necessary settings for specialised techniques and complex injection moulding processes. It also allows the integration of peripheral device control systems, such as hot runner, temperature control and automation equipment. This makes the NC5 a powerful control centre that makes it possible for the operator to evaluate at a glance all machine and peripheral functions and obtain information on the current

cycle, past production and actual condition of the machine. The NC5 also has logical documentation capabilities to monitor all quality-relevant processes and machine data. Physically, the NC5 controller is arranged midway between the injection and clamping units.



In addition to the hot keys on the screen, the NC5 controller also has new function keys



1 Setup

This key is used to select basic functions, such as units (metric/imperial) and user language.

2 Clamp unit

Function to set up mould movements and mould protection.

3 Injection unit

This key is used to set up the injection unit and to define whether operation is with nozzle contact pressure and what nozzle contact pressure.

4 Temperatures

Page to select the desired barrel temperatures of the individual heater zones and the applicable tolerance band.

5 Statistics

The statistics page provides an overview of current process parameters that are listed in the statistics.

6 Production

This button provides management of mould designations and identification as well as production inspection.

7 Service

The service button permits the various hardware components to be checked for integrity.

8 Alerts

This provides the operator with direct access to the list of alarms with all defect messages.

9 Automation

The automation page provides direct communication with connected peripheral equipment.

10 Robot

This function key is used to display the screen pages of a robot integrated in the control system.

11 Printer

This is used to call up the setup page for the printer where the configuration can be changed.

12 Password

On clicking this button, a window will appear in which the operator logs on with his identification code.

1 Machine configuration

This hot key is used by the operator to call up all screen pages with machine-specific functions, such as the startup and shutdown program, shutdown matrix and alert response actions.

2 Setup/process optimisation

This hot key calls up all screen pages with process-specific functions, such as temperatures, clamping and injection end, process optimisation, and mould catalogue.

3 Production

This hot key switches the user to all screen pages with production-specific functions, typically for process data acquisition, statistical process monitoring, and reject separation.

4 Maintenance

With this key, the user calls up the screen pages with maintenance-specific functions, for example, diagnosis, putting into operation, and alerts.

5 Peripherals

This switches to all screen pages with peripheral-specific functions, such as robots and Euromap 67.

The more complex the process that a machine control system has to monitor, the clearer the interface to the user should be structured and the more user-friendly it needs to be designed. The NC5 provides three different methods for the operator to establish comprehensive and convenient communication with the machine. One is to use the keyboard of the NC5 in line with common practice to enter the data. Secondly, there is a touch screen, which now is a standard feature of the NC5 control for direct and fast inputting via the screen. This is highly effective in avoiding erroneous operation and, thanks to intuitively designed user interface, which also improves operator productivity. As a third possibility, the NC5 control permits operation by means of any familiar PC keyboard that can be connected via a USB interface.

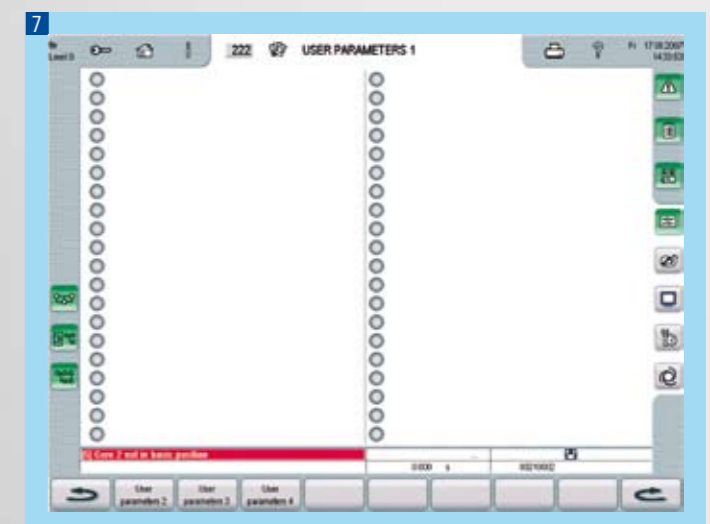
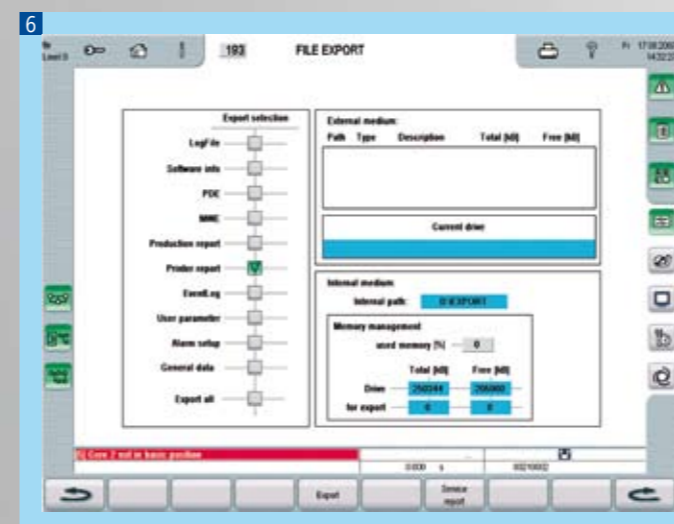
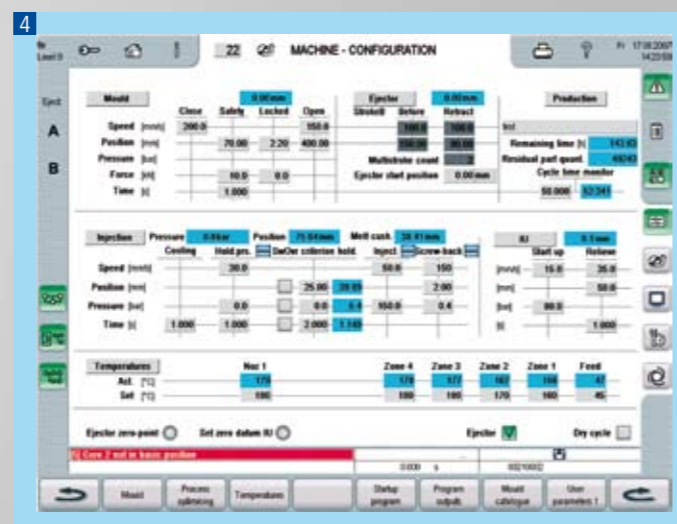
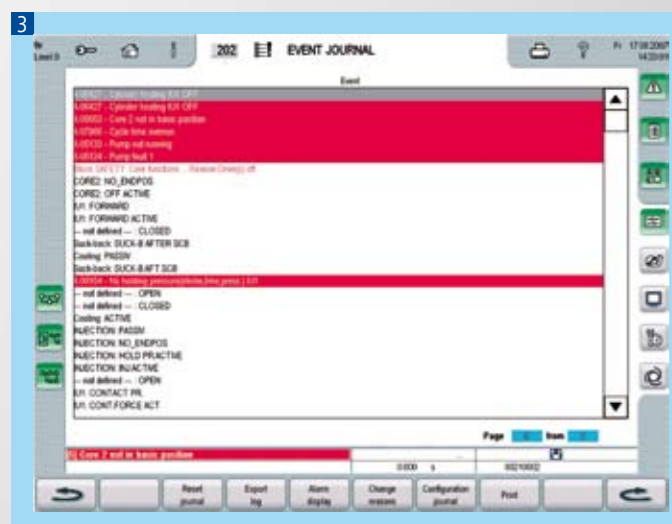
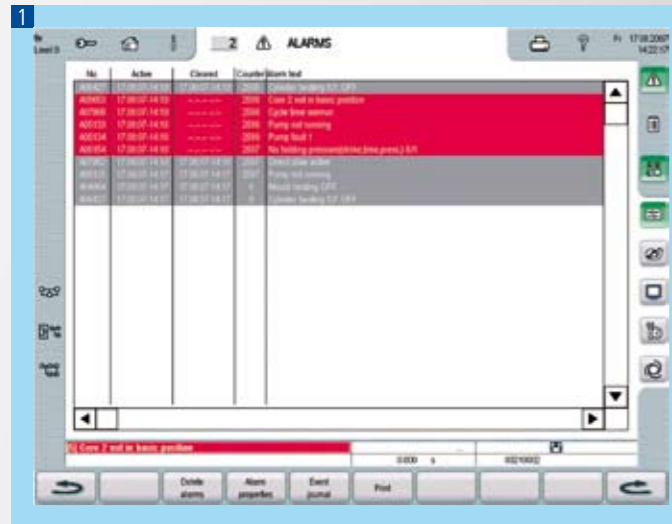
Aside from the extensive new functions added

by the touch screen, the NC5 is based on the field-proved and popular Sumitomo (SHI) Demag operating philosophy. For instance, there are many controls in the familiar position and providing identical functionalities that have proved their value in the NC4. Transfer between the use of the keyboard or the touch screen is simply by means of a function switch.

All operating pages of the NC5 are clearly structured and organised on a similar pattern. Tool bars placed around the actual display incorporate various function buttons, referred to as soft and hot keys. The bottom tool bar, for instance, includes the soft keys of specific operating and function groups. Depending on the menu, these soft keys allow the user to open additional sub-menus or activate menu-related functions. The alert box, highlighted in red, appears to the left above this tool bar to alert

the operator to any current message. Directly below it, there is a box with other current messages. Arranged on the left side of the tool bar, there are soft keys to call functions of mould and machine sequence control. Mould sequence control is used to effect the sequence programming of the clamping end, whereas machine sequence control handles sequence programming for the total injection moulding machine.

HIGHLIGHTS



The NC5 reflects the consistent onward development of the field-proven NC4 control. Its extensive expanded functionality is orientated exclusively to the specific needs of the operator in the production process. The straightforward, self-explanatory user interface provides the operator with comprehensive assistance from setting up and process optimisation through to process monitoring and defect correction.

The NC5 also features expanded alert functions: apart from the listing of alarms, additional information is provided on possible causes of defects. In respect of defined alert groups, the operator can select in what way an alert should be produced: visually by the warning light, audibly by a horn, by a message on the operator terminal or whether any connected peripheral item, such as a separation

unit is alarming to reject production. The operator can also define the response of the machine to an alarm situation.

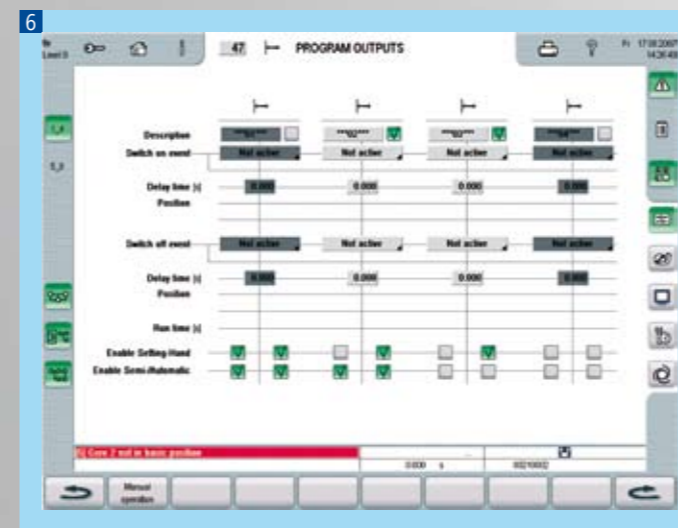
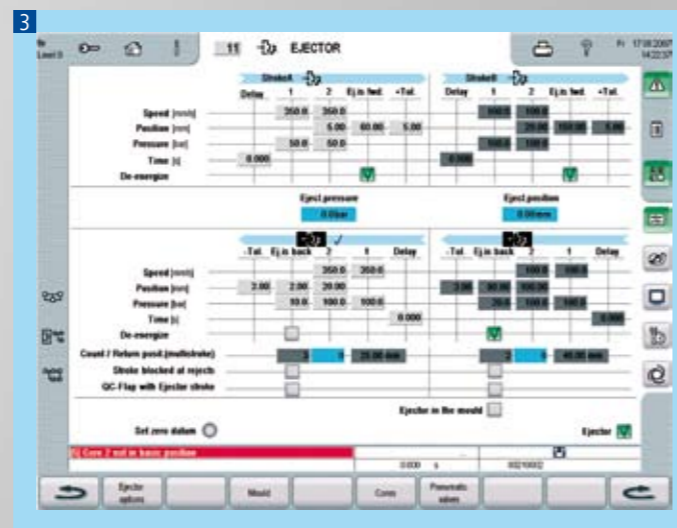
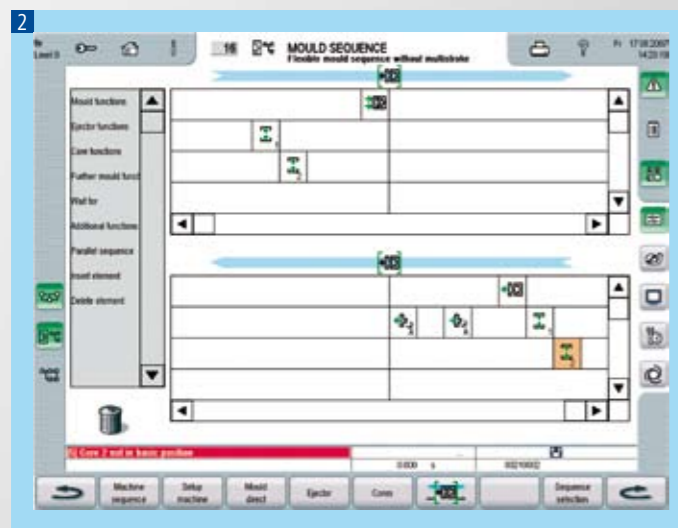
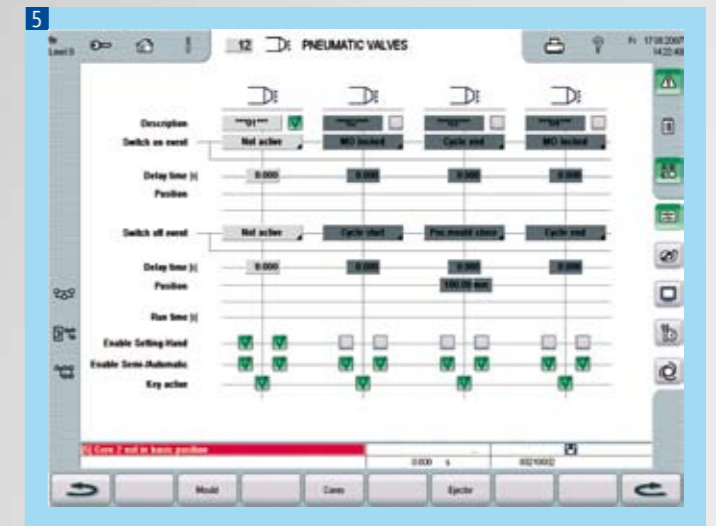
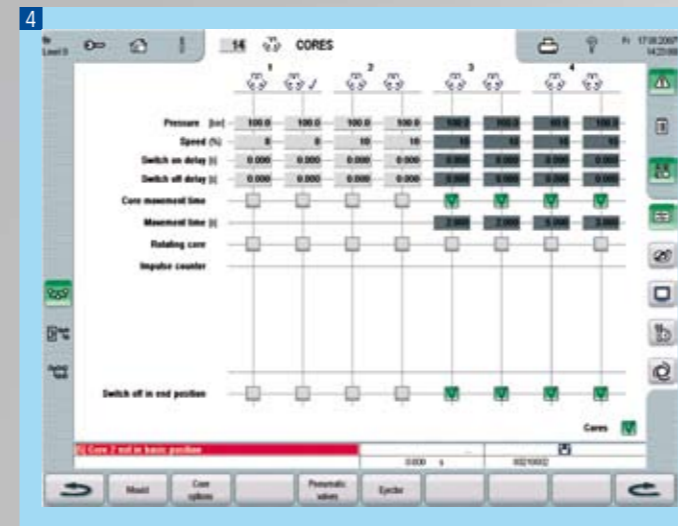
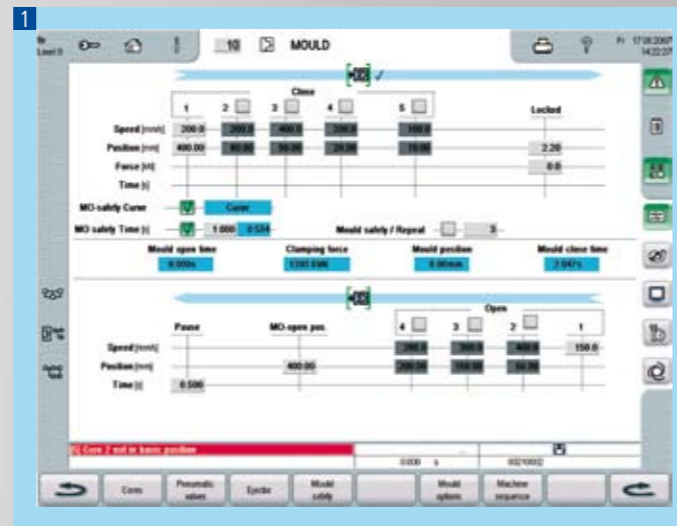
The property settings for alarms enable the operator to define which messages in the alerts should be recorded and what information will appear in the alert message. This new screen with machine setting data displays a summary of critical process phases and the setting parameters on one screen page. Thus, the operator can quickly survey the critical settings at a glance. Small icons transfer to the corresponding graphical images.

The NC5 will also accept any kind of peripheral. Thanks to a new technology, this has made it possible for the first time for a machine control system to directly operate any kind of peripheral device. All

that is necessary is to connect the control system of the peripheral to the NC5 in a suitable way.

The NC5 permits convenient management of machine settings, mould data and storage via USB interface on to any data carrier, for instance, mould and automation data as well as the complete setting of the machine. Where frequent product changes occur, this will save time and money. Of course, it is also possible to store all quality-relevant process parameters locally or to transmit them to a central computer.

There are four freely configurable pages which the operator can use to set his own parameter combinations which he requires to monitor his particular process. Not only does this enhance process transparency, it also facilitates data entry.



Setting up the mould

The NC5 control assists the operator in setting up and putting the mould into operation with logically organised, easy-to-read screens and numerous help facilities.

1 The first step is to enter the opening strokes and mould speeds via a three-stage velocity profile. Also entered on this page is the clamping force, which includes a “set/actual” comparison as standard. The efficient mould-protection function of the Sumitomo (SHI) Demag machine is programmed by entering the protection force as well as the start and stop positions. This can be done in two stages.

2 The “Mould Sequence” page enables all mould internal sequences to be programmed extremely flexibly and conveniently. The integrated sequence control allows the operator to handle even complex

settings in a simple way. This creates entirely new possibilities to make effective use of the wide variety of parallel movements provided by the Sumitomo (SHI) Demag machine in production. Clear symbols and an unambiguously designed screen form facilitate the exact assignment of all movements of mould, cores and ejectors. The programming switch permits transfer between basic sequence and flexible sequence, with and without multiple movements.

3 In setting up the ejectors, the NC5 control permits ejector movements to be divided into two strokes, each with two stages. Programming of each stroke with speed, stroke and pressure is standard. If the ejectors are programmed in the mould sequence to move in parallel with the mould movement, a symbol will automatically appear on

the screen calling for the setpoints to be entered. In operation, the parameter sets are displayed in a “set/actual” comparison.

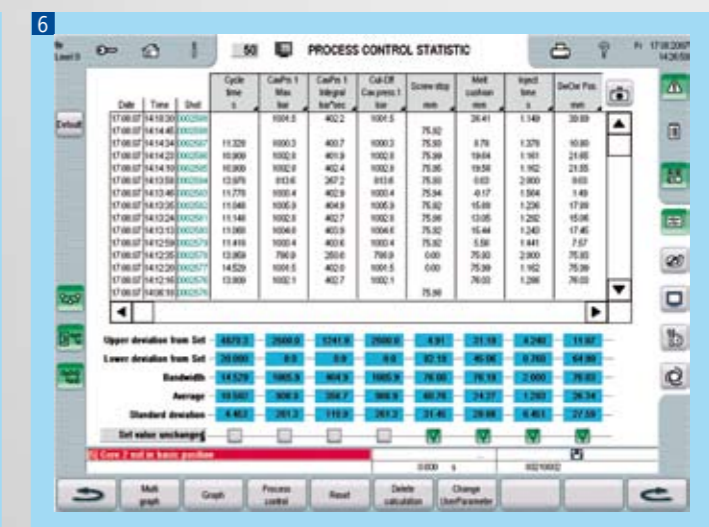
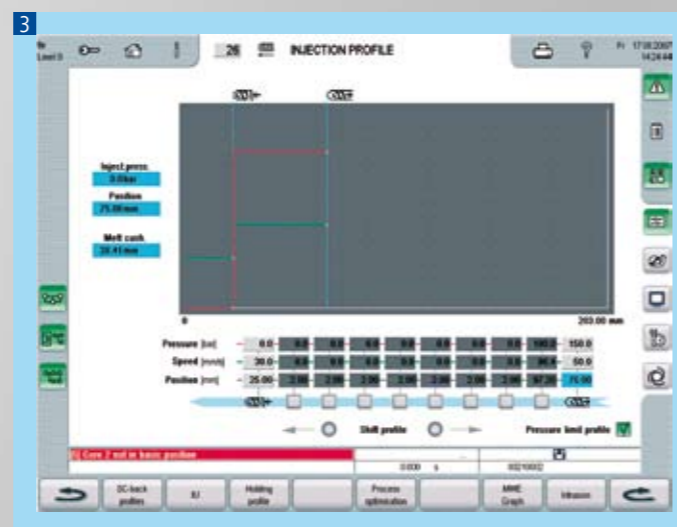
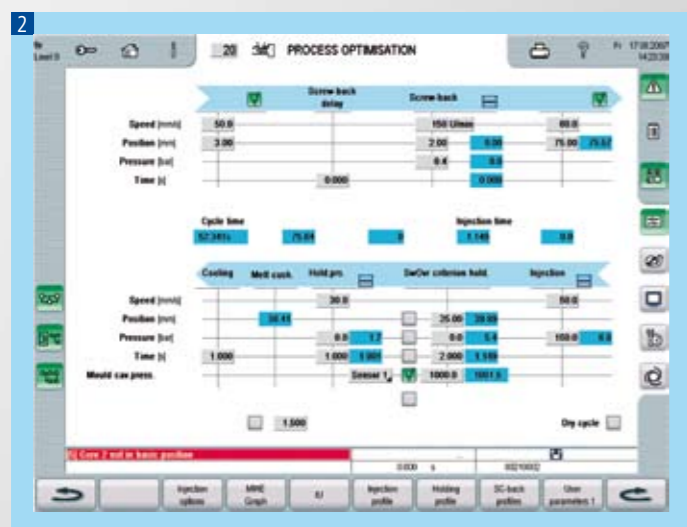
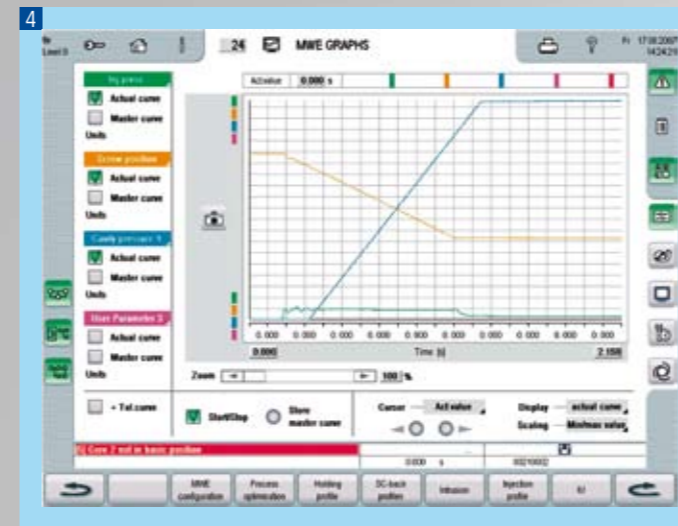
4 Programming of the cores, in addition to the usual functionality of core pullers, also includes that of hydraulic ejectors, including multiple strokes. As a result, there is no longer any strict separation of ejectors and cores: ejectors and cores can be programmed together in the mould sequence. The well-designed screen shows all parameters for extending and retracting of the cores, such as path, pressure and speed. In addition, it is possible to have such parameters listed as core movement time, multi-stroke on delay, off-delay, and the enable signal for a parts handling device.

5 Setting of the pneumatic valves is by a separate, logically organised screens. There is a window where the operator can select the start and stop conditions per valve out of over 30 items. In addition, the pneumatic valves can be enabled or

locked out for particular modes, such as setting up, manual, semi-automatic or automatic mode.

6 Another highlight of the NC5 control is the extensively freely programmable outputs. The screen page corresponds in design and function to the NC4 page 12 “Pneumatic Valves”. The programmable outputs ensure positive operation of any connected peripheral devices and the precise control during the operation of coordinated movements.

7 The programmable inputs allow signals of peripheral devices to be used to trigger any desired sequences in the machine or in the mould.



Temperatures under NC5

Special attention in process optimisation is focused on temperatures. The NC5 allows a rapid assessment and convenient monitoring for increased quality.

1 One of the hot keys activates directly the indication of barrel temperatures and – if integrated – also the temperatures for hot runner systems or temperature control devices. All hot runners can be controlled via the machine. The associated data are stored with the mould data. In setting up the injection phase, the NC5 provides the operator with a host of help facilities. Upon entering the basic setting, he has to guide the process to the optimal operating point. In doing so, the clear display of current setting parameters and process data ensures the necessary process transparency and so facilitates process optimisation.

Setting up the injection end and process optimisation

2 The “Process Optimisation” screen page compiles all essential parameters for process control on one page for convenient evaluation. The operator can enter screw speed, back pressure, injection speed and hold pressure as a constant value in each case or, using appropriate profile forms, also stepped or as a polygon. Aside from the setpoints, the NC5 control also displays the actual values of various parameters and provides the user with a quick overview of the process. The transfer to hold pressure can be effected as a function of time, volume or hydraulic pressure, and other parameters can be activated in the process as monitoring parameters.

3 Convenient setting of the functions injection, hold pressure and metering is facilitated by the use of default profiles that can be entered as polygonal

curves directly into the graphical image or numerically. For injection and hold pressure, there are ten data points available each and six each for back pressure and metering.

4 The basis for complete transparency of the process is provided by the integrated data acquisition system. The injection pressure, screw travel, and results of mould cavity pressure measurement during the injection and hold pressure phases are displayed as a function of time. Via the start and stop delay, the user can choose the recording period so that the complete cycle is displayed from injection and hold pressure through to metering or even beyond. A zoom function allows the user to have part of the screen displayed in greater detail.

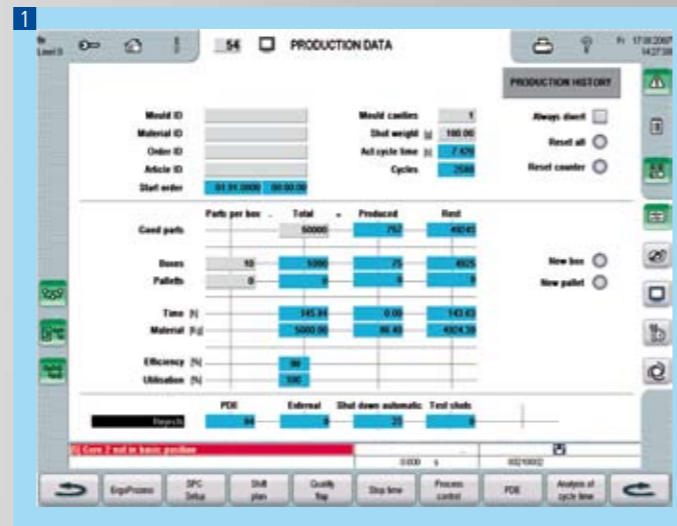
The NC5 control conveniently monitors and documents the production of all moulded parts and evaluates it statistically. This allows the operator to keep the process clearly in view and to define all quality-determining process parameters.

Process data monitoring and statistics function

5 The statistical representation of production data is freely configurable. Process parameters can be freely chosen and the cycle counter is always visible. The individual values are output in a table and are selectable via a scroll function. Below the table are displayed numerically the upper and lower deviation, band width, mean value and standard deviation. If the operator switches to graphical display, he can select the variable to be displayed above the graphic.

6 More and more frequently, users require seamless documentation of production and machine data. The NC5 control is designed to provide this facility and delivers the data via the USB interface for storage on any data carrier. Prior to export, the data can be converted into an Excel format. Regular printouts of the desired data can also be provided

by means of the integral thermal printer.



1 The "Production Data" screen page supports the user in monitoring production. For instance, he can enter a setpoint and during production can see the number of good and bad parts. At the same time, the remaining production run period is indicated. A counter function provides management of moulded part quantities in a box or tray and there is another possibility to activate a monitoring system. Also provided on this page is the management of production activities since clear identification of the moulded part is possible by entering the mould, order and article numbers.

2 The NC5 control allows the operator to freely select any quality-related process parameters required for monitoring. To this end, he can activate up to 50 parameters and for 16 of these he can also determine the order in which they are to be

recorded. The process parameters to be supervised have each an upper and lower tolerance limit. Whenever the tolerance is exceeded, the separation unit is activated to separate the non-conforming part. In addition, the rejects will be counted. If a freely selectable limit is exceeded, the operator will have an alert displayed and a red warning light will be flashing. In the case of some moulded parts, monitoring of process parameters alone is not sufficient. Therefore, it is also possible to include and monitor externally detected quality characteristics, such as weight, size and surface appearance in process monitoring.

3 The print program also allows the automatic printout of individual screen pages and process statistics to be activated. The operator will define after what number of shots or after what period of

time the printout should be produced. The change log documents any changes in the settings. To this end, the NC5 control will record who has changed which parameter when and for what reason. This is an advantageous feature in promoting quality assurance.

Functions for automatic starting and ending production enhance the availability of the machine and lower costs.

Automating production start and end

4 The NC5 switch-on program allows oil preheating, barrel heating, mould temperature control or switched plug socket combination to be initiated unattended. Initiation of all phases can be in staggered fashion so that the programming of date, day and log time facilitates the automatic switch-on of the machine.

5 With the start-up program, the NC5 control will run up the injection moulding machine for initial production or after production interruptions in three stages via the key parameters. An integrated shot counter allows the length of each stage to be exactly programmed, the number three stage representing normal operation.

6 The purge program permits the controlled end of production to be programmed, for instance, at

the end of the shift or when a preselected number of parts have been completed.



Ergosupport – high moulded part quality quickly achieved

1 The switch-off matrix determines which mal-function or what number of parts will result in the pump, mould heating, barrel heating, and heating of peripherals or coolant being shut down or whether the purge program is to precede the switch-off.

2 For quicker, trouble-free mould set up, the mould catalogue allows the operator to store mould data sets of a number of moulds and, when required, to select and read in a data set. Explanatory notes can also be stored and read out from the corresponding catalogue on the screen.

The Ergosupport supplementary software assists the operator at each level of process control: from the machine basic setting using Ergostart and stepwise process optimisation and error correction through to seamless monitoring of the process sequences and variations. Ergosupport allows

the operator to access Sumitomo (SHI) Demag's complete process and application know-how.

The Ergosupport program also assists in identifying and eliminating possible moulded part defects. It provides the operator with instructions as to which measures he can initiate to remedy which defects. In order to permit defects to be quickly identified, these are grouped according to such features as surface appearance or dimensional deviations. To correct any defect occurring on the moulded part, the operator can call a number of options. These include a defect description, a list of remedies in the case of parameter-related causes and a list of remedies in the case of design-related causes.

3 Based on the material to be processed and the moulded part geometry input by the operator,

Ergostart will calculate a basic setting for the injection and clamping units. This provides the starting point for the incremental optimisation of the individual process parameters.

4 The remedial actions listed are sorted in the order of probability with which they will contribute to the correction of the defect. Ergosupport extends the familiar system of process inspection for quality monitoring explained under "Process data monitoring and statistics function". The extended process inspection is intended to alert the operator whenever the process threatens to drift out of its variation band. For this purpose, it is possible to define what are referred to as "alert limits". The starting point for the selection of process parameters that lend themselves to monitoring is the configuration which the operator adopts for the

selected moulded part. The system draws on existing body of process know-how and suggests concrete process parameters for monitoring for the operator to select. For the selected parameters, the system determines the "natural" process variation and calculates meaningful alert limits. An error message will appear on reaching an alert limit.