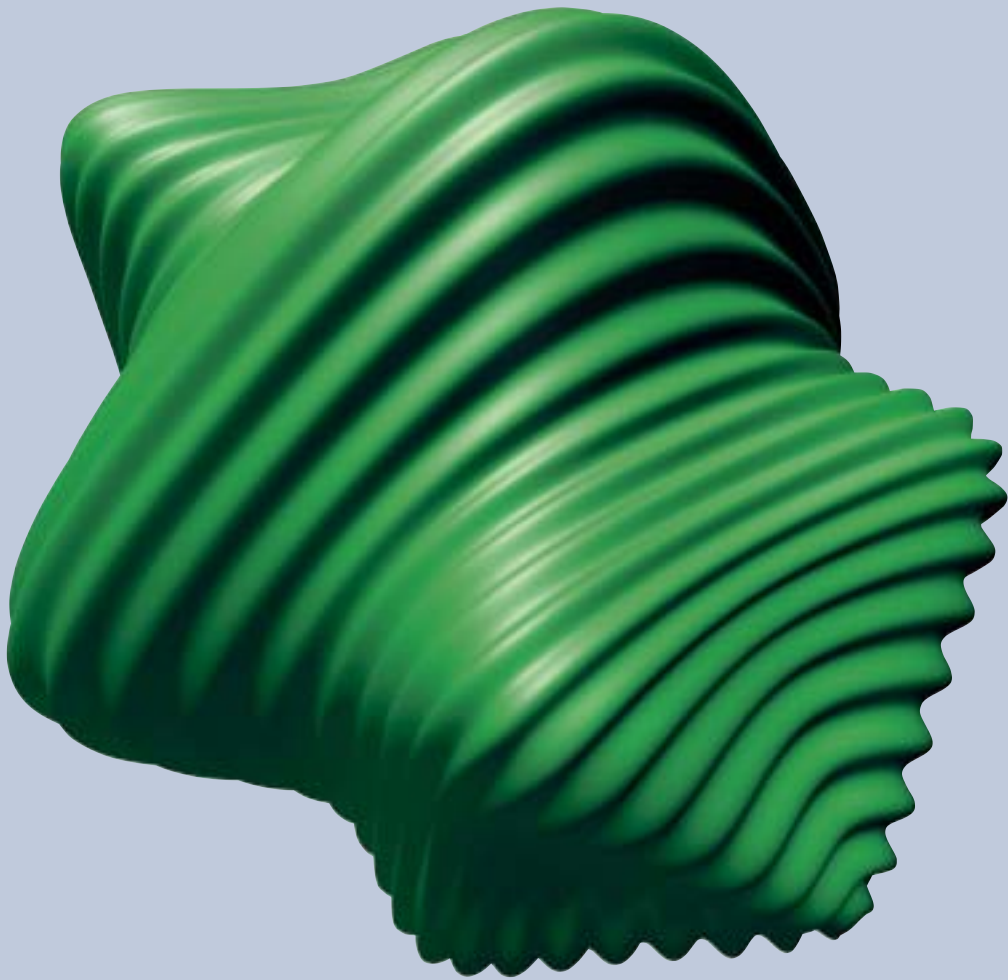


>> The best way to predict the future
is to invent it. << Alan Kay (american computer and internet pioneer)
be the first.



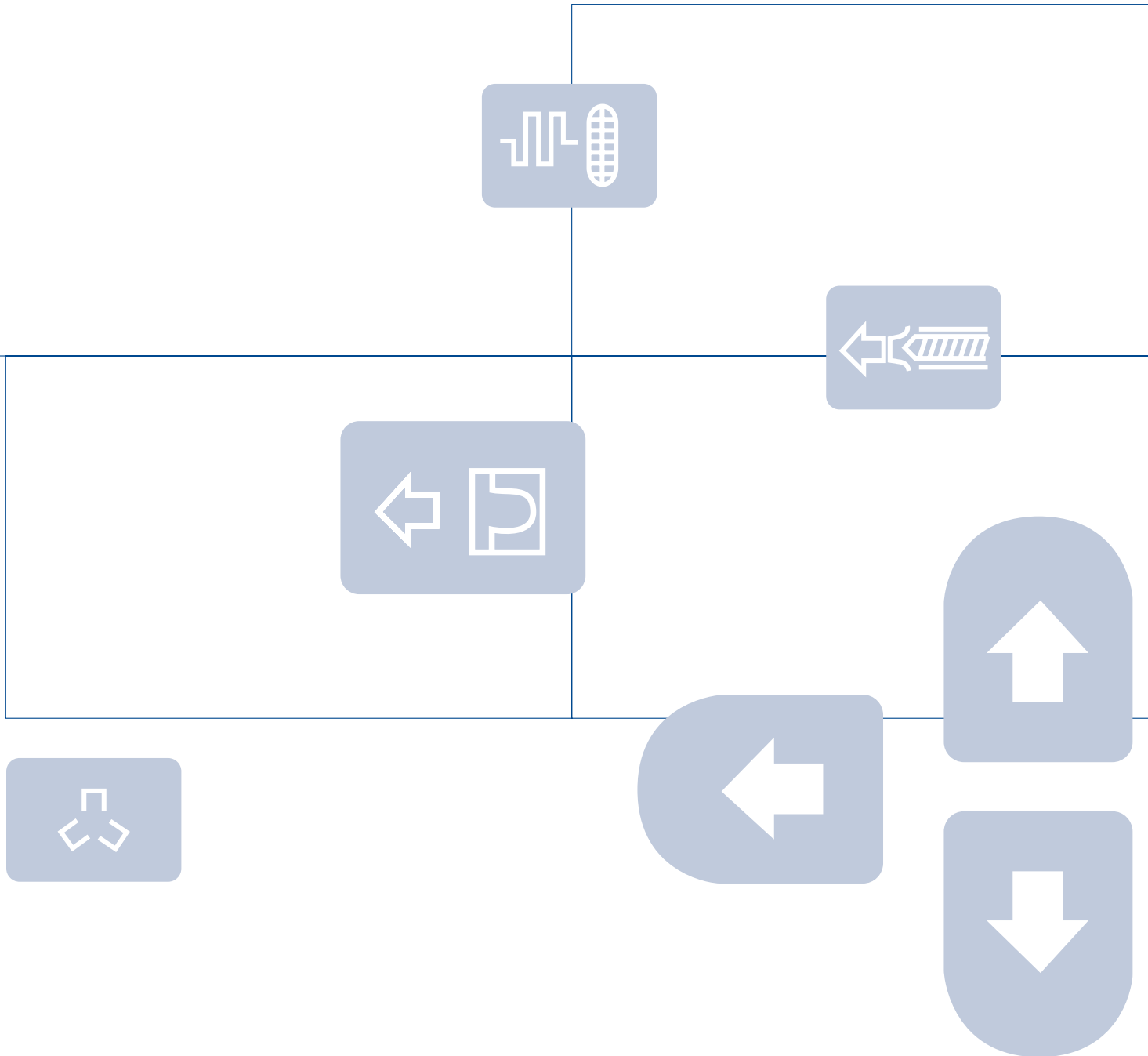
Innovative injection molding technology

ENGEL
control systems

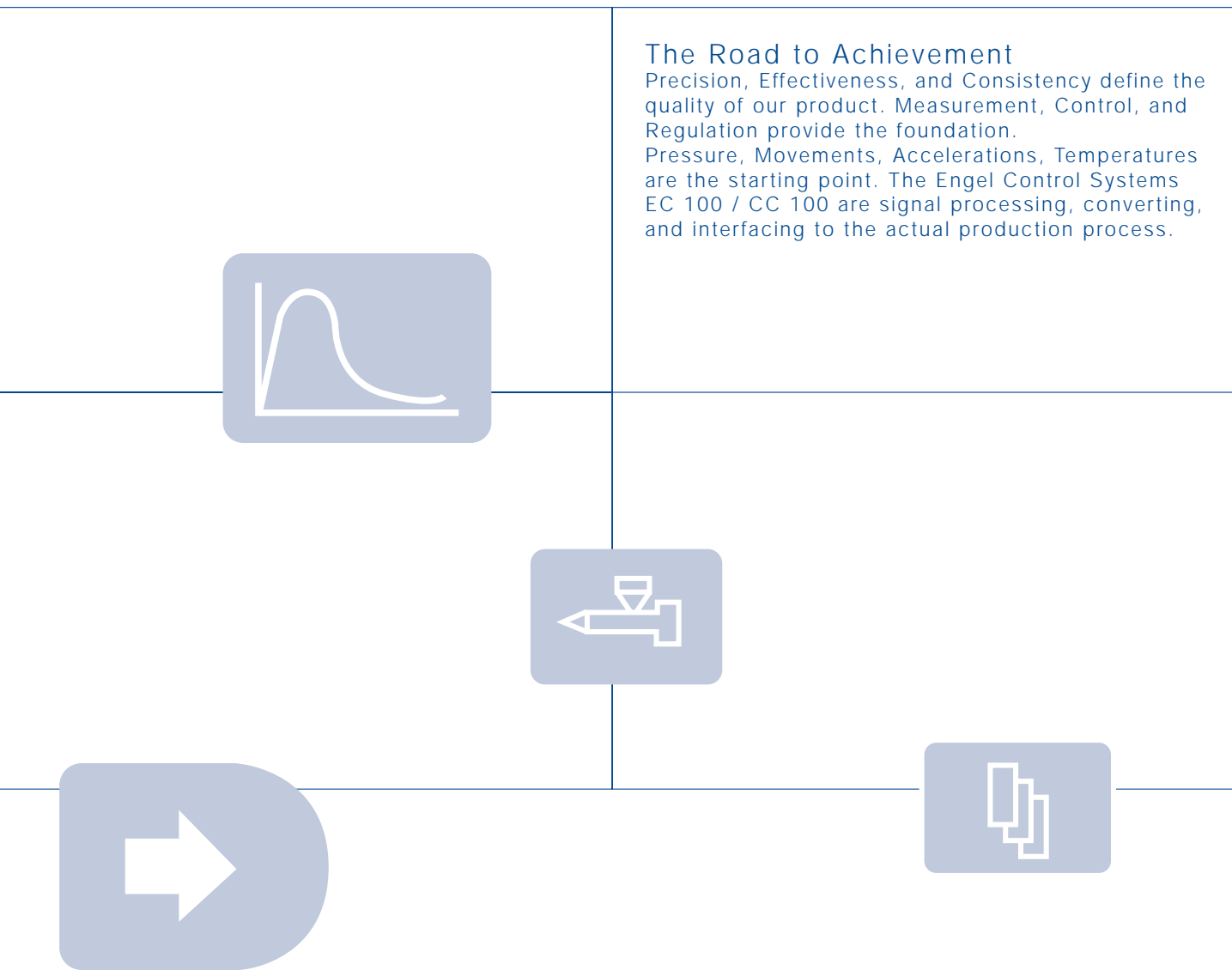
ENGEL CONTROL SYSTEMS.

Precise Control and Sequencing of all Injection Molding Processes

2



S.



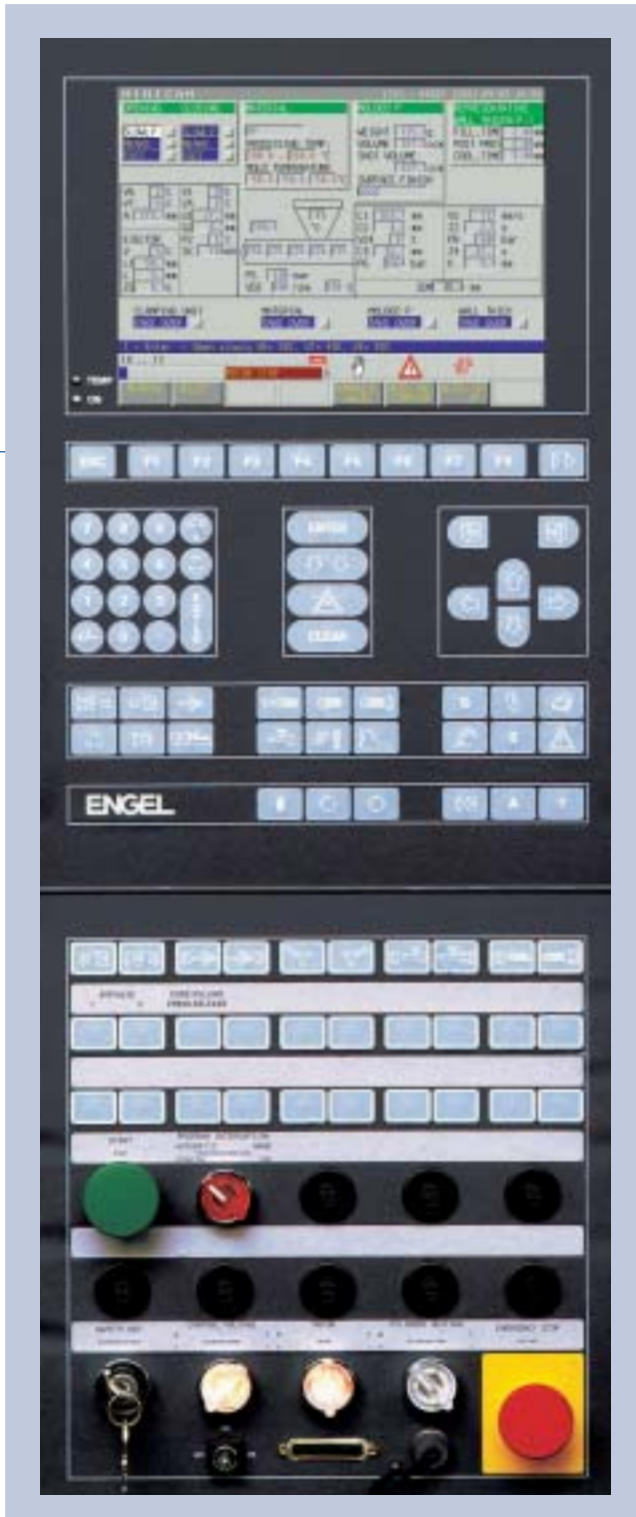
The Road to Achievement

Precision, Effectiveness, and Consistency define the quality of our product. Measurement, Control, and Regulation provide the foundation.

Pressure, Movements, Accelerations, Temperatures are the starting point. The Engel Control Systems EC 100 / CC 100 are signal processing, converting, and interfacing to the actual production process.

ENGEL CONTROL SYSTEMS. Universal for all Engel Machines.

4



System family

Engel attaches great importance to a standardized user panel for the control of injection molding machines and robots. For this reason all control variants have the same symbols and arrangement of function keys. To facilitate maintenance and stocking of replacement parts, identical hardware modules are utilized. Standardization and clear operator guidance helps you to rapidly and efficiently implement Engel controls.

Fast

32 Bit RISC processors are the high speed computers in the EC 100 and CC 100 controls. Important commands are directly executed via hardware within the processor. The result is fast command execution times. Execution of complex programs can be reproduced with short cycle times. The "real time multi-tasking operating system" executes the required tasks simultaneously and accurately.

Intelligent

Digital control technology and fuzzy logic are used for the self-learning temperature control circuits. Barrel, nozzle, mold and hot runner temperatures are automatically optimized and accurately controlled. The digital control of the sequence of motions is accomplished by a 32 Bit RISC processor. The intelligence – that is the computer performance – is spread over the individual modules. Additional modules are either plugged into free ports or connected through the field bus. In this way the system can be flexibly expanded. Speed and accuracy of the system are not changed by options and upgrades.

Reliable

All components of the system are made in Surface Mounted Device (SMD) technology. The design of the hardware is matched to suit the requirements of rough industrial surroundings and the regulations for electromagnetic shielding. The modules are made sturdy and reliable by use of a protective metal casing. The integrated diagnostic system automatically detects hardware errors.

Precise

For precise injection control, exact signals from the respective transducers, such as position, pressure, etc. in the millivolt range are crucial. The analog measuring signals can be influenced by sources of machine interference. To prevent signal (noise) interference from occurring, the signal is converted from analog to digital directly at the respective transducer and is transmitted to the control system in digital form. Transducer signals of extremely long strokes can be transmitted precisely, at an accuracy of 0.0004 in.

Plenty of color

The EC 100 / CC 100 controllers have a high-resolution 10.4" TFT color screen with active matrix, allowing the operator to quickly and easily compare actual and ideal curves. Different colors are used to distinguish alphanumeric data – such as red for position, and green for pressure.

Real time graphics

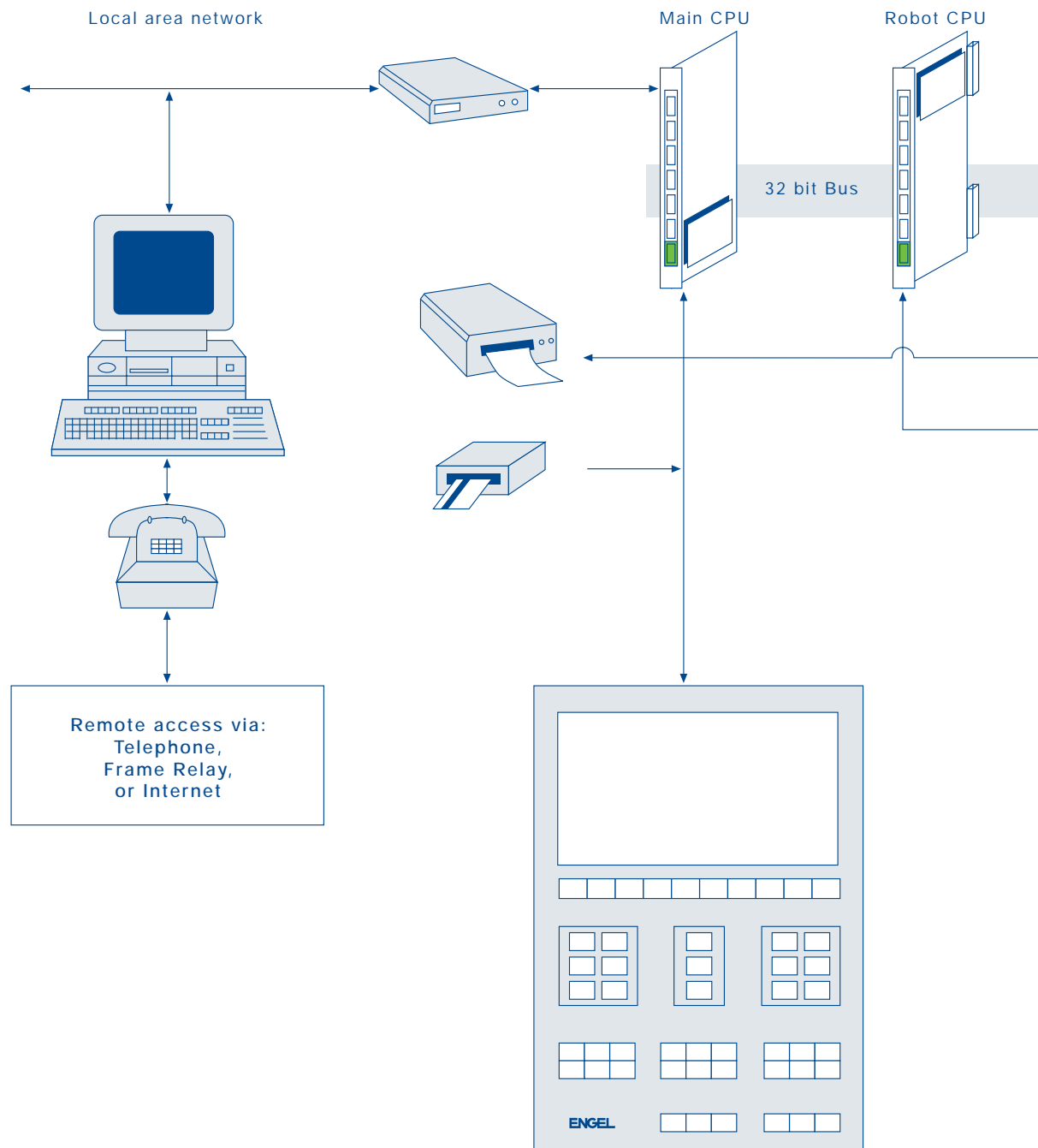
The powerful, expanded graphics package ENGEL MICROGRAPH PLUS is standard on the CC 100 controller, giving quick access to key information. Features like the "Auto Set" function, which gives you all the most important process variables – injection pressure, speed and screw travel – are automatically displayed and optimally scaled at the press of a button.

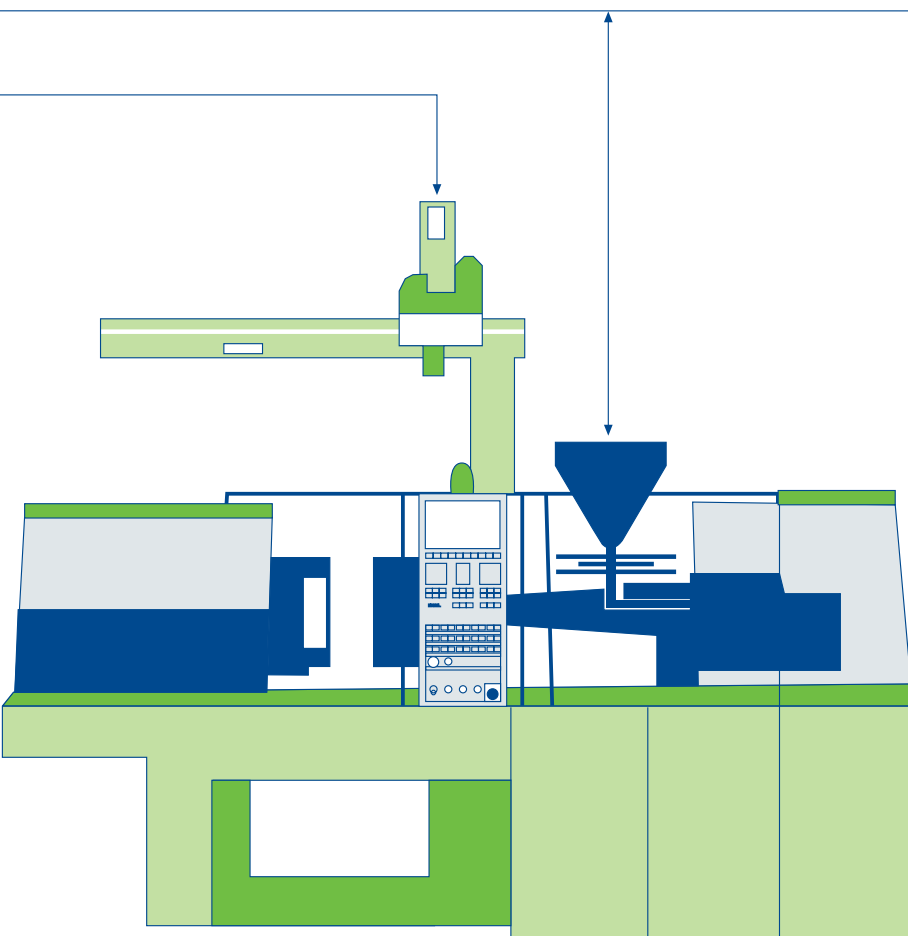
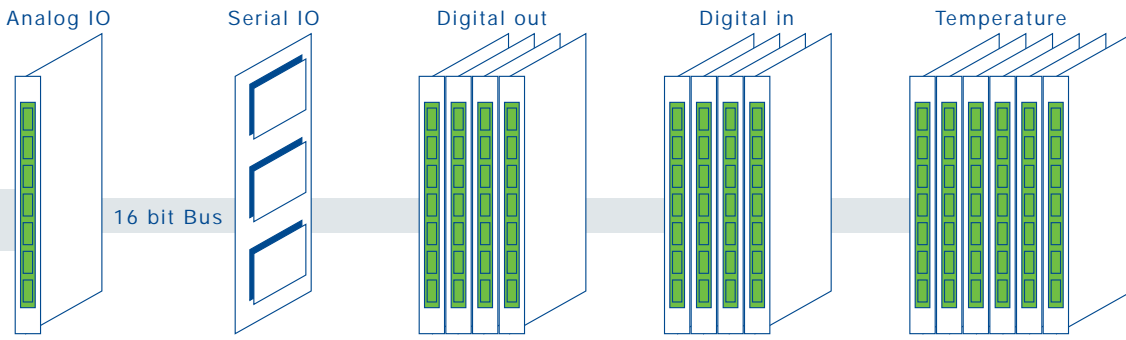
Another feature is the Automatic Ideal Curve Screen. To determine the ideal curve and tolerances, perform a trial run over a period such as one hour. ENGEL MICROGRAPH PLUS will track the curves while you are molding good parts, plot them over one another, and automatically calculate the ideal curve and tolerance tunnel.

ENGEL CONTROL SYSTEMS.

The right control for each application.

6





ENGEL CONTROL SYSTEMS.

EC 100 – the standard control / CC 100 – top of the line.

Standard Equipment

- 3D display page structure with logical page hierarchy, and quick call soft touch keys
- TFT color flat screen; 16 colors
- High speed integrated 3.5" disk drive
- Control of injection functions
- Self-learning temperature control
- Cut-over to holding pressure (position, time, pressure dependent)
- Digital display of all actual parameters and actions
- High resolution mold protection
- History reporting for all errors & alarms
- Graphic cycle time analysis

Optional Equipment

- ENGEL MICROFLOW and ENGEL MICROPLAST
- ENGEL MICROGRAPH PLUS (standard on CC 100)
- PD-Graphics & Reports. Continuous, graphical monitoring of process parameters (standard on CC 100)
- Quality Data Statistics QDS (SPC Reporting)
- Weekly timer
- Energy calculation or energy measurement programs
- Interface for robot, central computer, EMS, auxiliary devices, etc.
- Remote maintenance interface (Ethernet connection)

8

- Set value graphics
- 3 freely programmable text pages
- 3 free composition text pages for individual summarizing of important parameters
- Log downtime & process variable changes
- Printer interface; IBM compatible keyboard interface
- Quick-Set-up page with cycle step display
- Debugging system for extensive diagnostics
- Cycle time analysis
- US / metric unit conversion
- Key and password security system

- Interface for freely programmable digital input/output
- Servo valve control
- Magnetic card reader – access to machine settings with magnetic card
- Cavity pressure cut-over device with pressure transducer
- Technology software (PVC, LIM, MuCell®)
- Hot runner PID temperature control
- PC programs: EMS – ENGEL MONITORING SYSTEM, EXPERT CONTROL PLUS, etc.
- Autoprotect: high-precision mold protection and injection monitoring systems
- Freely programmable cycle sequencing
- MINI-CAM: Support for setting of process parameters
- Display text available in 25 languages
- Automatic shutdown for "lights out" operation (ghost shift program)
- Networking capability via "teleservice / ENGEL MONITORING SYSTEM" ethernet connection on CC 100 models. (optional on EC 100 models)

Globally Applied.



Screenpage Spanish



Screenpage French



Screenpage German



Screenpage Italian



Screenpage Japanese



Screenpage Chinese (Mandarin)

ENGEL CONTROL SYSTEMS. Clear and functional design.

10



QUICK-SETUP

QUICK SETUP

With Engel's "Quick Set" function, all critical machine parameters can be set from a single page. The control system performs pre-calculations automatically to allow you to ready the machine for production with minimum data input.



Set value graphics

Machine setup with graphic support

The main machine functions: closing, opening, injection, holding pressure, plasticizing and back pressure, can be set using the set value graphics. This provides the machine operator with a clear picture of the current function.

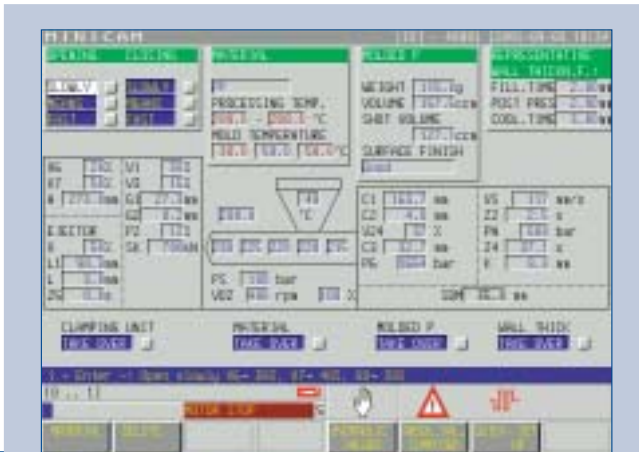


Cycle time analysis

Cycle time analysis

This program records the real time for each machine function and displays it for the current and preceding cycle. The graphic design offers a quick cycle time overview of each individual machine function.

Innovative Process Optimization Tools.



MINI CAM

MINI CAM

MINI CAM offers machine set-up made easy through:

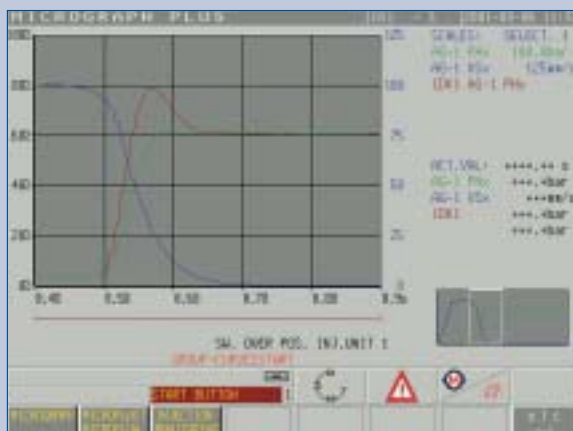
- Automatic setting of material and part related process parameters on a single display page
- Active machine setting assistance through a "molding wizard", based on an expert system.



Absolute Value Input

Absolute Value Input

Parameter setting in actual values related to volumes, strokes and pressures.



Self Optimizing Software Control

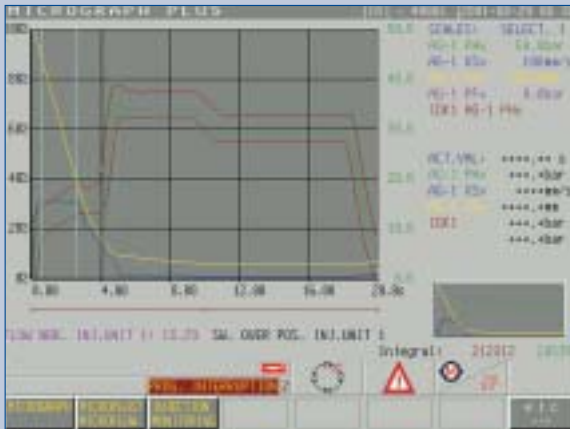
Self Optimizing Software Control (for injection speed and injection pressure)

Self optimizing software control which adjusts the process according to settings, within three cycles after measurements of its speed or pressure profile.

ENGEL CONTROL SYSTEMS.

Programs for Process and Quality Monitoring.

12



ENGEL MICROGRAPH PLUS

ENGEL MICROGRAPH PLUS

This universally recognized graphics program serves for real time recording, monitoring and analysis of process variables.

Up to 7 different process values can be plotted as curves on each of 4 different screen pages. One ideal curve can be determined per page.

By presetting a tolerance field, partial or entire functions, such as the injection process, can be monitored individually without interruption.

The tolerance field can be determined automatically in that the curves from a specific number of cycles are plotted over each other so that a defined tolerance range is automatically calculated.

This is the tolerance field for all subsequent cycles, which can actually be adhered to by the machine.



ENGEL MICROPLAST / MICROFLOW

ENGEL MICROPLAST

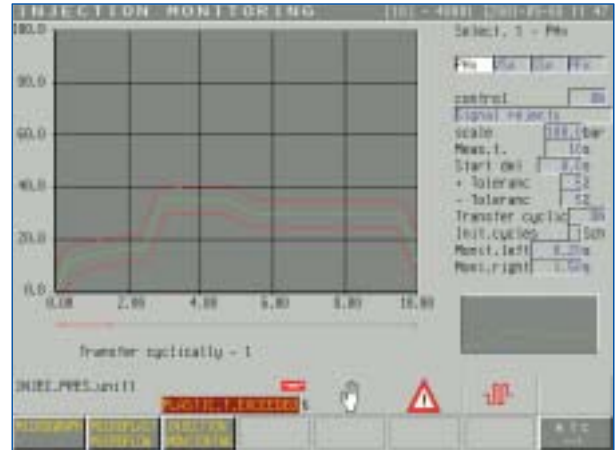
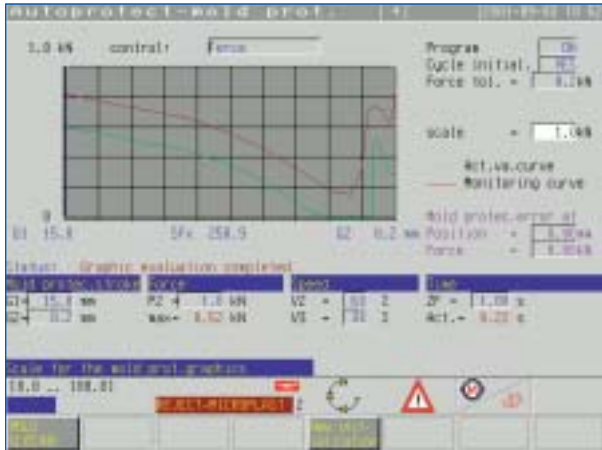
Each injection stage causes a specific injection pressure characteristic derived from the set value for velocity. By finding the integral for a given area under the curve, an index or flow number is calculated based on the work done to create the part. The operator can define an ideal flow number with tolerances, and monitor all subsequent cycles automatically.

ENGEL MICROFLOW

This program performs an automatic correction of cut-over points and/or holding pressure according to variations in the flow number measured. Correction takes place, in cycle, to help prevent rejects caused by variation in material.

ENGEL CONTROL SYSTEMS.

Autoprotect – the self-learning protection program.



14

Mold Protection

a) Automatic determination and monitoring of the mold protection pressure:

The machine operator determines the range for the mold protection. During clamping of the mold, the control determines the pressure required within the set mold protection range, which is then displayed graphically. In future cycles, a tolerance field is placed over the pressure curve. All subsequent clamping movements will have this tolerance curve as the maximum limit. When the tolerance range is exceeded, the machine stops and the mold protection alarm is activated.

b) Automatic determination and monitoring of the mold protection speed:

The same principle is also applied in the determination of the speed within the mold protection range. In this case the actual speed is graphically recorded and provided within a defined tolerance. When the speed drops below this tolerance, the machine stops and activates the mold protection alarm. This new principle permits highly sensitive mold protection.

These software programs enable a continuous monitoring of the pressure and speed profiles during the mold protection phase.

The advantages compared to the usual mold protection are as follows:

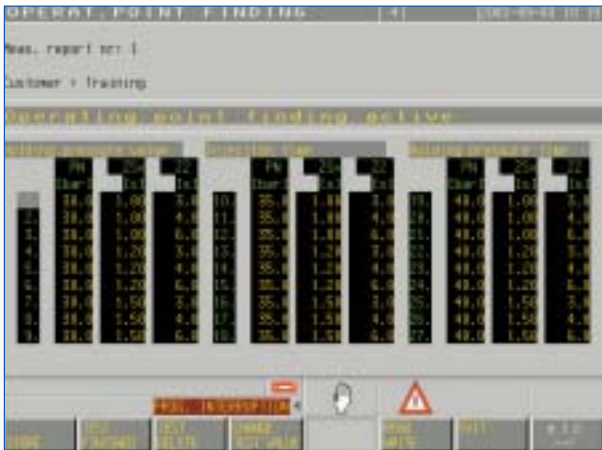
- self learning
- higher sensitivity and therefore the possibility to operate at higher speeds
- increased mold protection through immediate recognition of higher resistance

Injection Monitoring

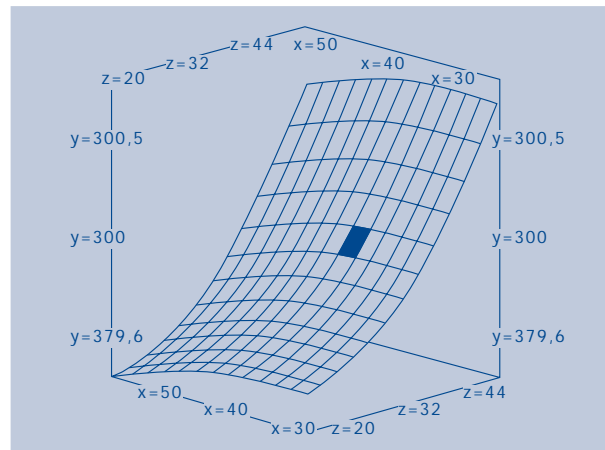
The "Autoprotect-Injection Monitoring" program serves to monitor injection and cut-over pressures through a comparison of the actual curve with a process adjusted, predetermined, ideal curve of one or more relevant, selectable values. The goal is to recognise critical deviations, e.g. over packing of the mold, as quickly as possible and be able to initiate the response action.

The ideal cycle is determined by the machine operator from one or more of the previously considered good cycles. Ideal and actual cycles are graphically displayed, similar to ENGEL MICROGRAPH PLUS. Scale of the data recording, monitoring tolerances, measuring times, and the monitoring window are all freely adjustable.

Expert Control – systematic determination of the optimized process settings.



Expert Control



Expert Control operating characteristics

Process Optimization

For a new mold, the operator is often faced with the task of finding the most suitable settings on an injection molding machine for good parts. But even here, where individual experience usually rules, there are systematic methods which, with regard to general quality assurance, play an essential role. The description of quality characteristics as a function of process variables creates a link between part quality and the injection molding process. The complexity of the injection molding process made optimization without computer support all but impossible. With a program package based on expert knowledge, Engel is paving the way towards the "self-learning machine". The search is not for the first workable machine setting, but for the best possible setting.

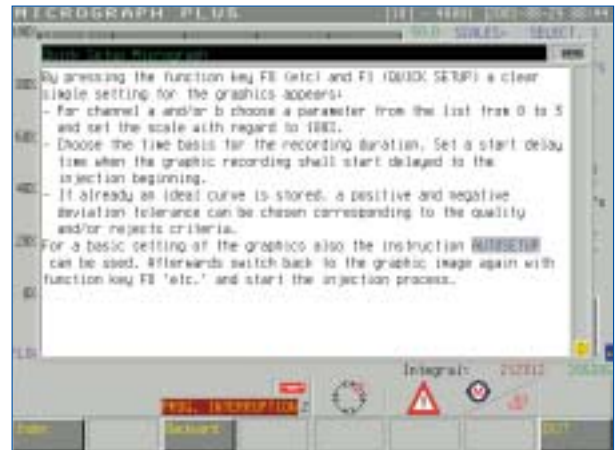
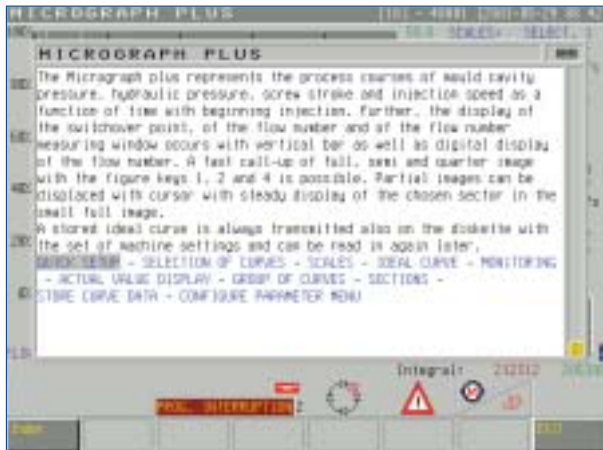
Expert Control Plus

The operator's guide to achieving the optimum operating point. The starting point is a machine optimized according to general criteria. While the limits for mold and barrel temperatures depend on the material, the limits for other parameters, such as the cut-over point or holding pressure, are chosen by the operator after assessing the molded part. After defining the required part properties with tolerance limits and with access to a technological matrix with expert knowledge, a given test plan is run through systematically, coordinated by the machine control and PC. The optimized set value for efficient production is calculated by measurements gained from the molded parts.

Based on the multi-dimensional process characteristics calculated, the process variables of the machine are controlled entirely automatically. During the process, variables stored in the technological matrix of characteristics are compared with the actual values being measured. At a pre-definable deviation, the program calculates a correction value, e.g. cut-over pressure, which optimizes the process by successive alteration of the given set values. This feedback process provides fully automatic quality control of the molded part. Direct information exchange is carried out over the controller.

ENGEL CONTROL SYSTEMS.

The Integrated Help System - Quick Help for the Operator.



16

Help text

An integrated on-screen help system offers quick, user friendly assistance to the machine operator. User help is available for each screen page, for each setting, for every measured value, for every alarm - for everything which appears on the monitor screen. This eases the operation of the system for untrained as well as for trained machine operators.

The screen text is stored with the "Hyper Text Markup Language (HTML)". This allows you to navigate in all chapters of the text - like on the Internet. Selected terms within the help text are connected to further detailed information.

You simply place the cursor on the selected term, press the help text key, and the additional texts become visible.

This is how you are able to direct yourself through the information.

Through the help system, the quality and efficiency of the machine operation and the machine set-up is improved. The machine control manual is provided at the operators fingertips.

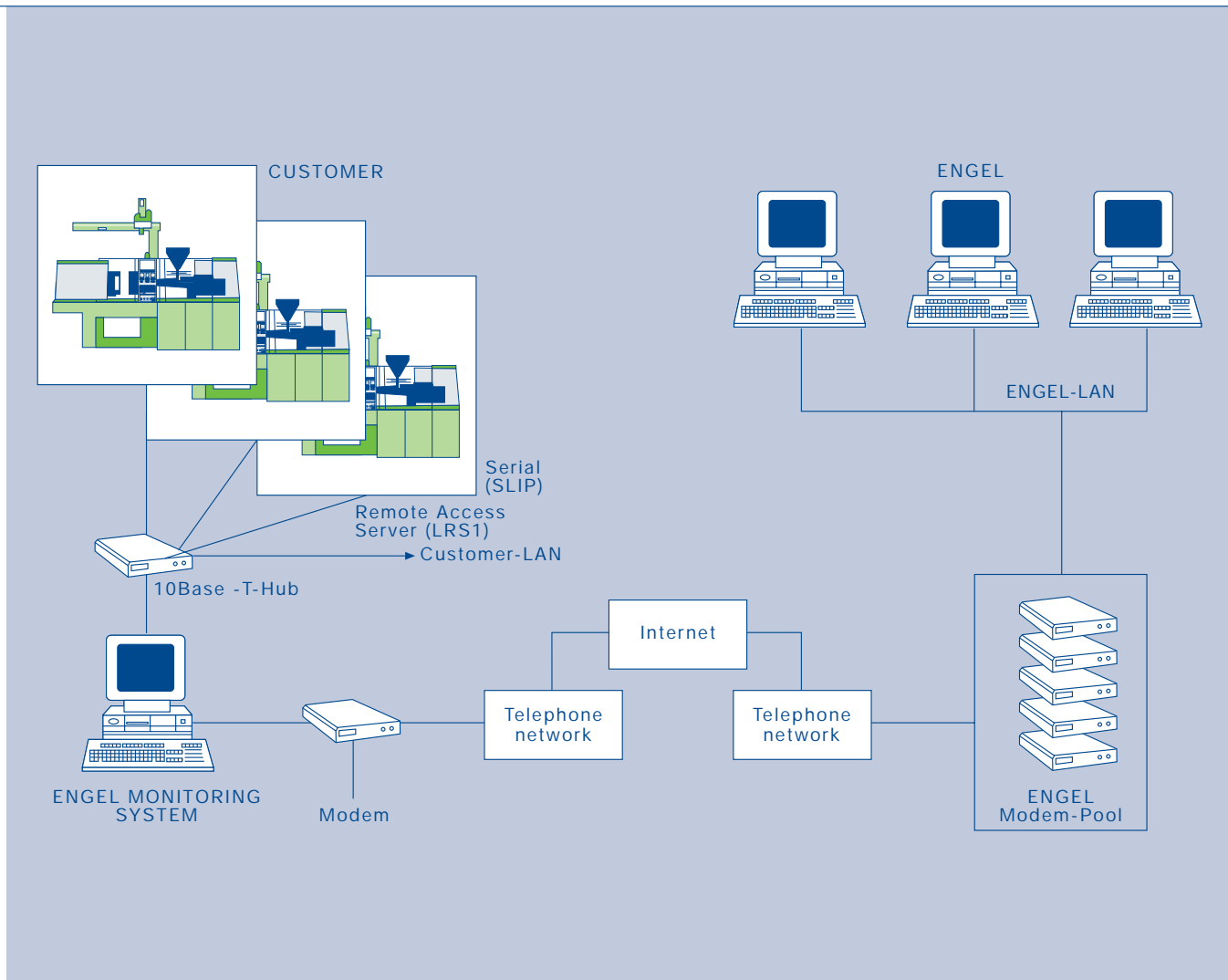
On-line help when you need it.

Engel uses remote connections for the following functions

- The viewing of all screen pages
- The analysis of hardware and software control issues
- The correction and down-loading of new processes and modified programs

Remote maintenance

The optional Engel remote maintenance module permits extensive diagnostics of hardware and software with the help of Internet tools. The web server, integrated in the machine controller, provides all information and is also able to process information. It communicates either directly through a telephone line or via the Internet. Applying Internet technology, all possibilities of communication are open to Engel. The connection is used for universal exchange of data.



ENGEL CONTROL SYSTEMS.

EMS – Engel Monitoring system.

ENGEL MONITORING SYSTEM (EMS)
All mold and machine related set-ups and actual process values can be transferred to the PC via EMS. The current status of each connected machine can be viewed remotely by a PC.



18

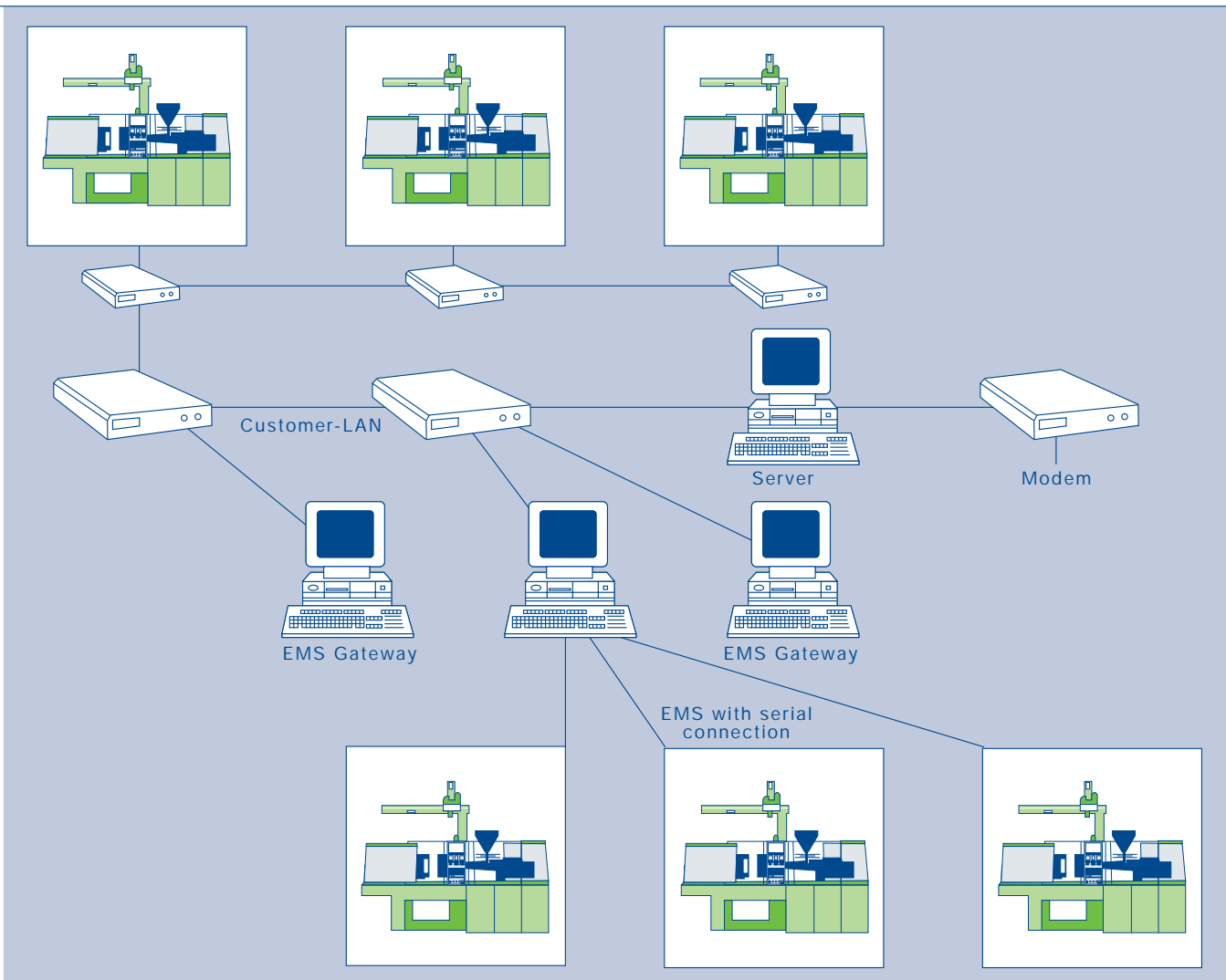
The following program package is available with EMS:

- EMS basic package (ENGEL MONITORING SYSTEM) runs communications with the machine control and stores machine data in standardized files for processing on a PC or network.
- PCS (PARAMETER CONTROL SYSTEM) for storage, management and visualization of set-up data for different molds and machines.
- PDT (PROCESS DATA TRANSFER) for selection, storage and visualization of process data for all connected machines.
- MST (MACHINE STATUS) graphically displays the production plant, including all machines, and provides fast access to the machine status.
- RDS (REMOTE DIAGNOSTIC SERVICE) serves for the remote maintenance of the EMS system and the connected control systems via modem.

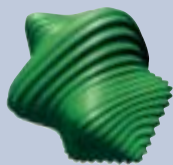
Engel in the PC world.

An injection molding machine works with individual data for the process. Here we distinguish between set-up data (set values) and process data (actual values). To be able to process this data in the PC, for example to evaluate it with standard commercial programs, suitable conversion is essential.

The ENGEL MONITORING SYSTEM (EMS) undertakes this conversion and establishes the connection between PC and Engel. With the Control Panel-PC, Engel has integrated the PC with all its advantages directly into the machine control system. All Engel PC programs are based on MS-WINDOWS™.



be the first.



Machines

ENGEL TIEBARLESS

ENGEL DUO

ENGEL CLASSIC

ENGEL E-MOTION

ENGEL INSERT

ENGEL ELAST

ENGEL LIM

Integrative technology

ENGEL ROBOTS

ENGEL CONTROL SYSTEMS

ENGEL PRECISION MOLDS

Technology

ENGEL COMBIMELT

ENGEL FOAMMELT

ENGEL GASMELT / WATERMELT

ENGEL TECOMELT

ENGEL FIBERMELT

ENGEL X-MELT

Services

CUSTOMER SERVICE DIVISION

Language

german

english

french

italian

spanish

ENGEL

ENGEL NORTH AMERICA: www.engelmachinery.com

Canada: Engel Canada Inc.
Guelph, Ontario, N1K 1C2
Phone: (519) 836-0220,
Fax: (519) 836-3714
e-mail: sales@engel-ec.com

USA: Engel Machinery Inc.
York, PA, 17402
Phone: (717) 764-6818,
Fax: (717) 764-0314
e-mail: usasales@engel-ec.com

Mexico: Engel de Mexico S.A. de C.V.
Mexico City, Mexico 11230
Phone: (52-555) 399-8999,
Fax: (52-555) 399-2649
e-mail: engel@prodigy.net.mx