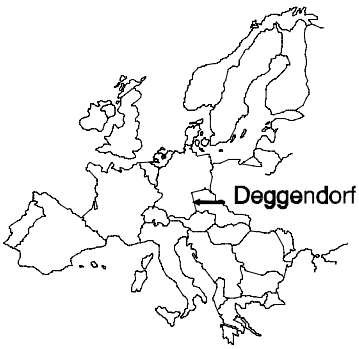
P-NET NEWS

News letter for International P-NET User Organization ApS. **1/1993 March.**



The 2nd International P-NET Conference

The 2nd International P-NET Conference was held 30th November and 1st December 1992 and it was a very successful arrangement. The conference took place in very nice surroundings at Parkhotel Deggendorf, Germany.

View from the conference.

The conference leader was Dr. Jörg Böttcher, Chairman of the local society of the International P-NET User Organization in Germany, and he managed to hold the time schedule and made the conference very exciting.

The P-NET Conference had 44 participants, coming from Denmark, Finland, France, Germany and United Kingdom. Most of the participants were members of the International P-NET User Organization, but also other companies and Universities were interested in the conference. Furthermore, more journalists from Germany, representing technical magazines joined the conference.

Several items were discussed during the presentations, but very important, the discussions continued in the evening in the bar. The atmosphere during the conference was remarkably friendly and relaxing, which was the optimal environment for exchanging experiences, and of course good stories and jokes.

The presentations were separated into five main groups covering:

Actual developments, Applications I + II, and Software I + II.

A short summary of each presentation is given below.

P-NET **Introduction to P-NET**, by Ole Cramer, Supervisor, International P-NET User Organization, Denmark.

The introduction to the P-NET Conference was dealing with the success from INTERKAMA 92 exhibition. The benefits of P-NET, as well as the difference between P-NET and other fieldbus solutions were explained. It is a fact, that the Profibus and FIP organizations have a surprisingly low number of installations compared with P-NET.

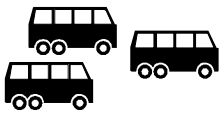
The difference between P-NET and the other fieldbusses was stated clear: P-NET is using the same micro processor to control the task of the node as well as the communication task, whereas other fieldbus systems, uses Add-on circuits with separate micro processor for the communication.

The conclusion is: P-NET fieldbus nodes need not to be more expensive than traditional equipment, whereas Add-on circuits will increase the price level.

The Profibus and the P-NET was described in relation to the seven layer OSI reference model, and again the Profibus have some drawbacks. For instance several combinations of protocols are possible for the Profibus, making it impossible to connect equipment and then be sure it is able to communicate.

Compared with other fieldbusses, some of the big advantage of P-NET are the high number of messages exchanged per second, the error handling as well as the multi-network facilities.

ACTUAL DEVELOPMENTS



Fundamentals on Fieldbusses and International Standardization, by Dr. Jörg Böttcher, Product Manager, Ultrakust Electronic, Germany.

This paper described the P-NET fieldbus in relation to the International Standardization. The difference between Centralized Fieldbus Systems (i.e. one master several slaves, e.g. Bitbus) and Decentralized Fieldbus Systems (i.e. multi-masters and multi-net, e.g. P-NET). The reduction of the ISO-OSI-Model for fieldbusses is necessary because of the real-time requirements. Typically, a fieldbus will cover the physical layer, data link layer, network layer and the application layer. Each layer and the related functionality were explained.

Details about the P-NET fieldbus were hereafter described, containing the structure of P-NET-Single Net, P-NET Telegrams, P-NET-Multimastering, and Structure of P-NET-Multinet.

The presentation contained a comparison of some fieldbusses (P-NET, Profibus, Bitbus, Interbus-S, CAN and Din-Meßbus), illustrating Extension, Nodes, Conductors, Technology, bus Access, Response time, and Services on layer 7.

The Industrial Communication Standards (ISO 7498, MAP 3.0, Mini-MAP, FAIS, MMS) and International Standardization for Fieldbusses (IEC, ISA, ISO, CENELEC) were covered in the paper. Finally was the trend in Fieldbus Development showed for different fieldbusses, and the Bitbus, Profibus, and P-NET are going towards the IEC Fieldbus.

IS-16, Intrinsically Safe P-NET, by Ole Cramer, Supervisor, International P-NET User Organization, Denmark.

This paper discussed a standard draft for an Intrinsically safe Multidrop Bus, IS 16. The IS 16 bus is designed for use in hazardous areas as well as non-hazardous areas.

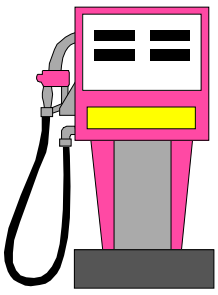
The IS 16 bus is a 2-wire bus carrying the power supply and the data. The maximum bus length is 1000 meters and up to 16 bus-loads can be achieved in a hazardous area and 32 bus-loads can be achieved in a non hazardous area, where one bus load has a current consumption of 10 mA. A bus junction can be inserted on the bus and acts as a repeater and as an isolator between different nets.

The communication protocol on the IS 16 bus is P-NET. A bus junction can connect a standard RS-485 P-NET interface to an IS 16 bus.

To simplify the bus connection for IS-16 a chip set is being evaluated with a single chip processor, EPROM/FLASH memory, EEPROM, RAM, timers, I/O's and P-NET interface.

A very interesting draft for a new fieldbus connector without electrical contacts was showed. The connector included both the chip and the interface.

APPLICATIONS I



Fuel Monitoring and Control Systems, by Christopher Jenkins, Chief Engineer, F.M.A., United Kingdom.

The paper described the aspects of a fuel monitoring and control system for British Rail, which use the P-NET fieldbus.

The system is used to meter fuel Oil (Diesel), Lubrication Oil, Glycol (anti-freeze) and Water. The requirements for the systems was described, e.g. all products should be measured into and out of the system, and all products in stock should constantly be monitored. This means that Flow Measurement and Level Measurement is to be implemented.

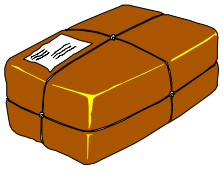
The installation is scattered over a wide area and has 21 sub-networks and a primary network. 24 controllers are used for monitoring, controlling and operator interface. One of the controllers is equipped with a Graphic Control System. The program for the system is based on standard software modules and interrelated application programs.

During the presentation, the single parameters to monitor and/or control was described in details. For instance the non-linearity of flowmeters was explained, and a solution for linearisation was given.

The facilities available within the Universal Process Interface (UPI) was used to linearise the characteristic of the various flowmeters and to provide local control of flow valves. The UPI slave module was used as a virtual machine, which provide standard I/O functions, PID regulation, pulse processor as well as the P-NET interface.

The same principles have been used to produce a Smart Injector, where the flow of a main product line is measured, and depending on the required ratio of additive to product (in parts per million), produces a controlled pulse to control an injector mechanism.

The conclusion was clear, that the P-NET is reliable, flexible, and above all satisfies the needs of the most importants - THE CUSTOMERS.



Automatic Labelling of Fibre Bales at the Hoechst AG in Kelheim, by Ludwig Meixner, Chairman, Pontis, Germany.

This paper described the control and monitoring of fibers (Viscose) at the Hoechst AG, Germany. For the fibers a great variety of types are available, different en length, thickness and treatment of fibre.

The system presented contained 21 production lines. A production line contain spinning process, cutting the fiber, drying, and lowing the fiber through pipes, and pressing the fiber. It is a very large process to produce the right fiber, and to guarantee the quality is it necessary to follow the fiber through-out the production process.

The production lines where connected together with streets, and each street was controlled by one PC. The PC's where connceted together with an Ethernet and the connection to the production line was performed with P-NET via a PC P-NET interface board. Every new data record for the production is saved on the harddisk, and on a server, and protocolled on a line printer.

In case of a crash of a PC, another PC is able to take over the work of the failure. For each PC the following signals has to be connected to the P-NET and the PC: 2 video cameras, 120 digital In- and Outputs (Thrubeams, Relays, Switches, BCD-Interface), 12 serial RS-232 Interfaces (Scanner, Label printer, Balancer), 3 Centronics Interfaces (Line Printers), and 2 analog Output (4..20mA).

The experiences with the P-NET from Hoechst AG were that the P-NET lower the expenses for wiring, the P-NET access via softwire numbers are a good solution.

Application of P-NET in Quality Assurance, Controlling of Chromatographic Devices and Asphalt Mixing Plants, by Josef Fromberger, Sales Manager, Ultrakust Electronic, Germany.

This paper showed the features of the P-NET, e.g. multi-master and multi-net. The paper illustrated three examples with P-NET installations.

The first example was a controlling of Chromatographic Devices in a biotechnological laboratory at Hoechst Frankfurt/Main. The second example was an installation of a Furnace-Controll-System in an Asphalt-Mixing Plant at Bayerische Asphalt Mischwerke. The third example was a installation of a customer designed data-acquisition system for quality end tests in the dishwasher plant of Bosch-Siemens-Hausgeräte GmbH in Dillingen.

The following aspects were highlighted for the P-NET fieldbus:

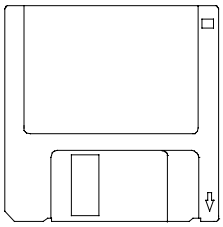
* Possibility of operation with the system either on the central PC or on the distributed stand alone system,.
* Programming of all devices via PC from existing databases.

* Self-controlling of the chromatographic process by the device itself.
* Recording of the process independtly in the controlling device and in the central PC.
* Time-controlled collection of fractionated materials (the results of chromatographic processes).
* Data- management and output facilities in graphic and alphanumeric forms.

By using the high level language Process-Pascal and the high performance P-NET modules, the automation task could be solved without any special hardware and software developing in the controlling system.

The dish-washer plant Bosch-Siemens-Hausgeräte in Dillingen, the biggest plant for dishwashers in Europe, is using data- acquisition system for data processing, which have to be adapted to whole logistical data-system in the factory. In order to satisfy the requirements of a transparency data acquisition, the use of a bus-system was necessary. Beside the network facilities an easy handling and a high reliabilty in a rough environment was forced too. The P-NET Fieldbus could satisfy these needs.

SOFTWARE I



P-NET Channel Structure, by John Johansen, Application Engineer, proces-Data Silkeborg ApS, Denmark.

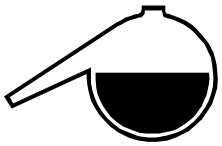
This paper described the P-NET fieldbus from the application layer point of view. The OSI reference model showed the functionality of the different layers.
The paper uses an example to show the contents of layer 7, the P-NET Channel Structure. As an example a PT100 temperature sensor was used.

All the parameters related to one analogue input was shown, i.e. the measured and scaled value AnalogIn, two internal userdefined alarmlimits HighLevel and LowLevel, the configuration for the channel ChConfig, scaling factors FullScale and ZeroPoint, general information for Maintenance, structured information for the channeltype and implemented functions ChType, and an error register ChError. Not only the temperature, but all the above mentioned information is connected to the analog input.

A standard for a P-NET channel was given, and again the mandatory requirements were pointed out, and represented: Primary Value (Scaled SI Units), ChConfig, Maintenance, ChType, and ChError.

Associated with the Application Layer within P-NET, is the data format standardized, which includes reals, bytes, strings, boolean, but also more complex entities such as arrays and records. All measurement values from interface modules, which are transmitted via P-NET are already scaled in engineering units.

Finally was the service channel presented. All P-NET interface modules shall contain this service channel. The service channel describes some general information for the entire module, i.e. a DeviceID, the PNETSerialNo, watchdog facilities in a ModuleConfig, Write protection, ChType, and a CommonError register.



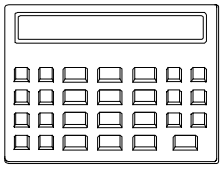
Demonstration of a Control System for a Production Plant Using Process-Pascal, by Prof. Dr. Hermann Klein, Professor, and Prof. Dr. Wilhelm Schönberger, Professor, Fachhochschule Landshut, Germany.

At the Fachhochschule Landshut a demonstration model of a Chemical Production Plant was build-up, including water pump, inductive flowmeter, mixing box, silo for granulated material, heating system, different valves, filling, weighing, and identification system, IR temperature sensor, hydraulic positioning system, industrial robot and a warehouse system. Sensors and actors in the plant model are controlled by P-NET.

The plant consists of batch processes, eg. filling water into a process container, supply of granulate, etc.

A model of the plant control have been developed in software model. The software was made using the language Process-Pascal. One of the aims during the construction phase of the demonstration model was to show the advantages of the high level programming language. According to this aim, the batch process were subdivided into different steps belonging to certain process activities. Extensive use of the structured datatypes supported by Process-Pascal were used.

A considerable amount of good experience was stated in the paper, and some solutions for separation and structuring software are presented. The software design presented in the paper allows an easy software maintenance and seems very useful for development works with the fieldbus P-NET especially if different people are working in a team.



Entire Implementation of P-NET-Simple Slave Functions in the High Level Language C, by Reinald Wunderwald, Chairman, Velox-Automation, Germany.

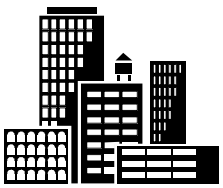
The material presented the results of the implementation of the P-NET Simple Slave onto the MCS51 hardware, with a 80C552 microcontroller. The implementation was made by using the programming language C 5.1.

The paper stated clear why the C language was chosen. One essential part of the C language was the portability of P-NET drivers, from eg. 80C552 to other 80C51 derivate, and the 87C528.

One other important advantage is the possibility of maintenance of the software modules. By using the C language and self-discipline it was possible to write well commented and readable programs.

The paper shows that it is possible to implement the P-NET Fieldbus in simple slaves during very short time, a few weeks.

APPLICATIONS II



Building Automation Control Realized in P-NET Standard, by Ludwig Dierauf, Chairman, LD Dierauf, Germany.

This paper focused on the building automation, where digital and analogue output devices are linked together via a two-wire system to a PC, which works as a central station for monitoring, recording and control. The integration of P-NET into the building automation components has the advantage in having a hand operating level in connection with a high level computer controlled automation system.

The P-NET offers some features of big advantage for building automation systems, such as:

* complete remote control of all functions by the PC with programs for monitoring, printing, and control.
* Complete state monitoring of the installation.
* unimpeded function of the control centre in case of a break down at the central station, because all controlled signals and signals for inhibit and release are still performed in the modules themselves, providing true distributed intelligence.
* complete performance of the system in the manual operation mode.

This paper also focus on the economical aspects of using P-NET modules for building automation instead of already know modules without a fieldbus. An example showed that the price of a P-NET solution was half the price of an old conventional system.

Intelligent Sensors with P-NET, by Wilhelm Bumes, Engineer, Ultrakust Electronic, Germany.

This article illustrated the possibilities of P-NET in relation to intelligent sensors. The intelligent sensor described is the IT2400 from Ultrakust Electronic GmbH.

The capability of the IT2400 is to handle different levels of analogue signals, and the possibility of focusing in on a specific part of the range. For example, if a temperature range of 0 to 200 °C is taken, and only those values between 10 and 40 °C are needed in greater detail, the IT2400 provides the ability to zoom on these values.

The IT2400 implements the use of an 8051 micro-controller, and essential the hardware is electrically separated from power supply, additionally, the P-NET driver hardware, is also separated.

It was realized that P-NET provides several advantages within various fields, eg. development, production, service.

In the development phase, P-NET can be best utilised as a debugging tool. As an example, variables can be taken from their physical addresses and as such, can control the intermediary results. Temperature tests can also be performed without the develop engineer has to leave his normal working environment, as the test are carried out in the fixed temperature room, thus saving both time and money.

In the service phase, the technician must not always travel immediately to the customer, but can perform remote diagnosis.

Handterminal with P-NET Interface,
by Peter Rasmussen, Engineer, Agrosoft, Denmark.

This article gives a detailed description of the build-up of the handterminal from Agrosoft. The layout are described, containing Batteries, Watchdog, CPU, Timer, Memory, Display, Keyboard, communication ports, and the physical box.

The handterminal can have up to 64Kb of program and up to 528 Kb of RAM. The 64 Kb program is in one EPROM, and all 528 Kb RAM has standby power, so they work as non volatile RAM.

The display has 4 lines with 16 characters.

The paper focus mainly on the connection to the P-NET supporting master facilities. Some of the problems were allocated to the CPU Z80.

The paper included a software description, containing standardized procedures, and an example.

The Handterminal gives some advantages for remote key-in of data, eg. while working down a production line, and when finished, download the data (eg. recipe, procedures, etc) in the Handterminal to a controller.

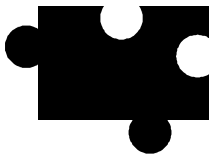
SOFTWARE II

The MMS Implementation on the P-NET Fieldbus, by Dr. Carsten Nøkleby, Data Communication Specialist, Proces-Data Silkeborg ApS, Denmark.

The paper focused on the concept of using Manufacturing Message Specification (MMS) as a line between P-NET applications and applications running on an other network.

MMS is the tool for integration of process applications and management applications via local area networks. The environment for MMS in process control systems, as well as the needed functionality for an MMS gateway is included within this paper.

A short description of the principle in the P-NET fieldbus is given. The general terms in the MMS standard, and the automatic construction of a VMD for the gateway representing the process control system are mentioned. Finally some arguments for using MMS for process control systems is given.



Modular Application Software, by Jan Krigslund, Manager R&D, IPH Automation, Denmark.

This paper describes the modular application software from IPH Automation A/S. The software is modular in relation to hardware components, eg. PD3000, PD4000, PD3221, etc., as well as software functionality, eg. process control, process display, data logging, report, etc.

The system shell includes a database where nodes, names, interface types, channel numbers, register numbers, I/O types, scanclasses and functions ID’s are stored. The system shell also holds the value and status for all the variables defined in the database. Furthermore a library of application programmes with corresponding definition parameter are found in the system shell.

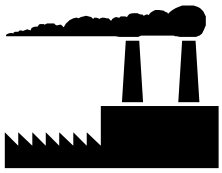
The firmware describes how the different applications are implemented in the system shell.

The entire system is set up by configuration. The configuration can be carried out directly from the controllers keyboard and display or by PC. The software on the PC includes NetPerfect and ConfigPerfect, which are used to create, edit backup and restore a complete or a part of a configuration.

Three software modules were described in details: the PCS 9130 alarm module, the PCS 9310 recipe module and the PCS 9330 process module. All the software modules are to be installed in a PCS controller.

* The PCS 9130 alarm module is a software module for monitoring of digital and /or analog signals - both internal and external.
* The PCS 9310 recipe module is a software module for processes executed according to a recipe.
* The PCS 9330 process module is an operator interface to the other software modules in the system.

All modules are readily configurable and a password protects the configuration against unauthorized modifications.



Visit at Ultrakust Germany

As a part of the 2nd International P-NET Conference a visit to Ultrakust Germany was arranged.
The visit at Ultrakust focused on the Building Control System developed on P-NET for the supervision of the electricity (eg. lights, plugs, Blinds, Skylights), windows and doors, electronically readable magnetic cards, and energy management.

The Building Control System supports several control and regulation functions, such as, Heating, Cooling, Air Conditioning, Water Heaters, and Night-Time Economising. The regulation of the Building depends on Weather Conditions detected by Ultrakusts own Weather Station. The Weather Station includes Precipitation Sensor (Closing the Skylights when it starts to rain), Anemometer (Raising the Blinds in stormy Weather Conditions) and Global Radiation Measurement (Switching the Lights). The building control system has build-in time-controlled actions: time-dependant switching of machines and time-limited admission rights.

The building control system is build up of 274 modules, 6 P-NET Controllers, 1 Graphic Control System, 7 PC's, 1 Weather Station, more than 2500 Data points, and approx. 2000 Meters P-NET cable.

Ultrakust Electronic GmbH in Gotteszell, Germany.

The 274 modules are in the following combination: 173 Ultrakust I/O box (UE5809), 10 Digital I/O box (PD3100), 26 Universal Process Interface (PD-3221), 17 Analogue Transmitter (PD-1611), 32 Intelligent Sensors (UE5807), and 16 P-NET - V24 Converters (UE5904).

The Building Control System consists of one main P-NET ring and 7 sub rings.

By exchange of defective modules, the Building Control System is able to re-establish the functions automatically via PC programs, and to download new programs from PC to the P-NET controllers.

The Building Control System showed the benefits of the P-NET, such as flexibility, robustness, reliability, etc.

P-NET EXHIBITION

The P-NET Conference showed a small exhibition of available P-NET products. This exhibition was very well attended at all breaks during the conference.

Many different applications were demonstrated, including both new hardware and software modules. The International P-NET User Organization demonstrated a number of available software tools (eg. monitoring, debugging, programming language, etc).

The exhibition included P-NET units from 10 different vendors.

The networks were based on RS-232, RS-485 and infrared links.

View from the exhibition room.

Fieldbus exhibition in Birmingham, May 25th - 27th 1993

The International P-NET User Organization has organized a P-NET Multi-vendor stand at the Control & Instrumentation Exhibition, in National Exhibition Center, Birmingham United Kingdom 25th - 27th May 1993.

The Exhibition will be the biggest showcase for process and industrial measurement and control in 1993 in United Kingdom.

The International P-NET User Organization has booked for a stand of 60 sqm., 12m * 5m.

The stand is located in hall 5, **STAND no. F33**.

Four members of the International P-NET User Organization will participate in this exhibition:

Ultrakust electronic GmbH
F.M.A. Limited
FLUID MANGEMENT TECHNOLOGY LTD
Proces-Data Silkeborg ApS

The International P-NET User Organization hope to meet YOU in Birmingham.

Associated with the Exhibition a number of conferences will take place, and especially will the conference *International End-user Fieldbus Forum* be of interest. At the particular conference Chris Jenkins, FMA, UK, will present the International P-NET Fieldbus.

Other fieldbusses will be presented, such as Profibus, FIP, International fieldbus, Echelon, Radio Fieldbus (PACS).

MMS Application Program Interface

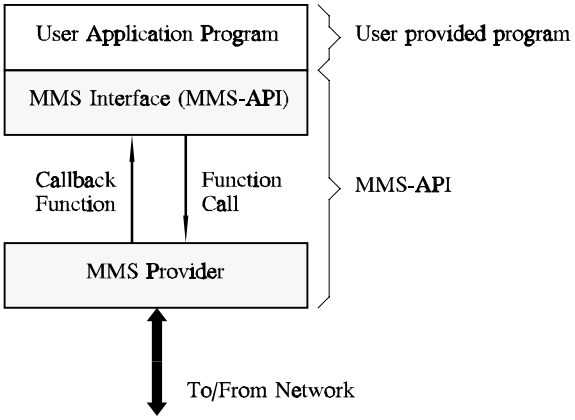
The MMS Application Program Interface (MMS-API) will consist of a library of C functions which provide the user with a high-level interface to the MMS application program. The interface of MMS-API is in a form that follows the MMS services specified in the International Standard of ISO/IEC 9506.

The MMS-API interface provides automatic functions to take care of actions that are specified to the operating system, such as reading and writing of variables, file management, and initiation of an association between two nodes.

Part of the MMS-API is being part of the application program, whereas part of the MMS-API is shared between applications on the same computer platform.

Most everything needed by an MMS application is provided by the MMS-API libraries. The user writes the application program, compiles it, and then links the user object code with the MMS-API libraries (Windows DLLs) to create an executable MMS application.

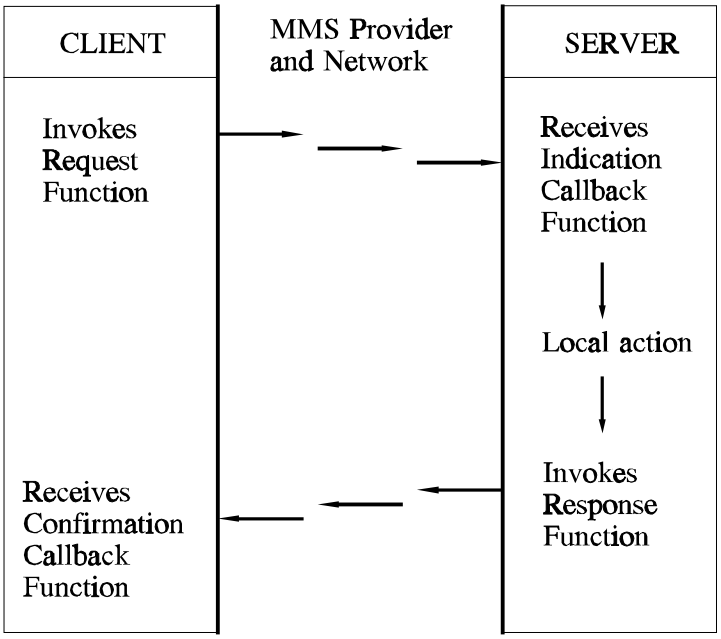
The services of MMS are modelled as being provided by an "MMS Provider" (MMS-API), which can be thought of as a software module that generates MMS messages with the appropriate parameters when called upon to do so by an application program, and parses incoming MMS messages and presents their information to an application program. An application program that a user writes to perform useful work, interacts with the network through the MMS Provider. These interactions with the MMS Provider are called Function Call and Callback Functions.



Use of MMS provider by the MMS-API interface.

Server-Client relationship

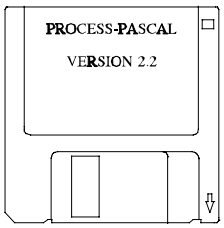
Although the network views two cooperating users communicating via MMS services as being equal, the nature of the MMS services is inherently asymmetric in its behaviour. One user plays the Client role, requesting another device, the Server, to perform some application-specific operation. The other user plays the MMS Server role, performing the requested operation and responding with information resulting from the operation. This is illustrated in the figure to the right, in which the four basic kinds of function classes, the Request, the Response, the Indication callback and Confirmation callback, are shown.



Client-Server relationship.

The response primitive can be either positive or negative, denoted Response(+) and Response(-), depending on whether the requested operation was performed successfully or not. The parameters of the Response(+) primitive differs from those of the Response(-) primitive. The Response(-) primitive always includes an error parameter. The Response(+) primitive will in many cases not contain any data because it simply indicates that the requested operation was performed.

The MMS-API pairs confirmations to the requests that they were responses to. This is done by having MMS-API return a pointer to the data structure used to initiate the request when the confirmation to the request is received. This added level of functionality relieves you from having to deal with determing which requests the received confirmations correspond to.



New version of the Process-Pascal compiler

Version 2.20 of the Process-Pascal system is now released.

The complete set of files includes compiler, operating system for PD3010 keyboard/display unit, operating system for PD3020 EGA colour graphic video controller, charactergenerators, various application examples for getting started, MONITOR program for downloading and displaying variables on a PC, TOPROM program for generating EPROM files, and P-NET drivers for PC.

The complete set of files is available on the Bulletin Board System (BBS, phone +45 86 81 30 10) and a file, READ.ME, will give you a survey and short description of all the enclosed files. An Appendix to the Users Manual for Process-Pascal is also found. This Appendix holds a list of additional features, errors corrected in version 2.20 and changes to the manual.

If you want a complete set of files on diskette and an Appendix to the Users Manual for Process-Pascal, please send your request to Proces-Data, John Johansen, either by phone (+45 86 81 40 33) or fax (+45 86 81 40 88).

Editorial.

This edition of P-NET NEWS is the 4th and it seems now to take shape. We still need articles written by the members of the Int. P-NET User Org., eg. information on existing P-NET systems, P-NET projects coming up or any other interesting information concerning the P-NET fieldbus system.

1992 turned out to be a very good year for P-NET with 2 significant events, the INTERKAMA exhibition, and the 2nd Conference both performed in Germany. Both events resulted in an extensivly increase in inquiries from many different lines of bussines and new many companies applied for membership. Also the press coverage in the technical magazines increased, which certainly is a step in the right direction to disseminate the knowledge of the P-NET Fieldbus.

This year seems also to be a very exciting year, with great activity for our organization as well internally in the standardization work as externally in the PR work: New channels type are under development and will be appended to the list of approved channel types, the MMS-API software (mentioned on page 16 and 17) is quite new and difficult to understand for most people, we participate in the Birmingham exhibition and the associated conference (mentioned on page 15 and 16), we are preparing a work-shop on a combined fieldbus trade-fair and conference in June in Karlsruhe, Germany. Additional information will be given in the next edition of P-NET NEWS.
Don’t hesitate to ask for further details.

P-NET NEWS

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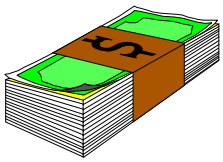
New members

Since the last distribution of the members list, additionally 6 companies have joined the International P-NET User Organization:

Medisense Inc., United Kingdom
Institute for Electronic Systems, Denmark
Danfoss A/S, Hydraulic Division, Denmark
Sauer, Kempe & Weitere, Germany
Micro-Epsilon Messtechnik, Germany
Roka Vertrieb, Germany

We would like to welcome these companies.

The members list is found on the Bulletin Board System. The list is updated each month.



Price List

Below is a list of manuals and video's that are available from the International P-NET User Organization. The table below contain the manual, number of copies recieved, and the current price (1993) in Danish Krone (DKK). The prices are only for members of the International P-NET User Organization.

Information	Number of copies	Price (DKK).
Video, German speak.	1	320,-
Video, English speak.	1	320,-
P-NET Catalogue	1	100,-
P-NET Standard	1	100,-
P-NET Brochure	15	100,-