Software Specifications

CNCBase -

Programming and control	• Compatibility with EIA RS274-D standard G&M codes. • CAD/CAM compatibility. • Advanced NC code editing functions, including automatic block numbering, comment management and code verification. • Absolute and incremental programming. • Supports canned cycles for drilling and boring. • Programmable tool offsets and cutter compensation. • Supports metric and English units. • Unlimited number of programs can be open simultaneously. • Unlimited number of program blocks. • Standard Windows functions for program editing (e.g., cut, copy, paste, find).
Programming verification	• Quick verification of G&M code to ensure correct and complete syntax during program editing. • 2D graphic verification of the tool path ensures precise programming.
Manual hardware control	• Movement along each axis at customized speed and step settings. • Spindle activation and speed control. • Movement control from dialog box and keyboard.
Real-time data display	• Real-time display of current hardware setup, including cross-slide and tool positions, tool in use, machining parameters (feed rate, spindle speed, depth of cut). • Real-time display of home switches' status and position errors, hardware status (shield open or closed, robot input). • Real-time display of program execution, including block being executed and program run time.
Parameters for adjusting controller operation	• Manual override of programmed spindle speed and feed rate. • Configurable soft limits for safe machining. • Parameters can be easily viewed and manipulated.
User interface	• Two operating modes: - Online: CNCBase communicates with the controller and simulation software - Simulation: CNCBase communicates with simulation software • Icon toolbars for frequently used commands and operations such as tool change and program verification and run. • Online help.

CNCMotion -

Graphic setup	• Interactive graphic set-up enables customization of machines, including various machine tools and fixtures. • Definitions and properties of clamps, vices and chucks; fixtures can be defined as pneumatically or manually operated. • Definitions and tool offsets for up to 20 predefined and user-defined tools. • Definition of manual tool holders/posts, or automatic tool changer/tool turret. • Definitions and properties of work-pieces: material, colour and size. • During setup all definitions are verified by software to ensure compatibility with actual hardware and physical environment.
Dynamic 3D simulation	• Dynamic simulation and graphic tracking of CNC mill and lathe during manual operation and NC program execution. • Simulates cross-slide, spindle and tool movements. • Simulates in real time the changing form of work-piece during the entire machining process, including milling, turning, engraving and routing. • Reflects the behaviour of machines in real-world conditions, including axis limits, impact, automatic and emergency stops, and shield engaged stops. • Enables experimentation with virtual parts of different shapes, sizes and materials, such as wax, brass, wood and aluminium. • Point and click on screen to move the tool for work-piece origin definition. • Full control of machining parameters during simulation, including feed rate and spindle speed. • Display of current tool coordinates and state of hardware components (e.g., on/off, open/closed). • Various viewing and display controls; e.g., zoom, rotate, pan, drag, redirect. • 3D tool path verification during machining. • Can simultaneously display three different 3D views of the CNC machine.
Programming and control	• Fully integrated with CNCBase control software, an intuitive tool for programming and operating CNC machines.

FANUC 21i Emulator -

Robotic work-cell setup	• Interactive graphic setup enables creation of virtual robotic work-cells. • Simple point and click manipulation of object for placement and definition. • Peripheral axis placement and connection: conveyor belts, XY tables, rotary tables, linear slide-bases. • Part definitions and properties: colour, size, position; unlimited number of parts of any shape or colour. • Definition and connection of sensors and I/O devices. • Definition of parts in storage devices and feeders; feeders can supply any quantity of any part. • Definition of CNC machines, control of machine doors and machine cycle time. • Predefined welding cell; user can modify. • CAD file import utility for user-defined parts and objects. • Setup module can be activated directly from SCORBASE module.
Programming and control	• Fully integrated with SCORBASE for Controller-USB robotics software, an intuitive tool for programming and operating robotic work-cells.
Interface languages	• English, Spanish, Portuguese, German, Korean, Vietnamese, Polish. • Can be easily translated into any user language
Dynamic 3D simulation	• Fully functional 3D graphic display module provides dynamic simulation and tracking of the robot and devices in the work-cell. • Simulation of robot movements and gripper part manipulation. • Simulation of peripheral axes: conveyor belts, XY tables, rotary tables, linear slide-bases • Simulation of CNC mills and lathes: moveable machine parts such as door, chuck and spindle; user-definable machine cycle-time; CNC processing reflected in shape of virtual parts. • Simulation of automated welding system: welding of multiple parts of varying shapes; full simulation of welding parameters: wire feed rate, robot speed, inert gas shield and voltage; analysis and simulated display of weld according to welding parameters allows users to study parameters effect on weld quality; incorrectly set parameters or misplaced objects results in flawed or failed weld • Simulation of parts: objects fall according to laws of gravity; stacked objects move together when lower object is moved; feeders supply parts according to user-defined properties and quantities. • Simulation of different types of sensors. • Detection and response to impact conditions and axis limits. • Point and click on screen to move the robot and teach position. • Display of robot origin, work envelope and gripper position. • Display of coordinates of work-cell objects and devices: absolute positions or positions relative to robot origin. • Display of names of robot, work-cell objects and devices. • Various viewing and display controls; zoom, rotate, pan, drag, redirect, continuous follow-me camera, shading and lighting. • Display of gripper path during robot movement. • Can simultaneously display 3 different 3D views of robotic cell.

SCORBASE -

Position recording	• Positions can be recorded both online and offline. • Positions can be absolute or relative. • Position coordinates may be for robot arm, peripheral axes, or both. • Unlimited number of positions can be recorded • User can manually move robot to desired location and instruct controller to record position. • User can enter XYZ coordinates for positions. • Position list displays all recorded positions and their coordinates. Different display options allow user to organize and display position data in an easily-understood format. • Positions recorded by teach pendant are automatically recognized by SCORBASE.
Manual control of robot and peripheral axes	• Movement by joints and and Cartesian coordinates at selectable speeds • Movement control from dialog box, keyboard and teach pendant • Graphic image of robot; user clicks on axis arrows to move robot axes.
Program execution	• Programs can be executed both online and offline. • Options to execute one command, single cycle or continuous cycle. • Command currently being executed is highlighted in program window. • Run, pause, resume and abort program available at all times.
Real-time data display	• Real-time, continuous display of robot and peripheral positions (encoder values and XYZ coordinates) and I/Os • Real-time, continuous display of home switches' status, joint angles, command value (PWM) and position error • Dynamic charts present encoder values, command value (PWM) and position error
Open system: integration and support for work-cell components	• Full integration with ViewFlex machine vision system, enabling robot guidance and quality control applications • Full integration with automated MIG welding system • Supports programming and control of two peripheral servo axes • Monitors and controls digital I/O devices • Monitors and controls analog I/O devices • User can simulate inputs and output status for offline program testing. • API software utility is provided to enable C/C++ programming interface to the controller
Parameter manipulation	• 160 user-accessible parameters, including: servo control; PID, speed, velocity profile; axis position error; gripper operation; thermic, impact, limit protection; homing; Cartesian calculations • Parameter tables can be easily viewed and manipulated; include detailed descriptions • Parameters can be optimized and saved for different functionalities (e.g., maximized speed, payload, accuracy) • Program command can be used to alter a parameter value during

	program execution • Program command allows selection and activation of a predefined set of parameters during program execution
User interface	• Industrial functions in an intuitive interface designed for training environments • 3 operating modes:Online: SCORBASE communicates with the controller. The robot, peripheral axes and I/Os execute all commands. Offline: SCORBASE does not communicate with the controller, even though it may be connected; axes do not move; I/Os are not switched, but different I/O states can be simulated by user (useful for testing/debugging programs). Simulation: SCORBASE communicates with RoboCell simulation software, which executes all SCORBASE commands • Several operational levels, each with progressively more programming and operational features, allow novice and advanced users to work in environments best suited to their level of expertise. • Users can switch levels without exiting software or rewriting projects • Icon toolbars for frequently used commands and operations • Predefined and user-configurable screen layouts • Programs and positions can be saved and loaded separately or together • Programs, positions and graphic cell setups are created and stored together as a "project"; users can open, view and save related data in a single mouse click • Comprehensive online help • Demo projects • Print programs and positions • Print preview and print functions for 3D cell setups and dynamic charts
Interface languages	• English, Spanish, Portuguese, German, Korean, Vietnamese, Polish. • Can be easily translated into any user language
Program editing	• Over 40 commands easily selected through icons, keyboard shortcuts and command list. • Command list displays all available SCORBASE commands grouped by functionality. • Single-command character generator calculates and teaches all positions required for producing any text string; used in robotic writing, painting and welding applications. • Dialog boxes for all commands include prompts and options to ensure correct and complete syntax during program editing • Unlimited number of programs can opened and viewed simultaneously. • Unlimited number of program lines • Standard Windows functions for program editing (e.g., cut, copy, paste, find).

HydraMotion -

Hydraulic component library	• A wide selection of components for creating hydraulic and electro-hydraulic systems. • Power pack • Pumps: gear pump; piston pump; tank. • Valves: pressure reducing valve; pressure relief valve; sequence valve; pressure compensated flow control valve; non-compensated flow control valve; non-return check valve; shuttle valve (implements the logic function OR); remote operated check valve; 3/2 manually controlled valve; 4/3 manually controlled closed centre valve; 4/3 manually controlled tandem centre valve; 4/2 manually operated spring returned valve; 2/2 manually operated spring returned valve; 5/3 valve (demonstrates valve action). • Cylinders: double acting cylinder, cylinder with roller valve, single acting cylinder, double end rod cylinder, telescopic cylinder. User can adjust: cylinder/piston diameter; piston rod diameter; force acting on the piston. • Hoses and connectors: T-connector, manifold, bent and curved hoses (to examine the effect of deformations on pressure and flow) • Gauges: Pressure gauge; flow meter. Pressure (bars) is displayed on screen: graphic scale; digital reading; graph drawn on parameter diagram. • Accumulators: Weight loaded accumulator; spring loaded accumulator; bladder accumulator; piston loaded accumulator. • Filter • Electrical components: 2/2 solenoid operated spring returned valve; 3/2 solenoid operated solenoid returned valve; 4/3 solenoid operated (both sides) spring centred closed centre valve; 4/3 solenoid operated (both sides) spring centred tandem centre valve; 5/3 solenoid operated (both sides) spring centred valve; double acting cylinder with magnetic switches; relay four change over contacts (used to latch hydraulic valve solenoids); V+ power supply; push-button; lamp (serves as indicator); electronic delay unit. • Text component: symbolic and user defined text captions can be added to diagrams.
Interface languages	• English, Spanish, Portuguese
Functions and tools	• Component selection: components required for a circuit are loaded from a complete component library, text list or graphic library; components are placed on screen, resized and repositioned through point and click mouse operation. • Component connections: hydraulic and electrical connections are drawn and removed by point and click mouse operation; user can link two or more push-button switches to simulate the system response when the two valves are activated simultaneously. • Cross-section (symbolic) display of components and circuits: enables examination of component design and structure, ports and significant internal elements (e.g., spool, spring, etc.) • Schematic display of components and circuits, as they would appear in standard schematic drawings. • Ladder diagrams: software can generates electrical connections in circuit drawing from ladder diagram; software automatically generates ladder diagram from circuit drawing; drawing and editing of ladder

diagrams using standard symbols; ladder diagram can be tested in simulation.

- Dynamic simulation of single component operation; four methods of simulation, allow user to observe how a component functions and how fluid flows through a component as a function of its internal elements.
- Simulated execution of user-designed hydraulic and electro-hydraulic circuits. User can pressurise the virtual system run it and observe the following: responses of visible components, such as piston rod movements; responses of non-visible components such as a valve spool movements; oil flow through the components and changes in oil pressure in the hydraulic hoses; errors indicating logic problems in the circuit.
- Timing diagram: drawn on screen as the components change their state; serves to identify overlapping signals in the control system.
- Software can control actual electro-hydraulic circuits.
- Software can perform on-line graphic tracking of hydraulic circuits in operation.
- Parameter setting options for piston diameter, pump flow, valve setting, etc.
- Software monitors pressure and flow during circuit operation; diagram graphically presents flow and pressure in the hydraulic circuit.
- File options: standard Windows management tools, including: New, Open, Save, Save As, Sort, Search, Print and Delete.
- Editing options: standard Windows graphic tools, including: copy, paste and cut, resize, rotate and mirror.
- Zoom display options
- User can simultaneously create, run and compare two different circuits.

OpenFMS -

Integration of systems and technologies	• Supports numerous elements and manufacturing processes. • Material storage and feeding (storage cells, feeders, palletizing racks). • Material handling (robots, slide-bases, positioning tables, vices, end effectors and tool changers). • Automated manufacturing and fabrication (assembly, glue dispensing, screw driving, grinding/deburring). • CNC machining (turning, milling, automatic tool changers). • Identification, detection and tracking (sensors, switches). • Quality control (machine vision, electronic callipers). • The following items are *not included* in the Virtual FMS Setup module, nor can they be configured for online operation: closed loop conveyor; ASRS; laser engraver; coordinate measuring machine, electronic height gauge, barcode reader; hydraulic robot and pressing station; pneumatic part feeding/sorting station; process control station
Open software architecture	• Object oriented technology enables user modifications and integration with other applications. • Interfaces with a variety of machines and robots by means of device drivers (small interface programs that translate and transmit messages between the FMS manager and machines). Device drivers are supplied with the system. User can create and modify device drivers to suit any machine type or model. • Interfaces with third-party software tools such as MRP, ERP, CAD, CAM, SQC (statistical quality control, CRM (customer relationship management), PDM (product data management). • Stores all data in standard industrial database format, allowing easy access and manipulation on any level. Data files can be read by any Windows application (e.g., Excel, Access, MS-SQL) and exported to any other application. Easily imports and uses data files from external applications. • User can write applications (e.g., in Java, Visual Basic, C++, C#) that will monitor real-time communication and display the data (graphically or statistically).
Internet access	• FMS Web viewer enables access to FMS manager via the Internet and allows users to monitor FMS cell operations in real time from remote locations. • Using Internet browsers users can view realtime reports generated by the FMS manager, remotely track live production cycles in the 3D graphic display, and view details of current FMS cell status. • Simultaneous Internet access by multiple users.
Real-time communication	• Multi-level, hierarchical communication network design, based on commonly used industrial communication networks; allows user to practice and understand different communication networks and protocols. • Uses TCP/IP protocol for real-time communication between the FMS manager and device drivers: LAN (Microsoft, Novell or any other

	Windows-compatible network); WAN (FMS manager PC or any station manager PC can be operated from any location on the network, such as a remote classroom). • Uses additional communication protocols: RS232 (connects PCs to machine and robot controllers); I/Os (connects external inputs/outputs to machine and robot controllers); Field bus (AS-I bus or PROFIBUS, optional)
Modes of operation	• Full simulation mode: software runs without any hardware or user intervention. Device drivers notify the FMS manager when operations have been executed • Simulation with manual control: software runs without any hardware, but the user interactively emulates the hardware by using device driver control panels. • Mixed mode: some components actually operate, while others are simulated. The simulation is based on data that predicts and defines the duration of processes. Device drivers are used to simulate operation of inoperative or missing components. • Full online mode: Software runs the system according to user programming. Device drivers operate the work-cell according to orders from the FMS manager. • Stand alone station operation: Individual stations and many components (e.g., robots, CNC machines, quality control devices) can be programmed, operated and controlled as stand-alone systems by means of their own software or the system device drivers. • User interface is identical in all modes of operation, which reduces the time and effort required for software familiarization.
Dynamic 3D graphic simulation	• Fully functional, dynamic 3D simulation module. • Accurately simulates operations and movements of machines, robots and peripheral axes, including components such as safety shields, chucks and spindles. • Accurately simulates part movement and manipulation, including supply of parts from storage cells and feeders. • Accurately simulates manufacturing processing, including milling, turning, engraving and welding • Parts change colour to reflect different stages in processing. • Accurately simulates the physical environment of the FMS cell. • Simulation speed can be defined by the user.
	• Three graphic display windows can simultaneously display three different 3D views of the FMS cell. • View control: zoom in and out, rotate (pan), view from above, below and any angle in between; camera redirect (reset camera focal point), drag camera (moves viewing area). • Follow-me camera: automatic and continuous camera redirect; useful for following a robot gripper or any moving object, such as a work-piece undergoing processing. • Lighting and shading control.
	• Enables more efficient use of FMS laboratory. Keeps equipment free for actual, online execution of applications and production cycles.

	• Improves comprehension of FMS management and manufacturing processes by viewing 3D graphic dynamic on-screen simulations. • Enables testing of the effect of various production strategies, or various shop floor layouts, on the behaviour of the system. • Allows programming and operation of the FMS system without causing damage to actual equipment or disrupting operation of the actual FMS cell. • Allows testing and debugging of programming before online production is initiated. • Enables experimentation with FMS cells in which some components actually operate while others are simulated. • Allows work with virtual FMS work-cells that do not actually exist
Virtual FMS cell setup	• User can design, create and modify FMS cells and components. • Cell setups can represent actual installations or virtual cells. • Interactive point and click object placement and property definitions. • Object library includes: robots; CNC machines; peripheral axis devices (e.g., conveyor belt, linear slide-base, rotary table); positioning devices (e.g., jigs, XY tables), quality control devices (e.g., machine vision, callipers), sensors and I/O devices; storage devices and feeders; tables, workbenches, computers. • Robots can be mounted on table, slide-base or gantry. • Any quantity of any part can be defined for storage devices and feeders. • Any shape or size can be defined for parts. • External CAD software can be used to design new 3D objects and assembled parts for manipulation by robot and other devices in work-cell. Includes utility for importing 3D object files.
Data acquisition and visualization	• Online 3D graphic tracking shows movement of robots, machines, parts and other FMS elements in a dynamic simulation of the shop floor. • Gantt charts present planned and actual scheduling of manufacturing processes. • Status views allow user to track production through eight screens that display data such as manufacturing orders; status of storage locations; current activity of all machines, robots and devices; status of pallets; log of all transmitted messages, etc. • Report generator lets user view and print ten types of predefined reports (e.g., machines, ASRS contents, manufacturing orders), or an unlimited number of own user-defined reports using Crystal or other report generating software • DB-Tool utility allows user to edit database files, repair database files, and save files in DBF or TXT format. • All data is written and stored in standard industrial database format to enable easy access, manipulation and use by any software application. • Database files from external applications can be easily imported and used.
Advanced (MES) operations	• Enables manufacturing optimization by allowing user to control algorithms used for part dispatching and machine queues. Parts waiting to be processed by machines can be queued according to parameters such as minimum process time, maximum priority, FIFO, etc. • Includes open source that allows user to add new queue algorithms. • Enables testing of algorithms, comparison of results, and analysis of

	system performance. • Optimizes use of machines when two machines capable of performing a specific process are both available. • Alerts user of any malfunction of any CIM component. User can correct the problem and instruct the system to repeat, continue or abort the operation. Disruption in the operation of other CIM components is minimal.
Interface languages	• FMS Manager, Project Manager, FMS Virtual Setup and Storage Manager modules can be easily translated into any user language

PLCMotion -

PLC editing module	• A fully operational ladder diagram editor that incorporates all the basic functions of PLC programming. It is used for creating and editing PLC ladder diagrams. • Students create logic control applications by selecting instructions from a list of functions used in PLC programming (inputs, outputs, timers, counters and flags) and linking these instructions to variable addresses. • Rungs and branches can be added to the ladder to form more complex programs. The ladder diagram can be run and fully debugged from within the PLC editor, making programming a much easier task. • The ladder diagram can be printed, altered and improved as needed.
PLC simulation module	• Enables online and offline activation of the application in the HMI alone, or together with actual equipment. • PLC simulator runs the ladder logic control program while the HMI responds accordingly. • When offline, the PLC simulator allows the user to control the process either from the ladder diagram or the HMI. • When online, the PLC simulator activates and communicates with the actual equipment, with or without graphic tracking on the HMI.
Ladder diagrams	• Ladder diagrams can be exported and displayed as IEC 1131-3 Instruction List.
PLC training panel simulator module	• Activates the PLC simulator with the panel HMI interface. • Allows students to run a previously programmed ladder and observe it in the training panel simulation.
HMI graphic editor module	• An interactive graphic module for creating any PLC-controlled system. • Allows students to develop original HMI (human machine interface) applications and visualize production lines and other industrial processes. • Includes a number of sample HMIs, including one of the PLC training panel • Students can also create their own HMIs. • Simple enough so that users with minimal computer or programming skills can create elaborate industrial applications.

	• HMIs simulate and communicate with control equipment, both industrial PLCs and the PLC training panel. • As the equipment is monitored and data is recorded, the HMIs reflect system logic requirements and operator requests.
Interface languages	• English, Portuguese
Functions	• Simulation of sample HMI applications bundled with the software. • Simulation of industrial PLCs, such as Allen-Bradley SLC-500 and MicroLogix and Texas Instrument TI 505 series. • Online operation and control of applications using industrial PLCs, such as Allen-Bradley SLC-500 and MicroLogix. • On-line graphic tracking of PLC: marks active elements; solves logic functions; displays digital and analog tracking charts for selected elements; displays status of I/Os

PneuMotion -

Pneumatic component library	• A wide selection of components for creating pneumatic and electro-pneumatic systems. • Conditioning unit: provides pressurized air to the system. • Valves: 3/2 roller operated spring returned valve (used as pneumatic limit sensor and switch); 3/2 air operated air returned valve; 3/2 air operated spring returned valve; 3/2 manually operated spring returned valve (push button valve); 3/2 manually operated manually returned valve (toggle valve); 5/2 air operated spring returned valve; 5/2 air operated air returned valve • Cylinders: Double acting cylinder. The cylinder's extension and retraction times are adjustable; spring return cylinder (2 types); double acting cylinder with two roller valves; diaphragm operated cylinder. • Miscellaneous: logic gate AND; logic gate OR; single pilot valve; pneumatic delay; pneumatic counter. • Connectors: T-connector; manifold. • Electrical components: 5/2 solenoid operated solenoid returned valve; 5/2 solenoid operated spring returned valve; cylinder with magnetic switches fitted as limit sensors; relay with four changeover contacts; V+ power supply; push-button; lamp; electronic delay unit; electronic counter. • Text component: symbolic and user defined text captions can be added to diagrams.
Interface languages	• English, Spanish, Portuguese
Functions and tools	• Component selection: components required for a circuit are loaded from a complete component library, text list or graphic library; components are placed on screen, resized and repositioned through point and click mouse operation. • Component connections: pneumatic and electrical connections are drawn and removed by point and click mouse operation; user can link two or more push-button switches to simulate the system response

when the two valves are activated simultaneously.

- Cross-section (symbolic) display of components and circuits: enables examination of component's design and structure, ports and significant internal elements (e.g., spool, spring, etc.)
- Schematic display of components and circuits, as they would appear in standard schematic drawings.
- Ladder diagrams: software can generates electrical connections in circuit drawing from ladder diagram; software automatically generates ladder diagram from circuit drawing; drawing and editing of ladder diagrams using standard symbols; ladder diagram can be tested in simulation.
- Dynamic simulation of single component operation; four methods of simulation, allow user to observe how a component functions and how air flows through a component as a function of its internal elements.
- Simulated execution of user-designed pneumatic and electro-pneumatic circuits. User can "pressurize" the virtual system, "run" it and observe the following: responses of "visible" components, such as piston rod movements; responses of "non-visible" components such as a valve's spool movements; air flow through the components and changes in air pressure in the pneumatic tubes; errors indicating logic problems in the circuit.
- Timing diagram: drawn on screen as the components change their state; serves to identify overlapping signals in the control system.
- Software can control actual electro-pneumatic circuits.
- Software can perform on-line graphic tracking of pneumatic circuits in operation.
- Parameter setting options for piston extension and retraction, speed, timer set point, etc.
- Software monitors pressure and flow during circuit operation; diagram graphically presents flow and pressure in the pneumatic circuit.
- File options: standard Windows management tools, including: New, Open, Save, Save As, Sort, Search, Print and Delete.
- Editing options: standard Windows graphic tools, including: copy, paste and cut, resize, rotate and mirror.
- Zoom display options
- User can simultaneously create, run and compare two different circuits.

ProcessMotion -

Level and Flow	• Lets user define control variables: set-point, high and low limits, Kp, Ki, Kd • Lets user define control type: open loop, closed loop, P, PI or PID. • Lets user define process variables (for simulation): number of open valves, tank volume. Software then determines and displays the settings for a particular component, such as the pump. • Provides real-time, dynamic simulation and measurement charting: Dynamic 3D solid model of the ProcessLine Level and Flow panel. Three windows can simultaneously display three different 3D views of the panel. Cut-away view shows structure and operation of internal components; Control loop block diagram displays variables and their changing values; Dynamic charts display real-time measurements of water level and pump power. • Allows graphs and process data to be recorded, saved to file, replayed and exported to spreadsheet software for analysis • Provides fully functional offline simulation of control processes. Applications created in simulation can be tested and implemented on the actual panel. Simulation software gives more students access to learning tools and enables more efficient use of hardware system in the school lab. • Users can create their own process control applications in any standard programming language. OCX supplied with system provides application programs interface (API) for functions such as reading level and flow data and setting values for the pump.
Temperature	• Lets user define control variables: set-point, high and low limits, Kp, Ki, Kd • Lets user define control type: open loop, closed loop, P, PI or PID. • Lets user define process variables (for simulation), such as number of open valves and tank volume. Software then determines and displays the settings for a particular component, such as the water tank, heater or motorized valve. • Provides real-time, dynamic simulation and measurement charting: Dynamic 3D solid model of the ProcessLine Temperature panel. Three windows can simultaneously display three different 3D views of the panel. Cut-away view shows structure and operation of internal components; Control loop block diagram displays variables and their changing values; Dynamic charts display real-time measurements of water temperature and level. • Allows graphs and process data to be recorded, saved to file, replayed and exported to spreadsheet software for analysis • Provides fully functional offline simulation of control processes. Applications created in simulation can be tested and implemented on the actual panel. Simulation software gives more students access to learning tools and enables more efficient use of hardware system in the school lab. • Users can create their own process control applications in any standard programming language. OCX supplied with system provides application programs interface (API) for functions such as reading temperature data and setting values for the heater or motorized valve.
Pressure	• Lets user define control variables: set-point, high and low limits, Kp, Ki,

	Kd • Lets user define control type: open loop, closed loop, P, PI or PID. • Lets user define process variables (for simulation), such as pressure and tank volume. Software then determines and displays the settings for a particular component, such as the E/P converter. • Provides real-time, dynamic simulation and measurement charting: Dynamic 3D solid model of the ProcessLine Pressure panel. Three windows can simultaneously display three different 3D views of the panel. Cut-away view shows structure and operation of internal components; Control loop block diagram displays variables and their changing values; Dynamic charts display real-time measurements of pressure Pout and E/P converter. • Allows graphs and process data to be recorded, saved to file, replayed and exported to spreadsheet software for analysis • Provides fully functional offline simulation of control processes. Applications created in simulation can be tested and implemented on the actual panel. Simulation software gives more students access to learning tools and enables more efficient use of hardware system in the school lab. • Users can create their own process control applications in any standard programming language. OCX supplied with system provides application programs interface (API) for functions such as reading pressure data and setting values for the valves.

ViewFlex -

User interface and image manipulation	• Easy-to-use interactive work environment • Control scripts using custom dialog boxes • Display colour and monochrome images in a variety of predefined or custom formats • Load and save images in many file formats (e.g., BMP, JPG, TIFF) • Record and playback image sequences using AVI and multi-page TIFF file formats • Annotate images with text and graphics • Create and manage image databases
Image processing tools	• 3 colours histogram (display as bar, line or data) • Extract band operation • Filters: Predefined (Erode, Dilate, Open, Close, etc.) and User defined • Threshold: (Band reject, Band pass, Low pass, High pass) • Fast Fourier transformations • Define and process non-rectangular regions of interest
Image analysis tools	• Colour image analysis • Pattern matching (with mask and rotate operations) • Blob analysis • Part identification by blob statistics • Calibration (compensation for aspect ratio, rotation and other spatial distortion) • Measurements (distance, angle, and area measurements with sub-pixel accuracy; measurements in real world units)

	• Automatic movement detection.
Full support for video applications	• Take snapshots manually and automatically • Record a video (and audio; requires Windows compatible sound card with speakers and microphone) • Create a movie
Full support for Web applications	• (Requires ISP, 28.8 Kbps or faster) • Make and send email postcards • Create web pages that incorporate videos, images, and/or sounds • Make Internet video phone calls
Open environment	• Easy acquisition of images from a variety of sources (USB camera, camcorder, VCR, industrial video camera) • Easy integration with other Windows applications (client/server) using OLE/Automation: send vision data (OLE); call vision functions from users code (OCX); call user functions from the vision system (script, DLLs) • Results easily transferred to Microsoft Excel or other Windows applications • Automate routines with Microsoft Visual Basic or C compatible scripting
Integration with Intelitek and OEM products	• Supports all controllers: Controller-USB, Controller-A, Controller-B, Controller-BRC, Controller-PC • Stand-alone system for machine vision and quality control • Robot guidance in SCORBASE/ RoboCell (ER 4pc, ER 4u, ER 7 robots) • Robot guidance in ACL (ER 5, ER 7, ER 9, ER 14, SV3 robots) • Supports full integration with OpenCIM software: part identification and quality control applications • Supports remote camera. • Supports barcode. • Supports optical character recognition (OCR). • Supports use of multiple cameras in the same vision application.
Colour USB camera	• 1.3 Mega pixel (1280 x 1024) CMOS sensor • USB 2.0 connection (backward compatibility to USB 1.1 with performance and functionality compromises) • Image format: BMP, JPG • Video format: AVI, WMV • Frame rate: 30 fps • 24-bit true colour • Auto exposure, white balance and colour control • Adjustable focus ring • f/1.6: 5 element glass lens • On/Off indicator • Cable 1.5m

OpenCIM -

Integration of systems and technologies	• Supports numerous elements and manufacturing processes. • Material storage and feeding (ASRS, feeders, palletizing racks). • Material handling (robots, conveyors, slide-bases, pneumatic transfer units, positioning tables, vices, end effectors and tool changers). • Automated manufacturing and fabrication (assembly, glue dispensing, screw-driving, welding, grinding/deburring; hydraulic pressing). • CNC machining (turning, milling, engraving, routing, automatic tool changers). • Pneumatic and hydraulic systems (manipulators, feeders, presses) • Identification, detection and tracking (barcode scanning, pallet tracking, sensors, switches). • Quality control (machine vision, electronic callipers, coordinate measuring machine, laser scan meter, electronic height gauge). • Process control • Programmable logic controllers (PLC)
Open software architecture	• Object oriented technology enables user modifications and integration with other applications. • Interfaces with a variety of machines and robots by means of device drivers (small interface programs that translate and transmit messages between the CIM manager and the machines at CIM stations). Device drivers are supplied with system. User can create and modify device drivers to suit any machine type or model. • Interfaces with third-party software tools such as MRP, ERP, CAD, CAM, SQC (statistical quality control, CRM (customer relationship management), PDM (product data management). • Stores all data in standard industrial database format, allowing easy access and manipulation on any level. Data files can be read by any Windows application (e.g., Excel, Access, MS-SQL) and exported to any other application. Easily imports and uses data files from external applications. • User can write applications (e.g., in Java, Visual Basic, C++, C#) that will monitor real-time communication and display the data (graphically or statistically).
Internet access	• CIM Web viewer enables access to CIM manager via the Internet and allows users to monitor CIM cell operations in real time from remote locations. • Using Internet browsers users can view real-time reports generated by the CIM manager, remotely track live production cycles in the 3D graphic display, and view details of current CIM cell status. • Simultaneous Internet access by multiple users
Real-time communication	• Multi-level, hierarchical communication network design, based on commonly used industrial communication networks; allows user to practice and understand different communication networks and protocols. • Uses TCP/IP protocol for real-time communication between the CIM manager and device drivers: LAN (Microsoft, Novell or any other Windows-compatible network); WAN (CIM manager PC or any station manager PC can be operated from any location on the network, such

	as a remote classroom). • Uses additional communication protocols: RS232 (connects PCs to machine and robot controllers); I/Os (connects external inputs/outputs to machine and robot controllers); Field bus (AS-I bus or PROFIBUS, optional)
Modes of operation	• Full simulation mode: software runs without any hardware or user intervention. Device drivers notify the CIM manager when operations have been executed • Simulation with manual control: software runs without any hardware, but the user interactively emulates the hardware by using device driver control panels. • Mixed mode: some components actually operate, while others are simulated. The simulation is based on data that predicts and defines the duration of processes. Device drivers are used to simulate operation of inoperative or missing components. • Full online mode: Software runs the system according to user programming. Device drivers operate the work-cell according to orders from the CIM manager. • Stand alone station operation: Individual stations and many components (e.g., robots, CNC machines, quality control devices) can be programmed, operated and controlled as stand-alone systems by means of their own software or the system's device drivers. • User interface is identical in all modes of operation, which reduces the time and effort required for software familiarization
Dynamic 3D Graphic Simulation	• Fully functional, dynamic 3D simulation module. • Accurately simulates operations and movements of machines, robots and peripheral axes, including components such as safety shields, chucks and spindles. • Accurately simulates part transportation and manipulation, including movement of pallets on conveyor and supply of parts from storage cells and feeders. • Accurately simulates manufacturing processing, including milling, turning, engraving and welding. • Parts change color to reflect different stages in processing. • Accurately simulates the physical environment of the CIM cell. • Simulation speed can be defined by the user
	• Three graphic display windows can simultaneously display three different 3D views of CIM cell. • View control: zoom in and out, rotate (pan), view from above, below and any angle in between; camera redirect (reset camera's focal point), drag camera (moves viewing area). • Follow-me camera: automatic and continuous camera redirect; useful for following a robot gripper or any moving object, such as a work-piece undergoing processing. • Lighting and shading control.
	• Enables more efficient use of CIM laboratory. Keeps equipment free for actual, online execution of applications and production cycles. • Improves comprehension of CIM management and manufacturing

	processes by viewing 3D graphic dynamic on-screen simulations. • Enables testing of the effect of various production strategies, or various shop floor layouts, on the behaviour of the system. • Allows programming and operation of the CIM system without causing damage to actual equipment or disrupting operation of the actual CIM cell. • Allows testing and debugging of programming before online production is initiated. • Enables experimentation with CIM cells in which some components actually operate while others are simulated. • Allows work with virtual CIM work-cells that do not actually exist.
Virtual CIM cell setup	• User can design, create and modify CIM cells and components. • Cell setups can represent actual installations or virtual cells. • Interactive point and click object placement and property definitions. • Object library includes: 10 robots; 6 CNC machines; additional machines and stations (e.g., welding, laser engraving, pneumatic sorting); peripheral axis devices (e.g., conveyor belt, linear slide-base, rotary table); positioning devices (e.g., jigs, XY tables), 5 quality control devices (e.g., machine vision, CMM, LSM, callipers), sensors and I/O devices; 13 storage devices and feeders; conveyor and PLC control unit; tables, workbenches, computers. • Conveyors and tables automatically created according to user-defined width/length dimensions. • Robots can be mounted on table, slide-base or gantry. • Any quantity of any part can be defined for storage devices and feeders. • Any shape or size can be defined for parts. • External CAD software can be used to design new 3D objects and assembled parts for manipulation by robot and other devices in work-cell. Includes utility for importing 3D object files
Data acquisition and visualization	• Online 3D graphic tracking shows movement of robots, machines, parts, conveyor and other CIM elements in a dynamic simulation of the shop floor. • Gantt charts present planned and actual scheduling of manufacturing processes. • Status views allow user to track production through eight screens that display data such as manufacturing orders; status of storage locations; current activity of all machines, robots and devices; status of pallets; log of all transmitted messages, etc. • Report generator lets user view and print ten types of predefined reports (e.g., machines, ASRS contents, manufacturing orders), or an unlimited number of own user-defined reports using Crystal or other report generating software. • DB Tool utility allows user to edit database files, repair database files, and save files in DBF or TXT format. • All data is written and stored in standard industrial database format to enable easy access, manipulation and use by any software application. • Database files from external applications can be easily imported and used
Advanced (MES) operations	• Enables manufacturing optimization by allowing user to control algorithms used for part dispatching and machine queues. Parts waiting

to be processed by machines can be queued according to parameters such as minimum process time, maximum priority, FIFO, etc.
- Includes open source that allows user to add new queue algorithms.
- Enables testing of algorithms, comparison of results, and analysis of system performance. Optimizes use of machines when two machines capable of performing a specific process are both available.
- Alerts user of any malfunction of any CIM component. User can correct the problem and instruct the system to repeat, continue or abort the operation. Disruption in the operation of other CIM components is minimal.

Interface languages	• English • CIM Manager, Project Manager, CIM Virtual Setup and Storage Manager modules can be easily translated into any user language.

spectraCAM Turning -

- Includes spectraCAD, allowing users to create CAD geometry.
- Drawing options: arc, circle, line, point, rectangle, text.
- Editing options: break, copy, delete, explode, fillet, mirror, move, offset, rotate, scale, trim/extend.
- Milling operations: contouring, drilling, engraving, facing and pocketing.
- Surface machining operations: revolutions, ruled and swept
- Turning operations: facing, roughing, finishing, grooving, cut-off
- Built-in tool and material libraries; automatically pre-selects the optimal speed rates, feed rates and plunge rates for machining part.
- Multiple views of geometry and tool paths.
- Online, context-sensitive help.
- Input and output DXF file format.
- Output standard G and M code NC part programs.

specraCAD Engraver -

- Converts CAD drawings to NC part program files.
- Enables creation of CAD drawing files and export to HPGL plot file.
- Integrated engraving capabilities, accessible via a pull-down menu
- Enables selection of machining parameters: feed and plunge rates, depth of cut
- Drawing options: arc, circle, point, rectangle, line, text
- Editing options: break, copy, fillet, mirror, explode, offset, delete, move, rotate, scale, trim, extend
- Intuitive graphic user interface. Simple graphic buttons and tool bars enable the user to start working immediately.
- CAD can display the geometry in a number of different ways and provide printed output for user inspection.
- Bidirectional DXF file transfer capability enables compatible with other applications such as AutoCAD
- When integrated with CAM software, users can automatically generate facing, drilling, contour milling, pocketing with islands, engraving, surface of revolutions, ruled surfaces and swept surfaces with cutter compensation.

Personal Tutor -

- Interactive simulation software
- Provides full 3D verification of CNC codes for both milling and turning
- Supports standard EIA/RS-274-D G&M code programming
- Enables development of NC programs from dimensioned drawings
- Saves time and maintenance cost on CNC equipment
- Camera function captures image of each step of programming
- Viewing options allow rotation, zoom, cross-section
- Animation of part being machined enables verification of tool movements
- Inspection view enables measurement of part dimensions
- Unlimited changes to part orientation
- Absolute and incremental programming
- Linear and circular interpolation
- Instruction on feed rates, spindle speeds, tool selection and depth of cut
- Canned cycles, cutter compensation and offsets
- Thread cutting
- Command tool moves on a lathe

spectraCAM Milling -

- Includes spectraCAD, allowing users to create CAD geometry.
- Drawing options: arc, circle, line, point, rectangle, text.
- Editing options: break, copy, delete, explode, fillet, mirror, move, offset, rotate, scale, trim/extend.
- Milling operations: contouring, drilling, engraving, facing and pocketing.
- Surface machining operations: revolutions, ruled and swept
- Turning operations: facing, roughing, finishing, grooving, cut-off
- Built-in tool and material libraries; automatically pre-selects the optimal speed rates, feed rates and plunge rates for machining part.
- Multiple views of geometry and tool paths.
- Online, context-sensitive help.
- Input and output DXF file format.
- Output standard G and M code NC part programs.