

certified by experience

ProLeiT



based on Mitsubishi PLC's

Process control technology. MES included.

Contents

Mitsubishi goes process industry	4
MELSEC System Q	5
Plant iT and MES	6
Plant Direct iT	8
Plant Acquis iT	12
Plant iT material	14
Plant iT connect	16
System requirements	18

Today Mitsubishi PLC's have made their mark in factory automation, because these systems are setting standards regarding reliability and availability.

Mitsubishi goes process industry

The changes taking place in the process industry have – partly driven by international standards becom-

ing more and more stringent – also lead to a relocation of the focus regarding the requirements for control systems. Especially system properties, where Mitsubishi controllers are particularly strong, like

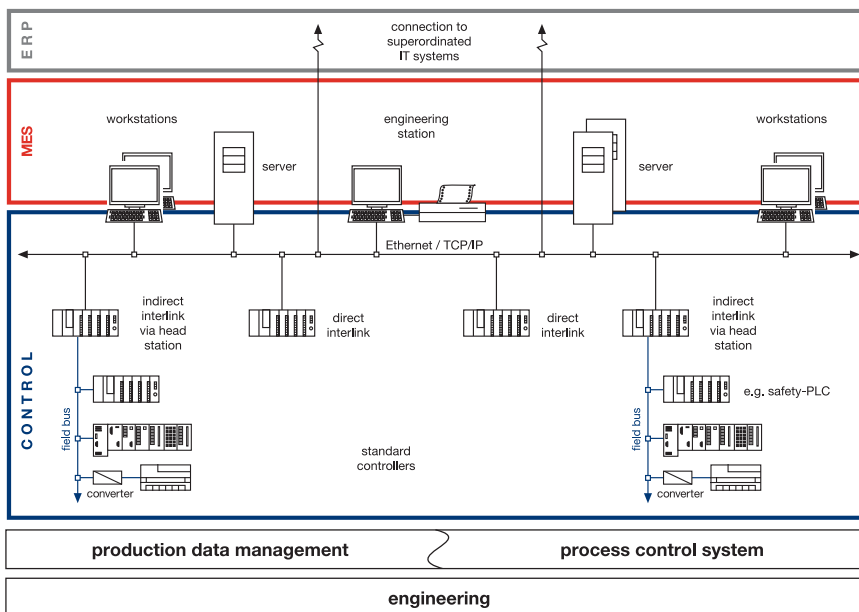
- high availability due to extreme reliability and the possibility for component exchange during running operation,
- high flexibility in scaling the systems to the application requirements,
- the wide application spectrum due to the multi-CPU concept and
- an open, transparent communication system

are in this context constantly moving to the front.

Hence there is a considerable potential lying in extending the field of application of Mitsubishi control systems to the process industry. The trend going to integrated automation solutions requires a combination of hardware systems, that are premium regarding quality and functionality, and a corresponding software system for utilizing this potential.

ProLeiT itself with its system platform *Plant iT* has made its mark in various branches of the process industry. *Plant iT* is the implementation of extensive process automation know-how. All experience gathered over more than 25 years in various sectors has flown into a modular software system. *Plant iT* offers everything needed for consistent solutions – from production data acquisition, process control technology and batch systems to functions for complete cross-location production management (MES – Manufacturing Execution Solution) and interconnection of ERP, LIMS and maintenance systems.

Based on this system platform Mitsubishi and ProLeiT offer together a process control system with seamlessly integrated production data management, a system with the licence to grow, particularly designed for applications in the process industry. The production data management is able to work in conjunction with the process control system as well as independent from it and can thus be extended to areas, which are not directly controlled by the process control system (e.g. filling and packaging plants, internal logistics). Hence also hybride processes can be mapped with a continuous solution, i.e. exceeding the limit of pure process technology right into areas characterized by discrete manufacturing.



Mitsubishi Electric's response to the growing challenges regarding the automation of production plants is the MELSEC System Q, a modular high-end controller with modern multi-processor technology. This technology offers the possibility of equipping one controller with up to 4 CPU's, that are available in 5 different types:

MELSEC System Q

- PLC-CPU's
- C-CPU
- PC-CPU
- Motion-CPU
- Robot-CPU



The PLC-CPU is available in 25 different types, 5 thereof special process CPU's and 2 types for redundant PLC systems.

This provides the possibility of aggregating different tasks in one controller while at

the same time keeping their processing separate by using specially designed CPU functions. The CPU concept of the MELSEC System Q consequently resumes the breakup of the border between process and discrete production that already took place in production data management.

Some key features

- program size up to 260k steps for PLC-CPU's
- Up to 8.192 I/Os in total, up to 4.096 thereof remote

- adjustable constant program cycle time
- self-diagnostics with error history stored in the CPU
- support for remote diagnostics and programming (modem/internet/intranet)
- integrated Flash ROM for all CPUs
- programmable according to IEC 1131.3/EN 61131-3 (PLC-CPU) or in high-level languages (C++, Visual Basic)

Two models of the PLC-CPU especially developed for the process industry provide over 50 advanced control loop functions directly integrated in the CPU. Their relocation away from the application into the operating system of the CPU provides better processing speed and at the same time enhanced safety for complex control tasks. Just by choosing these CPU models the system provides component change during running operation without requiring other special hardware (e.g. backplanes).

These two CPU models are also provided as high availability version, whose redundancy concept especially integrates all communication interfaces. From the application point of view the system is fully transparent, i.e. no software changes are required to move from a standard to a redundant PLC.

Beside supporting a wide range of open network standards (Ethernet / TCP/IP, Modbus TCP, Modbus RTU, CC-Link, Profibus DP, DeviceNet, AS-Interface, CANopen) for communication and integration of remote I/O especially the MELSECNET/H and the Ethernet-based CC-Link IE provide a very efficient infrastructure, because both use a redundant fiber optic rings as standard topology.

Plant iT. at a glance

Plant iT is a modular system platform for the process industry with a PLC-based process control system as its core component. The client-server of the system in combination with one central database and object-orientated engineering form the base for an almost unlimited scalability from a single station system up to multi-server solutions for complete sites. Graduated redundancy concepts – starting from basic RAID solutions up to failure-tolerant server systems – meet the competing requirements of economic efficiency and safety. The system is field-proven in a large number of applications worldwide.

Plant Direct iT – Process control system

Originally being developed for the food and beverage industry *Plant Direct iT* now provides a large spectrum of application for almost all areas of the process industry. It fulfills the requirements for safety and transparency in controlling production processes, but at the same time it provides the maximum of openness for the integration of existing control systems and flexibility for modifications during running operation. With its class concept (technical and technological automation objects with encapsulated functionality) *Plant Direct iT* provides a future-proof basis for solving control and process technological tasks.

Plant Acquis iT – Production data management

The powerful production data management system can be used stand-alone as well as in combination with *Plant Direct iT*, especially also for hybrid processes, i.e. production dominated by process technology combined with adjoining areas of discrete manufacturing (e.g. filling and packaging plants). Operation, process, machine and energy data acquisition can be done continuously, event-triggered or by manual input. Standardized interfaces on technical (e.g. OPC) and on technological level (Weihenstephan standards for production

data acquisition in beverage packaging lines) simplify the automatic data acquisition, but it can also be done in an application-specific way for other kinds of automation systems. Purely time-related but also shift, order or batch related analysis is possible.

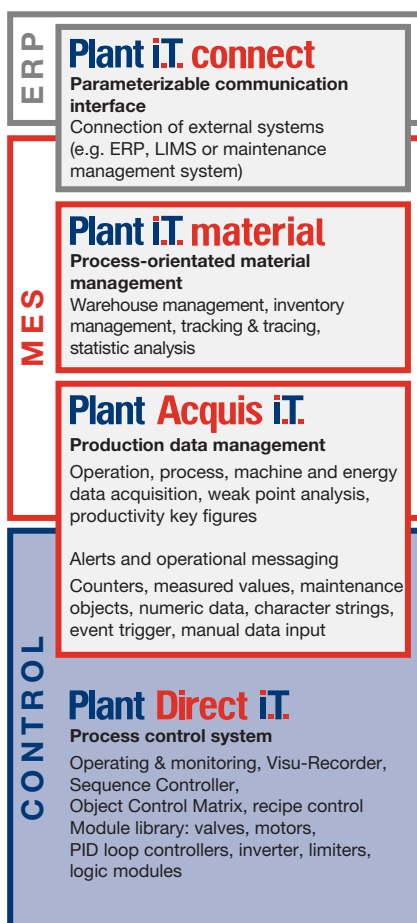
Plant iT material – Process-orientated material management

Plant Direct iT as well as *Plant Acquis iT* can be combined with this system component and with it provide important functions for material-related production processes. The recording of all material movements accurate to the single transaction is based on a warehouse structure that is flexibly parameterizable to fit the process. It enables detailed inventory management and – in combination with a super-ordinated order management – *Plant iT material* also provides comprehensive tracking and tracing functionality.

Plant iT connect – The parameterizable communication interface

By using *Plant iT connect* also the engineering of interfaces for data exchange with external IT systems (e.g. ERP, LIMS, inspectors, intelligent analytic devices) becomes parameterizable to a large extent. The interfaces implemented with it provide a detailed online diagnostics also transparent for production-orientated staff.

System architecture Plant iT



Plant iT. und MES

Historically speaking, it is the view on discrete manufacturing processes that has characterized the understanding of MES. In discrete manufacturing comparatively large numbers of highly specialized manufacturing units work nearly autarkic. Normally they are only connected by different equipment for material transport. For the plant wide acquisition

In discrete manufacturing, functions are implemented in superordinated systems. In contrast to that, they are directly required in process industry for the entire control level. For that reason MES has to be a Manufacturing Execution Solution where essential parts of the required functionality can be directly integrated in the process control level, depending on production and organizational requirements. By doing so, the technological characteristics of the production process can be ideally integrated in the overall solution.

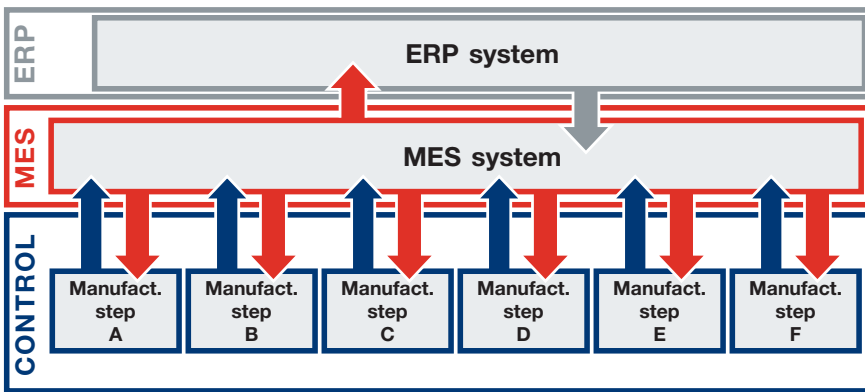
Leading institutions share this approach to MES for process industries:

- NAMUR, an international pool of users for automation and MES in process industry, postulates that MES functionality is to be considered as an integrated part of process control technology.
- According to a survey by Gartner Group, ERP systems tend to merge with the process control level, so that classical MES systems are going to be replaced in the near future.

Material management online

Material management is one example for the importance of a seamless integration of MES functionality in the process control level.

One of the most important decision criteria within many processes is the availability of materials, e.g. normally raw materials and supplies. Often, decisions have to be made very quickly and spontaneously during running production. The quality of these decisions strongly depends on the timeliness of information regarding quantity in stock, local availability and the quality status of the materials to be used. The most efficient system is one where up-to-date information is permanently available online, without depending on data exchange with an external system.



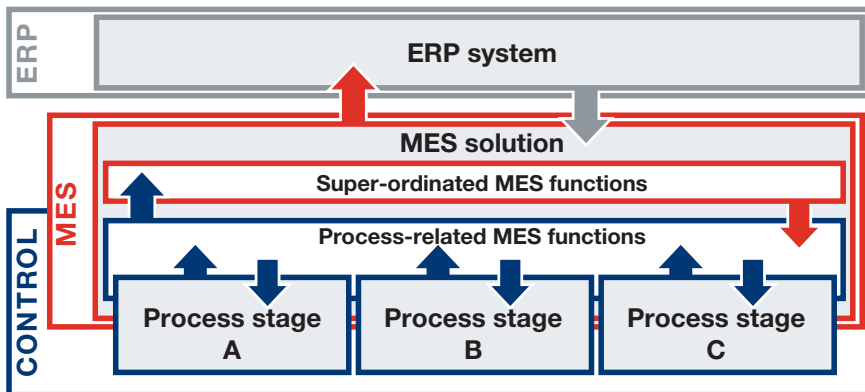
MES approach in discrete manufacturing

and processing of production data as well as the optimization of production processes there is functionality required that can only be provided by means of additional infrastructure, the MES system.

Solution instead of system

Compared to discrete manufacturing, the number of process stages necessary in process industry is rather small. However, due to process-technological interferences between the different process stages, the required level of integration and the complexity of information exchange are significantly higher.

MES approach in the process industry



Plant Direct i.T.

The process control system

Plant Direct i.T. is an open, component-based process control system focusing on the technological requirements of such a system. By combining the client/server architecture with an object-orientated class concept, it offers a secure, future-proof alternative for a conventionally programmed PLC with super-ordinated visualization.

Classes – Modules for plant-wide automation

The basic requirements for a control system are a secure process control combined with maximum transparency for the operator's personnel as well as efficient engineering, independent of whether it is used for a new plant, for expansions or for modification of existing plants.

Plant Direct i.T. allows for extensive parameterization of technological functionalities. Only specific functions need to be programmed. The class concept of Plant Direct i.T. ensures highest functional quality as similar objects are controlled and monitored just by one software module. Thus, re-usability is assured. If necessary, it facilitates the effective qualification of the system. As a consequence operating expenses for validation can be reduced considerably.

Plant Direct i.T. provides maximum flexibility for interventions in running operations, cutting down on the frequency and duration of downtimes. The system permits modifications during running production operations without neglecting safety aspects, as all changes are logged in detail by the system. This applies for all operator interaction as well as to any intervention with the engineering of the system (Audit Trail).

Class structure

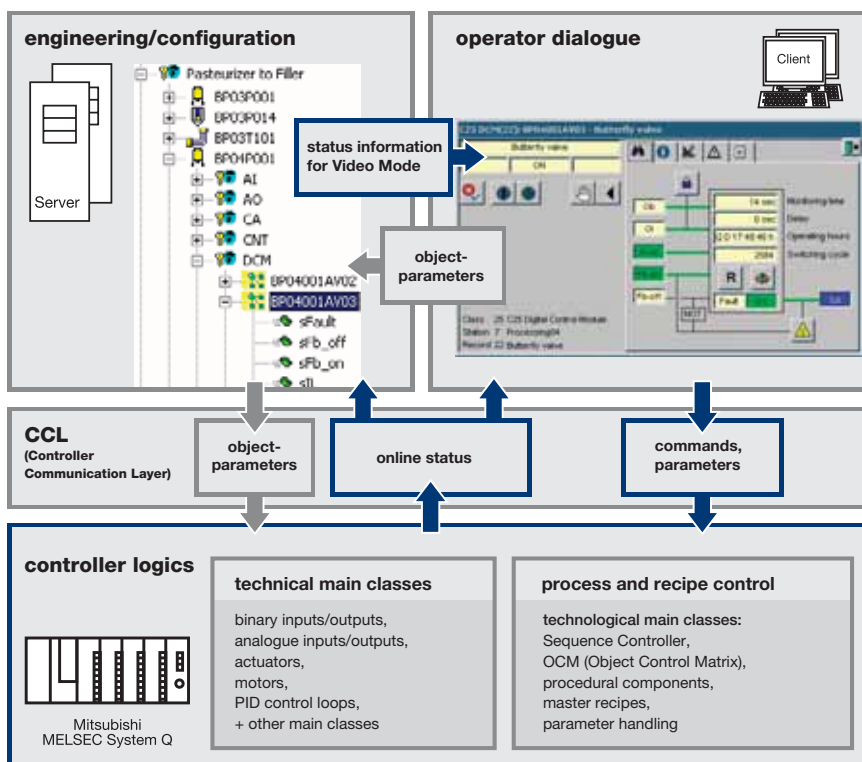
A class comprises a closed system consisting of three seamlessly integrated components. The system has complete control over the function of a technical component (e.g. a valve) or an entire step-controlled sequence:

- Class description
- Operating dialog (class dialog)
- Control logic (class handler)

The class description is stored at the central database of the system server and includes a structured mapping of all properties of this class including all status information and the command set.

The operator dialogues are available to the user within the process graphics that provided via the clients. Via the operating dialogue every single object can be controlled and monitored.

The principle of the class concept



Plant Direct iT – The process control system

The control logic is implemented in the PLC and controls the technical device (e.g. the valve) via the I/O system.

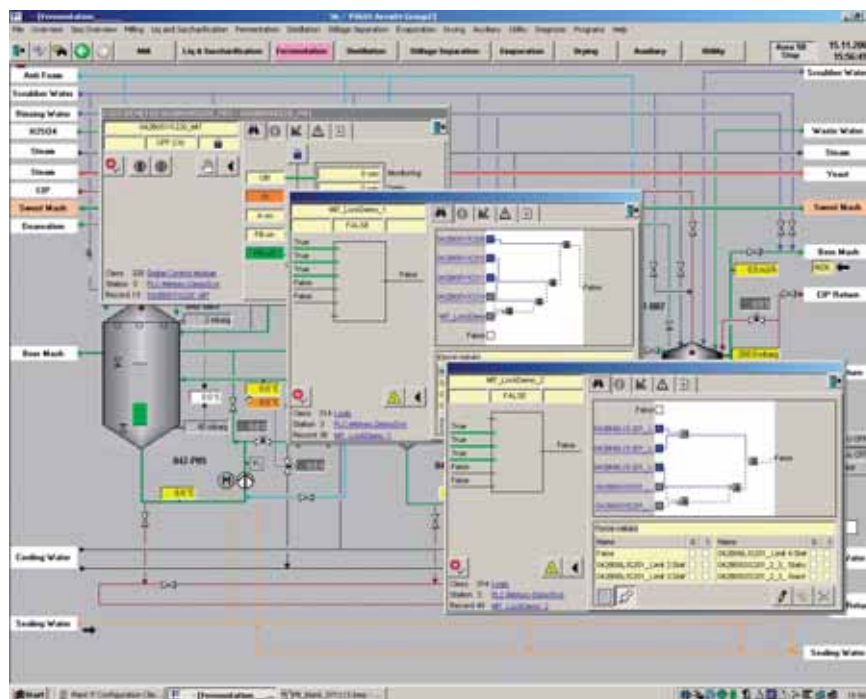
All components form one functional unit. They synchronize status information and operating parameters.

These parameters can easily be changed during running operations. In this way, there is maximum flexibility with regard to the selection of changes to be transferred as well as the time of transfer. Where necessary, a single parameter for a specific object can be selected and changed during running operations.

The system standard already contains an extensive set of the system standard already contains an extensive set of

- technical, and
- technological classes,

that are constantly being further developed. The great variety of technical basic classes includes largely equipment-neutral functionality such as valves, drives, measured values and closed-loop controllers, logical functions, and highly qualified, equipment-



Example for interlocking of automation objects by using logic objects

specific functions, e.g. for the complete control of a certain model range of frequency converters. With the Sequence Controller and the Object Control Matrix

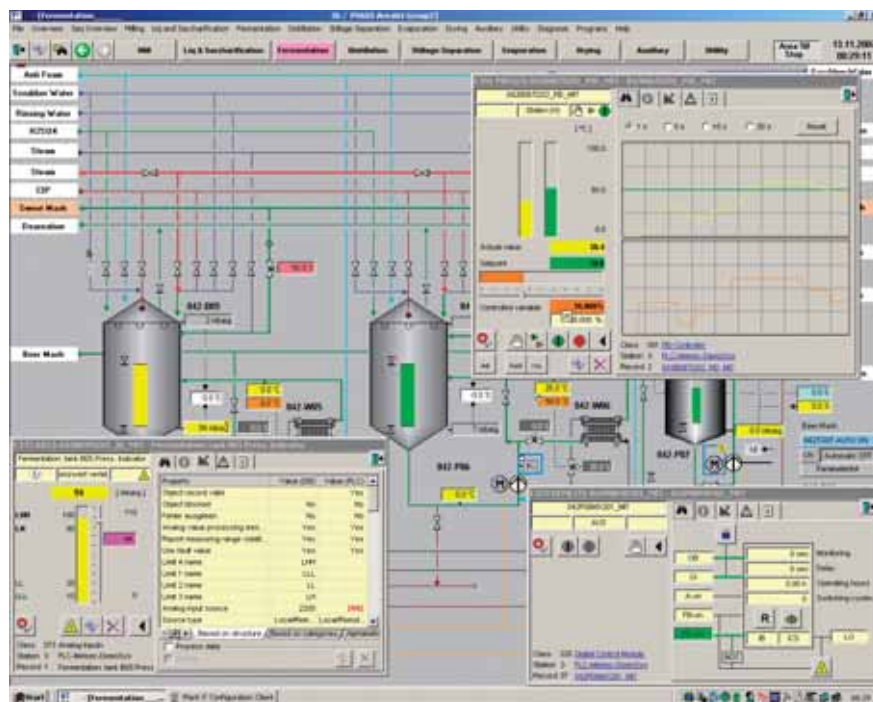
(OCM) there are two powerful classes available for the mapping of complete processes.

The system also supports the development and complete integration of additional classes or class libraries for a various applications. The required infrastructure including templates and documentation is available within the standard system.

Plant iT objects are cascable and provide an API that allows to access them from conventional PLC code. Because the Plant iT system software and application-specific PLC programs can be run parallel in one controller, the system allows the implementation of very complex tasks.

Video Mode

The classes also support the Video Mode, a special function of Plant Direct iT. With the help of Visu Recorder past sequences can be replayed directly in the user interface to support the staff in error diagnosis.



Process graphics with open operator dialogues of objects

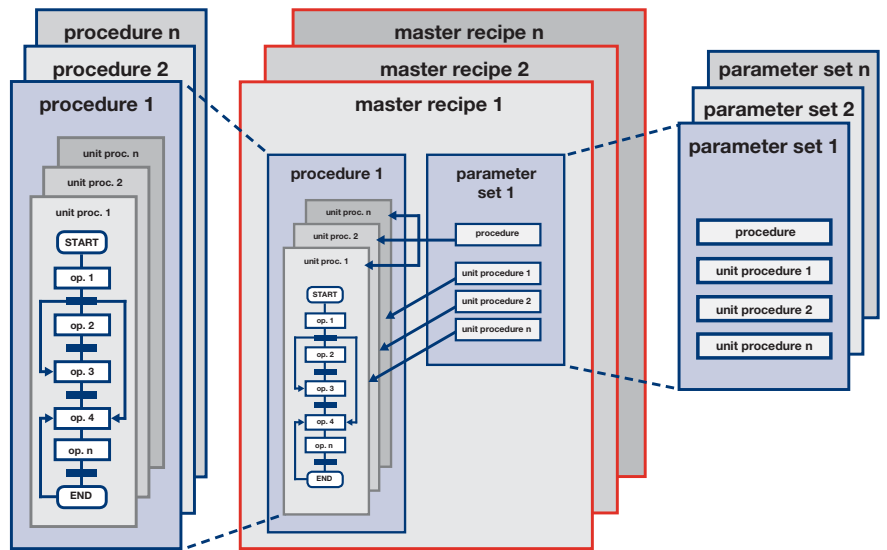
Integration from valves to sequence control

Plant Direct iT does not only provide classes for technical objects. There are also classes for the parameterization of complete processes following different methods.

In particular, continuous processes are often mapped by using interlock-based control. In addition to classes for automation objects, a logic function class is available. With its help the conditions for the activation and interlocking of each single object can be parameterized.

The second method includes the mapping of processes by means of a step sequence and also for this Plant Direct iT provides the adequate classes:

The Object Control Matrix class (OCM) enables the user to parameterize the controlling and monitoring of a complete group of technical objects (actors, sensors) for a variety of activities that have to be carried out in the process sequence. In a matrix for each object is parametrized how it is to be treated if a specific activity is called (e.g. monitoring for "Off" and "Error" for activity "Inherently safe"). The activities defined by



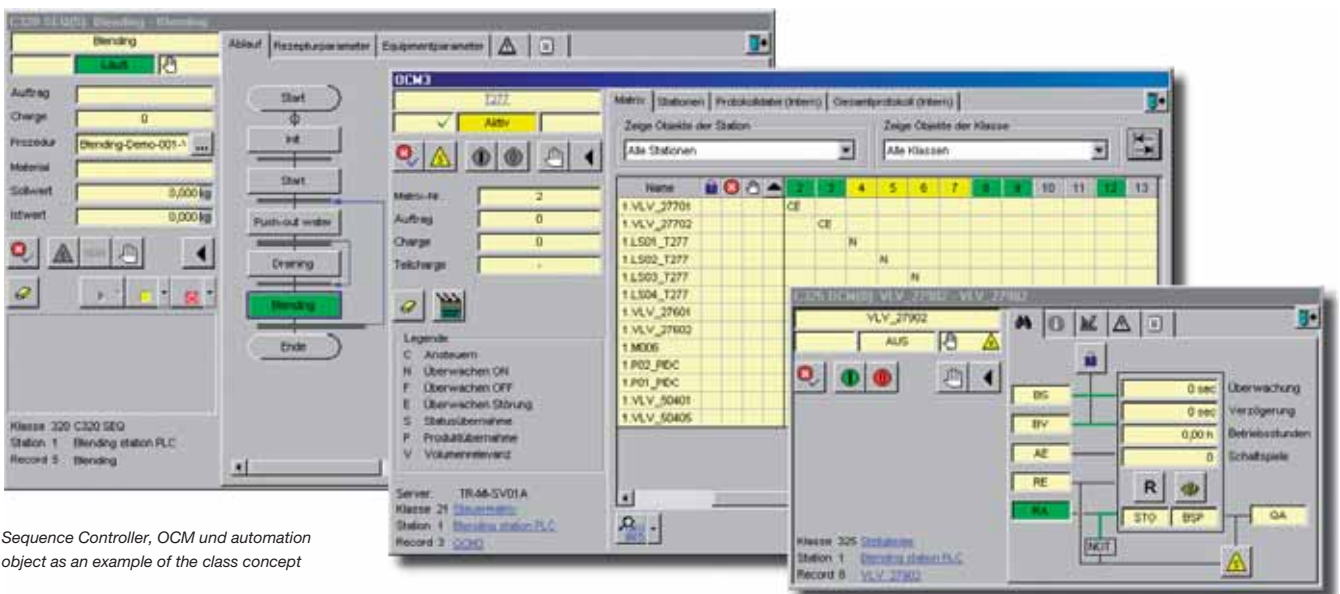
Creating master recipes by combining procedures with parameter sets

an OCM can be called by superordinated sequential control in any possible combination.

The class "Sequence Controller" allows the parameterization of step sequences including the required branch targets and transitions. Calling OCM activities within these steps results in a completely parameterized sequential process control.

Efficient Source/destination handling

The use of sequence controller and OCM allows variable process control in respect of the allocated plant resources. The parameterization of the group of technical objects to be used by OCM is done by means of object lists, which then can be dynamically allocated to an OCM matrix. In this way, the activities for a specific process need to be parameterized only once.



Sequence Controller, OCM und automation object as an example of the class concept

Plant Direct iT – The process control system

But by combining them with different object lists they can be executed for different resources (e.g. source tanks).

Recipe control

Plant Direct iT provides special functionality for recipe-controlled processes based on a simplified procedural model. Processes are described by means of procedures comprising one or more unit procedures which themselves consist of one or more operations. Each unit procedure equals one object of the class Sequence Controller and the steps defined for this object represent the operations.

Master recipes can be created by combining such a procedure with different, equally structured parameter sets, e.g. for making different products using the same process.

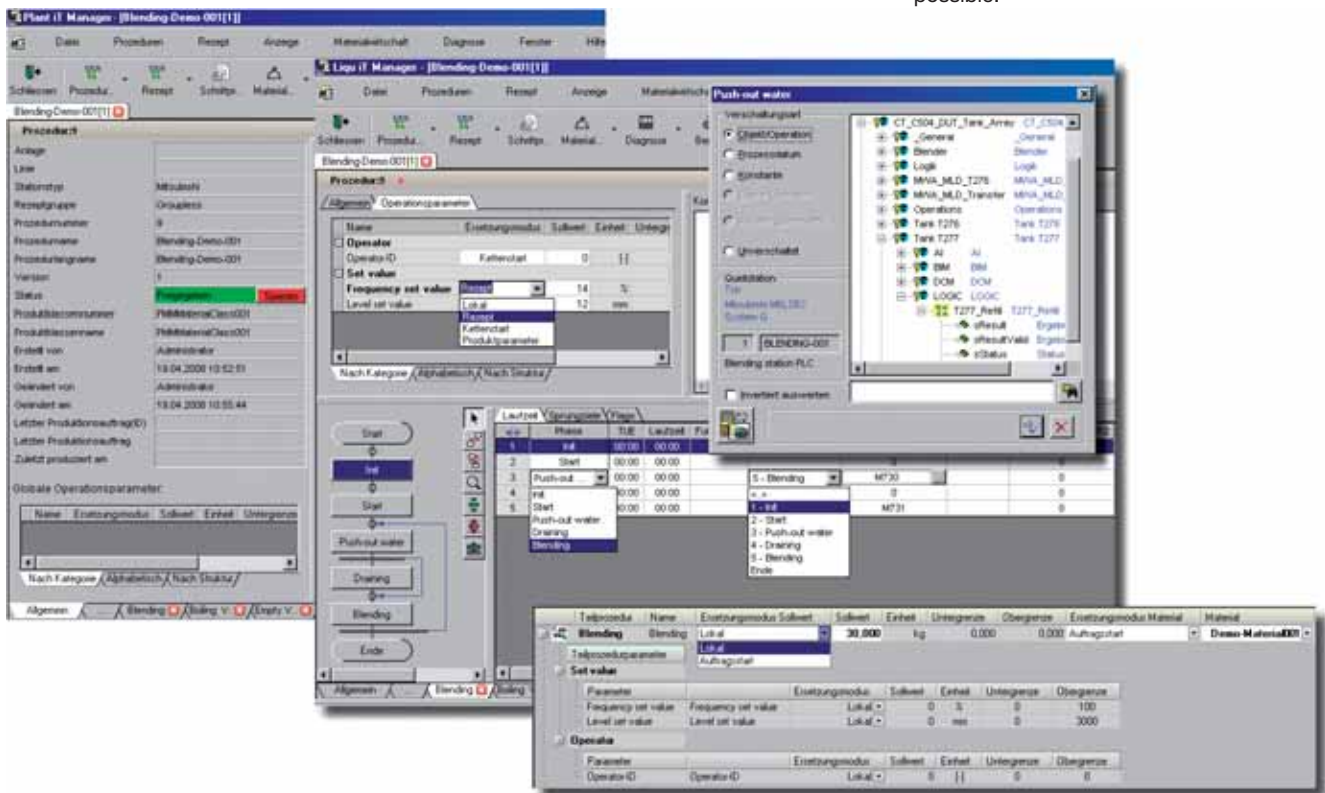
The system distinguishes between recipe and equipment parameters. For the recipe parameters different replacement methods are selectable which allow to define for

each parameter, whether it is a constant with regards to the master recipe or it has to be defined individually each time the process is started. Equipment parameters are constant in relation to recipes, because they just describe product-independent, technical properties of plant components. Thus the process control system *Plant Direct iT* itself provides extensive possibilities for the automation of recipe-controlled processes.

Material-related process control

Plant Direct iT allows the implementation of material-related process control solutions. *Plant iT material*, the system component for process-orientated material management, can be accessed directly from process control level. With the help of system-internal standard functions transaction-accurate booking records can be generated for every single material movement out of the running process and almost real-time. In that way, material-related process control including inventory management and – in combination with a super-ordinated order management – also tracking and tracing is possible.

Creation of a procedure by parameterization of unit procedures, parameter set of a unit procedure in a master recipe



Plant Acquis iT.

Production data management

Plant Acquis iT acquires, processes and files process, operational, machine and energy data for the plant-wide information management. In particular it takes into

consideration the heterogeneous and complex nature of subordinated automation systems from which data are acquired. OPC is used as preferential interface. For systems not supporting OPC an additional, a driver-based interface is available. It is designed in such a way that it avoids interfering with the functionality of subordinated systems. Using connection methods like this, easy and flexible interfacing with various controller platforms is possible (e.g. Mitsubishi, Siemens, Rockwell, VIPA or others).

Data acquisition

Plant Acquis iT acquires and processes various types like:

- Messages (binary values),
- Measured values (analog values),
- Counter impulses/counting results and
- Character strings

both online and offline, i.e. by means of manual input.

In accordance with the Plant iT class concept, corresponding objects are created and parameterized for the recording of these values. The standard system includes additional types of objects that provide particular functions. They can be used either for data recording or processing:

- Manual input objects allow the feed of parameterized data points by means of manual input (e.g. laboratory values).
- Formula objects enable the direct mathematical and logical processing of recorded measurements (e.g. the simultaneous calculation of derived values and the acquisition of the actually measured value).
- Event objects can trigger complex activities in the system (e.g. batch switch-over or automatic reporting).
- Maintenance objects offer the possibility of setting up counters for operating hours and switching cycles. They create the basis for using a maintenance management system.

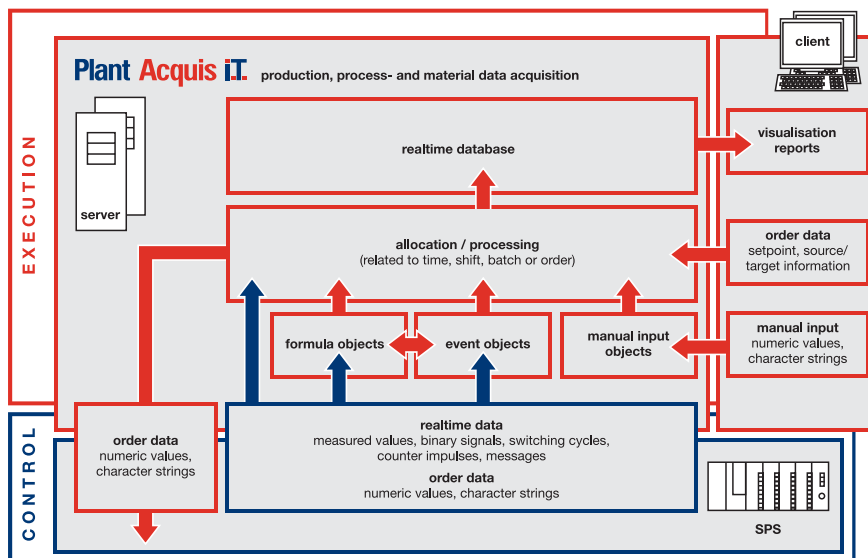
Up-to-date standards

Plant Acquis iT is customized to the specific requirements of the Weihenstephan Standards 2005 for beverage packaging plants. In addition to using OPC and driver-based interfacing with subordinated controllers, Plant Acquis iT provides an extra communication channel for this standard.

Material Management

Plant Acquis iT fulfils the latest requirements for product tracking by providing functions for material-related production data management. In combination with Plant iT material booking records for material movements can be generated by using special kinds of event objects. As a result, functions like inventory management or tracking & tracing are also available for processes, not directly controlled by Plant iT components.

Dataflow with Plant Acquis iT used for production data management



Data analysis

Plant Acquis iT provides the fundamental functions for the immediate analysis of production data:

- Curve representation of analogue and binary data in terms of freely parameterizable and storable views
- Efficient error handling by means of freely parameterizable message groups and profiles
- Weak-point analysis with the help of message hit lists, e.g. analysis of error messages according to frequency or length of appearance.

Data may be selected either by time periods, orders or batches. The results can be further refined by easily selecting from entire plant areas, individual units or single objects. For more complex analysis the system offers a data export add-in to Microsoft Excel.

Visualization

Plant Acquis iT also includes a visualization feature. The focus is on providing plant or unit-related status overviews in combination with single, operator-controlled transmission of set points. In respect to the

functional principle and the applied engineering tools, the visualization feature is fully compatible with the visualization Plant Direct iT offers. The use of identical infrastructure allows visualization functions of Plant Acquis iT and Plant Direct iT to be combined in a homogeneous operator interface.

Open for extensions

Due to its open architecture Plant Acquis iT provides optimal possibilities application-specific enhancements like

- Excel-based reporting or
- Filling and packaging management

Via system-internal standard interfaces Microsoft Excel accesses the central database and enables the flexible creation of reports. The advantages:

- Consequent utilization of analysis and presentation functions of Microsoft Excel allows design of tailor made reports based on the acquired production data.
- Users familiar with Microsoft Excel can make modifications themselves

As an alternative the system also provides open interfaces for integration into HTML- or XML-based reporting.

But Plant Acquis iT also provides a good basis for filling and packaging management and can provide functionality like

- line-related order lists including data exchange with sub-ordinated control systems,
- plant monitoring,
- error analysis and
- performance analysis (e.g following OEE).

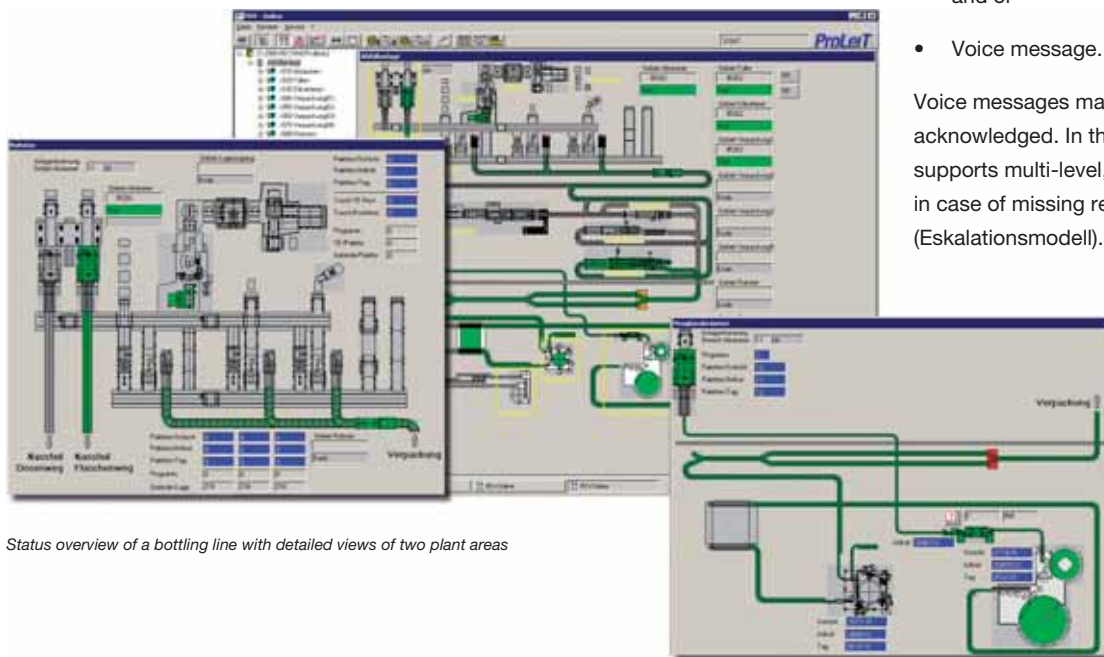
These functions strongly support the operating company in optimizing the plant performance.

Acquis iT messenger – the whistle blower

This Add On for Plant Acquis iT is a remote messaging system for informing responsible staff of critical alarms. The following communication channels are available:

- Short message services (SMS),
- eMail (SMTP),
- Windows warning service (NetSend) and or
- Voice message.

Voice messages may be defined as to be acknowledged. In this case the system supports multi-level, automatic forwarding in case of missing reaction of the recipients (Eskalationsmodell).



Status overview of a bottling line with detailed views of two plant areas

Plant i.T. material

Process-orientated material management

One of the central instruments for the effective management of order or recipe controlled production processes, is a material management system working close to the process that offers transaction-accurate online views on material movements. They are recorded based on a warehouse structure defined compliant to the process and beside a precise inventory management they also allow examination and analysis, especially tracking & tracing.

Plant iT material provides this functionality as a module that is flexibly combinable with all other *Plant iT* components, so that especially production data management applications can be enhanced by adding a material-related view.

Master data management

The relevant properties of storage locations, materials and storage transactions are parameterized within the system. Beside a comprehensive set of properties *Plant iT material* particularly considers the requirements of the process industry regarding the definition of storage locations by distinguishing between different types:

- **Automatic storage location (Storage Unit):** permanently attached to the plant, material movements controlled by automation system (e.g. tanks, silos)
- **Manual storage location:** not connected to the plant, material movements done manually (e.g. fork lift) or controlled by external system (e.g. automatic transport system)
- **Docking storage location:** temporarily connected to the plant by automated docking device, material movements controlled by automation system (e.g. containers, big bags)

Materials with an identical set of relevant properties are summarized in material classes (e.g. liquid goods, granulates, finished products) and described by parameterizing these properties. The system distinguishes between

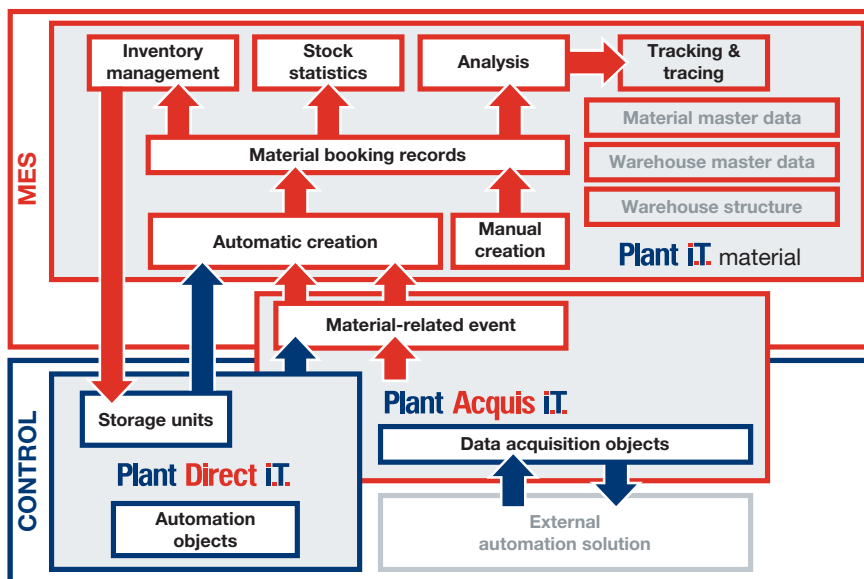
- Material parameters and
- Batch parameters,

which enable the correct consideration of material properties that may change with every single batch of this material (e.g. agent concentration).

Storage transactions are in the first step categorized by booking type (e.g. inflow, outflow) and then rendered more precisely by means of transaction keys (e.g. stock receipt bulk ingredients, automatic dosing). Each warehouse transaction is allocated to one booking type and one transaction key for allowing more accurate selections during data analysis.

The recording of material movements normally takes place automatically, triggered via system-internal standard interfaces by the single system components. But they can also be entered manually via the operator front end of *Plant iT material*.

Functional principle of Plant iT material



Investigations and analysis

Stock overviews (warehouse status) as well as transaction overview (list of selected warehouse transactions) are directly available within *Plant iT material*. The flexible combination of

- warehouse/storage location,
- materials/material classes,
- time period,
- order/batch ID,
- goods receipt ID,
- supplier's batch ID,
- booking types and
- transaction keys

makes these standard views to be very efficient tools.

The details of every warehouse transaction is directly accessible online and the use of special archiving methods keep the system response time high even with large quantity of data without losing detail information.

Depending on the type of storage location *Plant iT material* allows direct operator interaction ranging from spontaneous stock taking to triggering the connection or disconnection of a container.



Transaction overview with flexibly combinable selection criteria

Tracking & Tracing

From the standard views (stock and transaction overview) there is direct access available to the consistent tracking & tracing function of *Plant iT material*. Starting from an arbitrary entry point batch tracking analysis can be carried out in both directions. A view splitted in predecessors (upstream) and successors (downstream) with visualization structured the same way

as in stock and transaction overview makes it easy to navigate and survey.

For using the tracking & tracing in an optimal way it is recommended to use a super-ordinated order management function. This may be implemented as an application-specific extension in *Plant iT*. For this purpose the sequence controller supports the processing of order and batch ID's.



Tracking & tracing with arbitrary entry point can be started from stock and transaction overview

Plant i.T. connect

Parameterizable communication interface

Parameterization instead of programming is one of the basic principles of the whole *Plant i.T.* system platform. *Plant i.T. connect* uses this principle to implement communication interfaces between *Plant i.T.* and various external systems. The range covers:

- Client-server or host-based systems (e.g. ERP systems such as SAP R/3, LIMS systems, maintenance systems)
- PC and PLC based systems (e.g. automation systems and SCADA systems)
- Intelligent measurement and monitoring systems (e.g. inspectors and inline analysis devices)

Plant i.T. connect consists of

- the project planning user interface,
- the communication channels and
- the system service.

The engineering interface

The operator interface of *Plant i.T. connect* is used exclusively for the parameterization and monitoring of communication interfaces. It seamlessly integrates into the configuration client, the central engineering environment of *Plant i.T.* The parameterization dialogues for the different communication channels are standardized in respect to structure. Contentwise they are adapted automatically to the particularities of each channel.

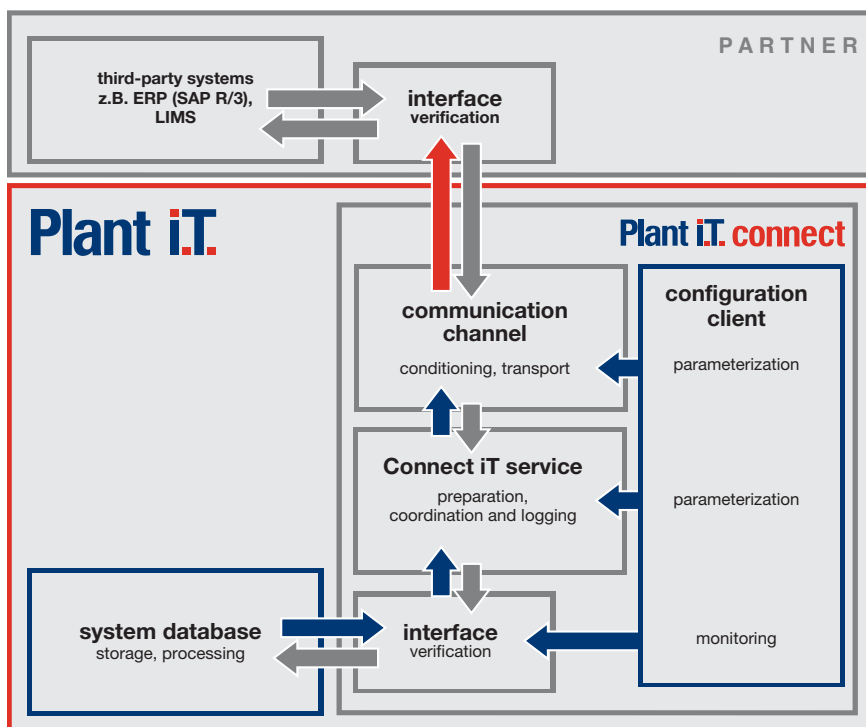
The communication channels

For each communication to be parameterized, a communication channel is selected in order to define the communication methods to be used. The function of the communication channel is to ensure interface-orientated processing of the data to be transferred as well as the use of standardized functions for sending and receiving data packages.

The following channels are available:

- **IDoc/MQ Series**
Plant i.T. connect sends and receives IDocs using message queuing as the type of communication.
- **IDoc/RFC**
Plant i.T. connect transfers IDocs by sending/receiving RFCs (Remote Function Calls).
- **XML/B2MML**
Plant i.T. connect sends and receives XML documents and supports the B2MML implementation of ISA 95.
- **RFC Client/Server**
Plant i.T. connect sends and receives RFCs (Remote Function Calls), i.e. requests for particular information. Their content and structure can be individually defined per interface. Either tRFC or sRFC can be used.

Overview of communications relationships for *Plant i.T. connect*



SQL/ODBC

Plant iT connect utilizes the ODBC standard interface for communication with relational databases of other systems.

ASCII/File

Plant iT connect sends and receives data by writing or reading ASCII files stored in an external system.

The system service

Plant iT connect service works on the operating system level. Its primary task is to coordinate and report communications transactions. It is here where incoming data are processed and forwarded to the appropriate communication channel. As the central authority, the service is in charge of an important part of data processing. In this way, the workload for the communication channels is reduced and the system can easily be upgraded with additional communication modes.

Typical applications

Among others IDoc and RFC communication are used for the data interface to SAP MM, PP and PM modules.

Interface to SAP-MM

Depending on requirements this interface is used for transaction-specific, bidirectional data exchange concerning individual material movements. It is also possible to alternately synchronize information on stock of materials.

SAP-PP interface

Production orders as well as respective bills of material can be transferred via this interface from SAP to Plant iT, which reports back order-related data to SAP, e.g. order status and actual values like quantities produced.

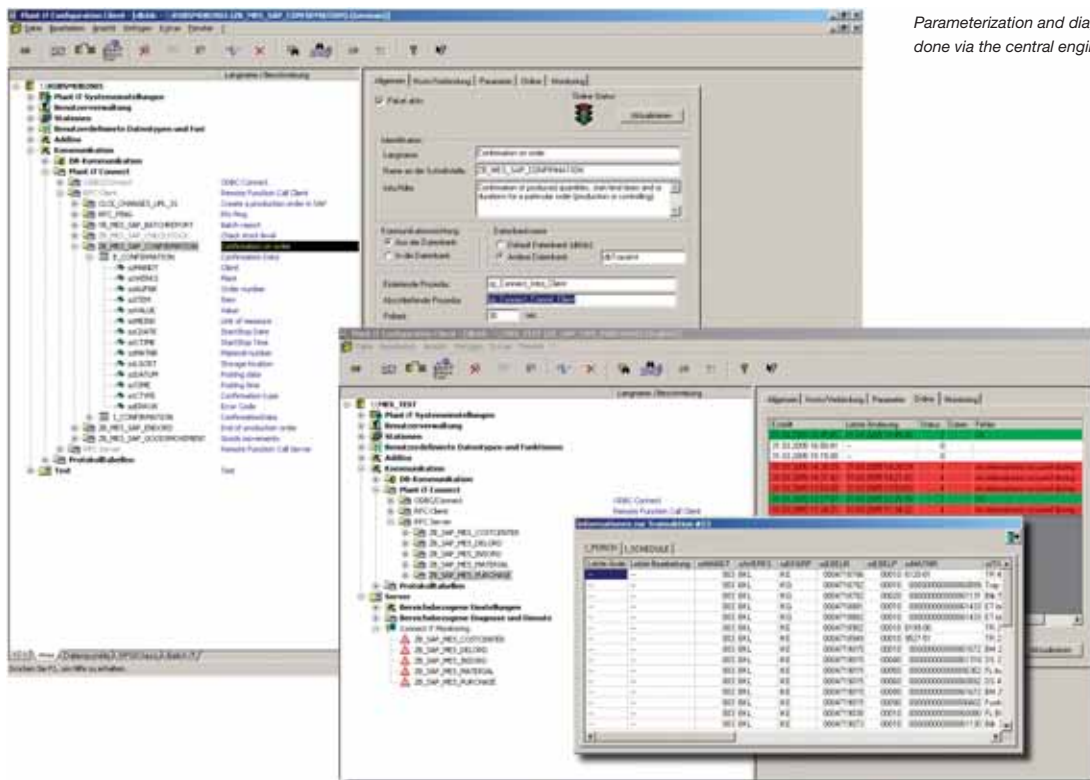
SAP-PM interface

This interface transfers counter and measured values to the SAP module for the planning and monitoring of maintenance activities (e.g. current status of operating hours and switching cycle counters).

ASCII interface

This interface can be used for the automatic transfer of various data from subordinate measurement and control systems, like for example inspector data of a bottling line. The individual inspectors (empties, full goods, empty crates) store their ASCII data files locally on a PC that belongs to the inspection system. The system service, located on the Plant iT server,

- accesses stored data via the network,
- checks stored data for any changes,
- reads them out, if necessary, and
- transfers them via the communication channel to the central Plant iT database.
- Here, data are available for further processing (visualization, reporting, investigations). Because of its flexibility, this type of communication is particularly suited for linking application-specific solutions to external systems.



Parameterization and diagnostics of the interfaces are done via the central engineering environment

System requirements

Servers and workstations

For servers and clients x86-based computers are required. The currently available CPU's of the manufacturers Intel and AMD can be used. The computer hardware and the driver software used with it have to be tested and approved for being operated under Microsoft Windows XP and Windows 2003 R2 or Windows 2008 Server respectively.

Component		Minimum specification	Recommended specification *
CPU	Server	Performance level Intel Pentium 4 1.8 GHz	Performance level Multi core CPU by Intel or AMD (Core 2 Duo, AM2) 2.0 GHz or more
	Client	Performance level Intel Pentium 4 1,8 GHz	Performance level Intel Pentium 4 1,8 GHz
Memory	Server	1024 MB	2 GB or more
	Client	512 MB	1 GB or more
Hard disk	Server	40 GB	80 GB or more
	Client	20 GB	40 GB
Network interface	Server	Intel Etherexpress Pro 10/100 PCI	100 MBit PCI or 1 GBit PCIe NIC (Intel, 3Com)
	Client	Intel Etherexpress Pro 10/100 PCI	100 MBit PCI or 1 GBit PCIe NIC (Intel, 3Com)
Graphics interface	Server	Onboard-Graphics	Onboard-Graphics
	Client	external AGP graphics board with min. 32 MB memory	external AGP/PCIe graphics board with min. 32 MB memory

*) The recommendation is for a mid-size system consisting of one server and three clients.

PLC hardware

Supplier	Model	CPU types
Mitsubishi	MELSEC System Q	Q06HCPU, Q12HCPU, Q25HCPU, Q12PHCPU, Q25PHCPU

Standard software

Software requirements for servers and clients:

Component		Requirement
Operating system	Server	Microsoft Windows 2003 R2 Server Standard Edition SP2 (32 Bit) Microsoft Windows 2008 Server Standard Edition (32 Bit)
	Client	Microsoft Windows XP Professional SP2 (32 Bit)
Database		Microsoft SQL Server 2000 Standard Edition SP4 Microsoft SQL Server 2005 Standard Edition SP2
Spreadsheet for analysis and reports		Microsoft Excel 2002, 2003 or 2007
Engineering operator front end		Microsoft Visual Studio 2005 Standard Edition

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