



## **Engineering Project Management and Control System**

### **GENERAL OVERVIEW**

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## **1. INTRODUCTION**

The EPMCS Package provides a number of specialised computer software tools to meet the needs of companies in the engineering, project management and construction business sectors.

The modules within the package provide a company with the tools to manage:

- drawing office, drawings and engineering data control
- estimating
- bulk material management, including engineering specifications, catalogues, bills of material, etc.
- equipment and instrument schedules
- CAD interface
- scheduling
- workshop / construction site management
- inventory management, multiple warehouse, etc.
- purchasing management, RFQ's, bids, orders, receiving
- labour management, including labour requirements, using standards or Linde factors, actual labour hours through time sheets, etc
- project costing
- revenue & invoicing
- debtors & creditors
- accounting modules
- general utilities

Each module is fully integrated, as appropriate, with the other modules in the package.

This package enables a company to very accurately and closely control the planning, procurement for and execution of a wide variety of engineering projects.

The benefits flowing from such control include:

- better management of the risks inherent in engineering projects
- better management of scarce resources, material, labour, equipment and capital
- detailed control of resources ensures that the material, labour, etc., are on site at the correct time, thereby reducing cost and minimising penalties for late delivery
- detailed audit trails provide sufficient detail to prove claims for variations in the scope of the contract
- runs on computer equipment suited in size / power to the needs of the company, avoiding costly investment in computer equipment

These benefits all contribute towards the critical parameter, a better bottom line.

The package is designed and developed by Stalberg & Associates.

Accordingly, the use and distribution of the software and this documentation is governed by the terms and conditions of the standard license agreement of Stalberg & Associates.



## 2. OVERVIEW OF THE SYSTEM

The package is designed to be multi project, multi-company, multi warehouse, multi currency and multi user.

The system is easy to use, being a Windows based product. All the cross referenced fields and fields with data base validation rules, will "pop-up" windows containing the valid options.

### ***2.1 The documentation control module***

The function of this module is to manage the activities of a drawing office and to provide a central drawing data base to the rest of the package.

Each detailed drawing will describe a part of the design of a project (could be a machine / a plant / a structure) to be constructed and/or fabricated.

All the drawings for a given project will completely describe that project. Any drawing coding system can be implemented, as the relationship of the individual drawing to the project structure is determined by cross reference fields. Currently these cross reference fields include:

- project                   to which project does the drawing belong
- area                       to which area within project
- sub area                 to which sub area within area
- unit                      to which unit within sub area
- node                     to which node in the project planning network does the drawing belong

The movement history can be recorded against each drawing, including such details as client drawings and history. The module provides a drawing transmittal facility for controlling the movement of drawings, internally and between client, site, workshop, etc.

Very tight control is maintained over the revision level of a drawing. When the revision level of a drawing is changed a "snapshot" of the drawing record and any attached material list is written to the drawing history file.

The module provides for different drawing types. For example, general arrangements, process diagrams, isometrics, hook up diagrams and dummy drawings.

Dummy drawings are used to create any artificial summary levels which may be required within the project structure, for example at the estimate stage, when the detailed drawings are not available.

Specialised requirements, such as line list cross references and vendor drawing control, are also provided.

Drawing performance reports are provided. There is a man hour budgeting system and an automatic interface to the labour time sheet system. Forecasting, percent complete and efficiency factors are also included. Percent complete can either be manually input or automatically calculated, based on milestone completion.

Transmittals notes can be generated and printed and a full transmittal history is maintained.



## **2.2 The bulk material management module**

The material module is designed to implement the engineering aspects of the material management of a project.

There are a number of tables which are provided by this module:

- item master
- specification master
- engineering bills of material
- assembly tracking

The module contains tables to hold client coding structures which can then be loaded into a new project. This provides a very flexible way of meeting client coding requirements.

### **0.0.1 Item master**

The item codes, which are used throughout the package, store all the static or descriptive data, including descriptions, specifications, costs, units of measure, etc. Multiple sets of client item codes can be stored and used.

### **0.0.2 Specification master**

An item master file can become extremely cumbersome when a large number of material items are defined, covering a number of projects.

To simplify the use of the item master by the rest of the system we have provided a specification file. This file groups all the items which conform to a particular standard which have been qualified for use in a given application.

Whenever the user is required to input an item all that is required are a specification and a short code. The program then "pops up" the qualified material items and their size range. This eliminates the need for constant reference to the code list and the error prone data capture of material item codes.

### **0.0.3 Engineering bills of material**

The engineering bills of material are created, in the material list file, by combining a drawing, an assembly and a series of material item codes. Against each combination is recorded the material required

The bills of material can be viewed at any of the defined levels of detail (project, area, unit, etc). There are various control summary and listing report / enquiry options.

### **0.0.4 Material control cycle**

The material control cycle provides a number of phases which can be optionally combined to monitor a project. The full list of phases, in sequence, is:

- estimate (quote, tender, bill of rates, etc.)
- budget (copied from the estimate / or created manually)
- preliminary bulk (initial bulk order quantities, derived from preliminary designs, flow diagrams, etc.)
- secondary bulk (refined bulk order, derived from the detailed design drawings)
- bill of material (captured from the production drawings, isometrics, etc... There is an optional CAD interface to automate loading of the bills of material.
- requisition (can be generated from either the preliminary or secondary bulk quantities, or at the bill of material stage. The requisition is the interface to the purchasing department.)
- receive on site (receipts are controlled by the purchase orders prepared by the purchasing department. Receipts can be directed to multiple stores. Multiple step receiving can be provided so that Quality Control can first inspect the items before they are received into the stores.)



- allocation (after material has arrived in the store it can be reserved / allocated to a specific drawing. The drawings can be selected in the order of construction to ensure the material is available to meet the construction plan.)
- issued (once material has been reserved it can then be issued to fabrication, production, erection, etc.)
- wastage (wastage occurs for a variety of reasons, including random lengths, bad workmanship, loss, etc. This step is used to ensure the wastage is not lost sight of and the demand for material is appropriately adjusted.)

### ***0.1 The equipment management module***

The equipment module is designed to implement the engineering aspects of designing and procuring unique, or tagged equipment items for a project.

There are significant differences in the approach to equipment items when compared to bulk material items.

In this module every item is uniquely described and priced.

The module provides for the equipment list to develop through various states. These states include:

- estimate
- budget
- bill of material

In the estimate the list can be summary in nature and as the project proceeds, progressively more detail can be added to each equipment item.

The module provides for the equipment items to be linked to disciplines. Any number of disciplines can be accommodated, for example:

- architecture
- civils
- structural steel
- piping
- erection

The module fully supports client coding as well as the standard company coding methodology.

### ***0.4 The inventory management module***

This module is designed to provide control over the physical inventory, in multiple stores, warehouses, or site stores.

In other words the user can define in which warehouse the items are to be stored and can move items between stores.

The inventory management module uses the same item master file as was described under the material management heading.

The warehouse / item or inventory file contains a number of segments. These are:

- item quantities / pricing per warehouse
- all transactions (kardex)
- FIFO layers (one layer per goods received voucher)
- summarised movement history



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The module provides a number of transactions, including receiving, issues, transfers between store, adjustments, physical count and trial kiting to determine availability prior to material issue.

The module also supports the selling of material to customers (and credits), transfers between warehouses, issue, receipt and adjustment transactions.

### ***0.5 The purchasing management module***

The module includes a requisition tracking or purchase operating plan structure which allows project staff to control requisitions and track the planned, forecast and actual completion dates on milestones.

This module is designed to automatically generate request for quotations (RFQ'S) from the engineering bulk material, equipment, instrument or works requisitions; control the bids received from potential suppliers, rank the bids; automatically create the purchase order from the accepted bid. The purchase orders include header, detail and terms sections.

A manual purchase order entry program is also provided, for purchasing items which cannot be automatically generated, e.g. site orders, by the material management module.

### ***0.6 The expediting module***

Progress chasing reports and document printing are also provided. Goods receiving against purchase orders is also provided. This function closely integrates the purchasing and inventory modules. The receiving department can direct the items to any warehouse / store and can optionally use the two step receiving facility, which enables the quality assurance department to inspect the items before they are officially received into inventory. The module tracks overs and unders and damages.

### ***0.7 The labour management module***

This module is designed to determine labour requirements, create job cards, provide an employee data base, capture time sheets / clock cards, update the job cost file and optionally update a payroll system.

The budgeted labour requirements are determined by means of a task take off, analogous to the material take off. The task take off is multiplied out by the standard rates to determine the standard hour requirements. These requirements can be printed on a job card and/or on a detailed report.

The employee master provides a data storage mechanism for all employee related data, including:

- personal details
- rates (normal and overtime)
- tax details
- union details
- paye details

Time sheets / clock cards are captured so that the hours can be allocated to any number of specific accounts, resources, work packages and / or drawings. A program summarises the time sheets and after applying the appropriate cost rates, updates the actual cost in the job cost, work package and resource files.

The module provides alternative mechanisms for the calculation of required hours. For example, calculation of required labour by means of the Linde factors is provided as an alternative to the standards.



### ***0.8 The cost management module***

This module is designed to accumulate all the cost information in a structured manner from the other modules, at the project, the WBS, or account level of detail. The module includes budget development, change control management, forecast, commitment and actual costs.

In addition resource and work package budgets are available with the ability to generate "S" curves and cash flow forecasts, and performance reports.

The module is designed to be as flexible as possible, so that it can be tailored to suit the particular needs of a company. The module is fully multi currency and allows both sell and cost rates.

In addition, it is possible to define the level of detail to be used for the summarisation of information before it passed across to the job cost module. For example, material cost information can be passed across either at part, commodity code, or simply as material cost. The same flexibility is available when posting costs to the general ledger, all transactions can be posted or progressively summarised information can be posted.

The following cost types are currently supported:

- project or original budget
- control budget (project budget adjusted by change control)
- committed cost
- forecast to complete cost
- actual paid cost

The module contains a sophisticated change control system.

### ***0.9 The site scheduling module***

This module is designed to plan and/or model the execution of a project.

The module contains three processes:

- the schedule
- the material plan
- the capacity plan

The schedule answers the question, "What are we going to do, and when are we going to do it?". Using the module the user can schedule the work load for an estimate or a major construction project.

To provide the data to answer this question, the module contains programs to load works orders, forecast orders, etc.. into the schedule. Forecast orders can be generated from any drawing / assembly in the data base, including those used to define an estimate. (NB. There is a similar program to load inventory usage history, e.g. spare part usage, into the schedule, as a demand forecast.)

There are also programs which the planner can use to manipulate these order entities to refine a schedule.

The material plan answers the question, "What material do we require to make the schedule happen?".

In the case of an estimate the module will forecast the required 'on site' dates, based on the schedule. This facilitates the calculation of meaningful project cash flow estimates.

The module contains programs to sum the material requirement from all the bills of material in the schedule, load the available inventory, and load the anticipated receipts from purchase orders. All this data is time phased according to the schedule dates, offset by the lead times.



From this data reports can be extracted which detail the total material plan required to meet the schedule. Consequently, a progress chaser can actually chase material according to the real required dates, rather than obsolete purchase order dates, or crisis calls from the shop floor or site. Furthermore because the schedule is time phased into the future, potential crises can be solved long before they become a real crisis.

The capacity plan answers the question, "What resources will it take to make the schedule happen?".

In the case of an estimate the resources required may either be detailed or very rough. The module will determine the requirement plan according to the level of detail available at the time.

The module contains programs to schedule each order according to the route and the standard hours allocated to each routing step. The program starts with the schedule date of the order and works backwards through the route, establishing the start dates for each work centre. The standard hours are then accumulated, according to the time phase.

The total requirement can then be graphed, etc., and assessed to determine whether the required resources are, or can be made available. Again, because the plan is time phased, potential crises can be solved long before they become a real crisis.

The module contains programs to adjust schedule dates in the works and the purchasing modules, under the control of the planner, after the schedule has been approved.

### ***0.10 The site works module***

This module is designed to control the physical execution of a project, in a workshop or site environment. The module has been designed to make full use of the power of the scheduling module, and provide shop floor / site control features.

Work orders can be created in a number of ways, but primarily automatically from the schedule, or manually by an operator using a terminal.

Each order can have associated with it a bill of material and a routing sequence.

The bill of material defines all the material that will be required to build the order.

The routing sequence defines the sequence through which the order will flow through a series of work centres. There is complete flexibility in the definition of a work centre. Consequently a work centre could be defined as:

- a department
- a machine
- an erection crew
- an engineer
- a draughtsman
- an artisan

Each work centre can contain a description, a crew size, available standard hours, etc..

The module contains programs to print the necessary paper work, load sheets, and priority sheets. The priorities on these documents are updated each time a new schedule is accepted

The module contains material reservation, issue and completion programs to maintain the work orders, as well as a time sheet capture program.



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The module contains a complete order tracking system, which tells the management exactly where each works order is in the process.

There is an optional interface to the purchasing module which provides for the loading of purchase order line items directly into this tracking system.

The inventory, labour, machine and assembly tracking modules are all directly interfaced into the workshop / site module and the workshop module is interfaced with the job cost module

### ***0.11 The sales order & invoicing module***

This module is designed to automatically generate a customer invoice for either completed jobs, or portions of completed jobs. The user can select what level of detail is to be transferred to the invoice file.

The module is also used for invoicing stock or warehoused items to a customer. Sales credit notes are also provided.

The module contains programs to automatically update the debtors and general ledgers.

The printing of documents is provided.

### ***0.12 The debtors module***

This module is designed to store information about the state of indebtedness of each customer. Statements, age analyses, etc. are provided.

The debtor's ledger is designed around the open item format, but supports both the open item and the balance forward methods of operation.

The customer master is also used to validate the on line inventory invoicing routines.

Cash receiving, adjustment journal and credit note transactions are provided.

### ***0.13 The creditors module***

This module is designed to store information about the state of indebtedness of the company to each supplier. Remittance advices, cheques, age analyses, payment forecasts, etc. are provided.

The creditor's ledger is designed around the open item format, but supports both the open item and the balance forward methods of operation.

The supplier master is also used to validate the supplier in the purchasing and material control systems.

An interface is provided to match goods received vouchers to creditors' invoices during the invoice capture process.

The creditors' ledger provides for the recording and eventual payment of retention's.

A facility is provided to automatically post the supplier invoice expense allocations to the general ledger.

### ***0.14 The cash book module***



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This module is designed to process cash book transactions, both receipts and payments, which are not automatically generated by either the debtors or creditors modules.

Multiple bank accounts are provided for and cheque account reconciliation is supported.

There is tight integration with the general ledger, eliminating the need to manually capture the transactions into the general ledger.

### ***0.15 The general ledger module***

This module is designed to provide a straight forward accounting system to support the project / company. It is designed to be multi company, multi cost centre.

The module includes journals, automatic posting programs from the other modules, month end and year end routines.

The module provides facilities to record prior year and budget figures for comparison purposes.

Reports included are transaction, audit trails, trial balance, income statement and balance sheet.

An on screen transaction enquiry facility is also provided.

## **1. DATA BASE, PROGRAMMING & USER INTERFACE**

The EPMCS is designed from the foundation up to be a client / server application.

EPMCS can be configured to run on any SQL compliant data base management system, ranging from MS ACCESS right up through ORACLE and DB2. EPMCS uses the latest OLE DB technology to link the client and the server applications. The standard system is delivered configured to run on MS-SQL Server.

The client software is written in MS Visual Basic 6, which is the best Windows client development tool on the market, when all the issues of speed, flexibility, cost and market acceptance are factored into the decision. The client software integrates seamlessly into the Windows and MS Office environment. This means that the EPMCS package can use all the functionality of MS Office and expose itself to these applications. For example, the two way movement of data between EPMCS and Excel is very simple.

EPMCS uses Crystal Reports for all the report writing and the standard reports are integrated into the forms, right along with the data capture functions.