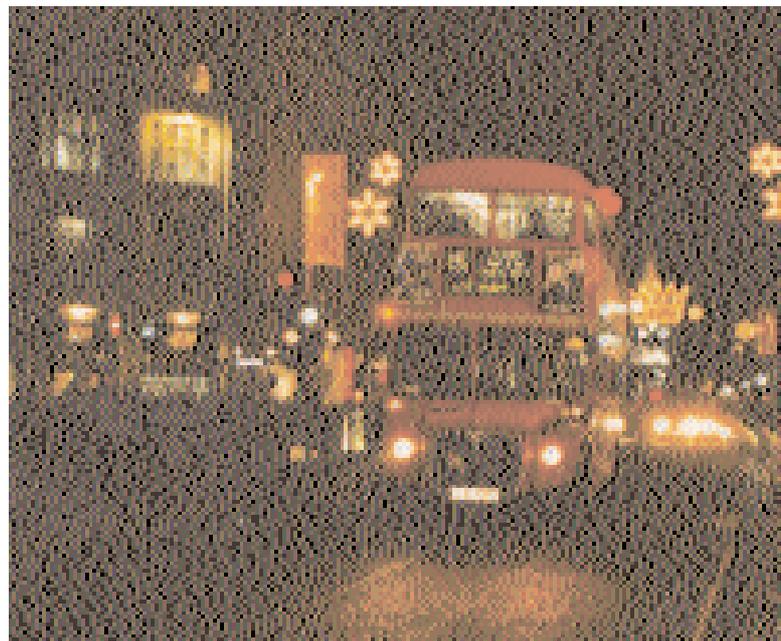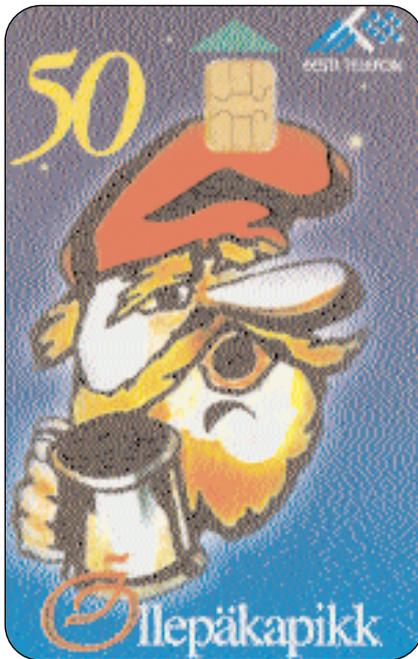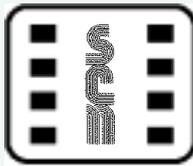# Major UK Schemes in Danger of Collapsing

Two of the biggest Smart Card-based projects in the UK are in danger of collapsing much to the embarrassment of the government which has found support from many of the major players in the industry slipping away as consortium after consortium pulled out.

The much-heralded motorway road toll trials may fizzle out with only two of the eight consortia invited to take part remaining as participants, the others having withdrawn for what the Department of Transport describes as "various reasons."

Even more embarrassing is the fact that London Transport has only received one tender for a ticketing and revenue collection service covering London Underground, the capital's fleets of buses and interfacing with British Rail.

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London Transport faces a serious dilemma. It was looking to the private sector to design, build, install and operate the revenue collection service and was expecting tenders from four consortia. Three dropped out and only one bid from the Transys consortium is on the table. Transys comprises EDS (Electronic Data Systems), computer giant ICL, Cubic Corporation and W S Atkins Consultants.

The scheme involves the Underground's 12 lines serving 273 stations, and some 6,000 buses operated by over 40 independent companies plus a requirement to interface with British Rail. London Transport successfully piloted Smart Card ticketing on buses in the Borough of Harrow but did not specify Smart Cards as mandatory in the tender.

With only one bid for such a large project, LT has nothing to compare it with and will not necessarily award the contract to Transys.

A spokesman for London Transport said an announcement would be made before the end of this month.

Motorway Toll Trials

Private trials of road toll systems will start early in the New Year at the UK Government 's Transport Research Laboratory at Crowthorne, Berkshire, if the two consortia headed by Bosch and GEC-Marconi remain in the field.

The trials, which will be conducted over 50 working days, are scheduled for completion by Easter.

A spokeswoman for the Department of Transport said: "We will be testing the technical performance of the systems to see if it is worthwhile to go further with trials on the motorway."

Both systems are microwave systems. The Bosch consortium comprises ANT Bosch (Germany), Brown and Root Civil (UK), Centre-File (UK), EDS (US/UK), Post Office (UK), Mondex (UK) and Syntegra (UK).

The other consortium brings together GEC-Marconi (UK), Lockheed IMS (US/UK) and Syntegra (UK).

It is believed that interest in the project has waned over the last few months because of government insistence on a fully automatic multi-lane motorway tolling system which is foolproof - a situation which could be years away.

The government's enthusiasm to charge motorway users would seem to be better served by ignoring the small percentage of drivers who might escape being charged and collect revenues from say 98 or 99 per cent of users - instead of nothing until the industry can produce the "perfect" system.

Contact: London Transport Press Office - Tel: +44 (0)171 918 3410. Department of Transport Press Office: +44 (0)171 271 5440.

Schlumberger Plans to Buy Solaic

In a major strategic move, Schlumberger Electronic Transactions is planning to buy Solaic, the magnetic stripe and Smart Card manufacturing subsidiary of Groupe Sligos.

Schlumberger and Sligos last month announced the signing of a letter of intent for the purchase of Solaic which had a 1995 revenue of £45 million with manufacturing facilities in France and Spain and marketing operations primarily in Germany, Spain, France and the UK.

In addition Schlumberger and Sligos are to jointly develop Smart Card-based systems.

Meanwhile, Sligos says it plans to join forces with Axime to create a new group and France's largest Information Technology services company. Currently, Sligos is France's second largest IT services company with Axime, the third largest. Shareholders will be asked to approve the merger of the two companies in the first half of 1997.

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MasterCard Takes Over Mondex

MasterCard International is taking a 51 per cent controlling stake in Mondex International - owned by 17 leading financial institutions in four continents - and will use its advanced technology in the battle to oust Visa as the world's largest card payments organisation.

Mondex was developed as an electronic cash system in which the card is pre-loaded with money, but MasterCard intends to use the technology for all of its credit and debit cards while retaining the purse function.

Estimates of how much MasterCard is paying for its share holding range from £50 million to £150 million, but the sum will not be revealed until the deal is finally signed off later this month.

H Eugene Lockhard, President and CEO of MasterCard, described Mondex as "the industry's leading chip platform, supported by more participating banks than any other global system." He added that Mondex presents the best business case for a true global Smart Card systems standard, capable of excellent security, functionality and consumer choice.

"The first application of the Mondex operating system has been the stored value card, but in the future the technology will support other applications including integrated debit/credit/ stored value cards and issuer-proprietary cards for such things as loyalty programs and data transfer," he said.

G Henry Mundt III, Executive Vice President of MasterCard's Global Deposit Access, who will oversee MasterCard's relationship with Mondex International, said the deal provided them with the best possible opportunity to "leapfrog other technology."

Marriage of expertise

So what can we expect now? It seems like a good marriage of expertise. Mondex is widely regarded as leading edge technology but, despite worldwide publicity, suffered from not being part of the card issuing establishment and some observers felt it

could lose its technical advantage through a slow roll-out of the necessary infrastructure to enable the mass distribution of cards. With the strength of MasterCard it will help to speed the introduction of the Mondex system around the world.

Mondex USA formed

The first important development since the announcement is the formation of Mondex USA Services Ltd with AT&T, Chase Manhattan, Dean Witter Discover (NOVUS), First Chicago NDB, MasterCard, Michigan National Bank and Wells Fargo Bank.

The new company, which is separate from Mondex International, has been set up to commercially develop and implement the Mondex system in the United States and says it will be actively recruiting other financial organisations as licensees who will be able to offer Mondex cards to customers and merchants.

It is also planned to accelerate Mondex's on-line roll-out. Dudley M Nigg, Executive Vice President of Wells Fargo, said they planned to introduce tests next year in which cardholders can purchase small dollar items on the World Wide Web.

AT&T's credit card unit, AT&T Universal Card Services, said that they planned to expand their current in-house trial next year to use Mondex for Intranet and Internet applications.

AT&T and Wells Fargo Bank are also members of Mondex International.

Technical changes

Some technical changes in the Mondex system will be necessary. A significant difference between the Mondex cash card and other electronic purses is that there is no centrally held record of transactions, but it appears that MasterCard has accepted that Mondex security is strong enough to allow the cash function to continue as it is with only a personal record of transactions held on the card, but not centrally.

MasterCard has already stated that it intends to integrate debit/credit with the Mondex card and

these functions will have an audit trail with information held centrally as traditionally happens on all MasterCard credit and debit cards.

This, of course, will require a new chip. Hitachi Europe has worked closely with Mondex in the development of the system and it is their chip which is currently used. A spokesman for Mondex said that there was room on the current chip for additional functionality and no doubt other chips would be developed for additional requirements.

MasterCard has already said that Mondex must be compatible with the EMV (Europay/MasterCard/Visa) specifications, but Mondex do not see this as a problem. They point out that they took part in a demonstration of interoperability earlier this year with MasterCard and American Express which showed that different cards could be read in the same terminal (*SCN June 1996*) and all the major card issuers are committed to the "one footprint" philosophy of a single transaction device at the point of sale.

Visa Reaction

Visa said it welcomed competition because it was good for the industry, although Visa still had some problems with the Mondex concept.

Dennis M Goggin, President of Visa International Asia-Pacific, said: "Visa Cash is available now, working now and evolving to meet the future needs of the marketplace. The Mondex-MasterCard product, whatever it turns out to be, has to run fast to catch up with Visa and meet the technology needs, regulatory needs and, most of all, consumer and merchant needs."

Visa Cash was one element of a product which would incorporate credit, debit and stored value onto one chip card, he said, adding that the current chip used in the Mondex system could not do this.

He said Mondex did not comply with the EMV protocol - which ensured all SVC products were mutually compatible - and would need to undergo major modifications in order to become so.

On accountability, Goggin said: "All Visa Cash transactions are recorded in a central archive, ensuring security and auditability to prevent fraud.

This also enables Visa Cash cardholders whose cards have been damaged to claim back the value on the card from the issuing bank. Without this accountability, the Mondex system, in its present form, cannot offer these important services."

American Express has bought a non-exclusive global license for the PROTON electronic purse technology from Banksys, Belgium and will implement multiple pilots next year.

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Smart Card System for Russia

Visa are set to pilot a new type of Smart Card system in Russia. The New Off-line Pre-Authorised Card system (COPAC) uses microchip technology to permit off-line authorisation of transactions up to a pre-defined monetary limit.

The technology was designed specifically to meet the challenges of market development in emerging economies. Financial institutions in such countries are faced with a number of problems if they want to implement existing payment card programmes. For example limited or expensive telecommunications networks prevent widespread on-line processing. The new COPAC system could deal with such problems. Spending limits and personal details could be easily checked by a card reader terminal at the point of sale.

The first pilot will begin in Russia in the second quarter of 1997 and will be a partnership between Visa International and the Russian Bank Inkombank. The pilot will be located in three cities; Togliatti, Ulyanovsk and Nizhny Novgorod.

According to Lucy Bates the system has already generated inquiries from Latin America and Asia Pacific regions where pilots could begin in 1997-1998.

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Swedish Electronic Purse Pilot

Two Swedish banks - Sparbanken and Nordbanken - last month launched a pilot electronic purse called "Cash" using Belgian Proton technology.

The pilots are in Uppsala, the oldest university town in Scandinavia and Sweden's fourth largest town with 27,000 students and 130,000 inhabitants; and in the seaport and tourist town of Halmstad which has a population of 50,000.

Some 50,000 chip cards based on the Proton technology will be issued during the pilot schemes which involve 1,575 payment and 210 load terminals all delivered by Banksys.

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Visa Cash Launched in Brazil

Fourteen Brazilian banks last month jointly launched a Visa Cash Stored Value Card in the city of Campinas, 50 miles from Sao Paulo. The banks plan to issued 50,000 cards which will be accepted by 800 merchants.

Retail outlets involved in the project include school cafeterias, fast food restaurants, convenience stores, newspaper stands, cinemas, pharmacies, vending machines and public transportation.

Visa says cardholders do not need a PIN number to authorise payments. Participating banks include BANESPA, Banco BMD, Banco de Boston, Bradesco, Banco do Brasil, Banco Real, Banco Sudameris, Caixa Economica Federal e Unibanco.

Contact: Colin Baptie, Visa, UK - Tel: +44 (0)171 937 8111. Fax: +44 (0)171 937 0877.

Company Card for Vending

Software company, ARKSYS, formerly Arkansas Systems, started issuing Smart Cards to its employees last month for use in vending machines at the company's headquarters.

Each employee received a card with US $5 value to purchase drinks and food items on-site. Value can be loaded by inserting currency into one of the vending machines supplied by Interstate Vending which has a device that transfers value to the card.

Based in Little Rock, Arkansas, ARKSYS provides payment and financial transaction delivery systems, including card systems.

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Visa Cash for Ski Championships

Visitors and participants at the World Ski Championships in Norway in February will be able to make low value purchases using Visa Cash cards in a partnership between Visa International, Visa Norway and the Sparbank l Midt-Norge Savings Bank.

Up to 30,000 reloadable cards will be issued for the championships in Trondheim from 26 February to 2 March 1997. The cards will be available from branches of the bank where customers will also be able to reload them with value. It can be used to pay for fast food, newspapers and parking and will be accepted by merchants in the event area.

Harold Storseth, Product Manager at Visa Norway, said: "Experience of using Visa Cash at events such as the Atlanta Olympic Games has shown that these cards reduce queues at cash desks. At large sporting events this is particularly advantageous, both for the organisers and for the public."

Sega World project

Sega World, Australia's first indoor theme park is to issue Visa Cash cards in a partnership with Visa's Asia pacific region and Westpac Banking Corporation. The theme park will open in March in Sydney which will also host the 2000 Summer Olympics. This is Visa's first step towards making Visa Cash available to visitors to the games.

Contact: Colin Baptie, Visa, UK - Tel: +44 (0)171 937 8111. Fax: +44 (0)171 937 0877.

ERG Award for French Project

AES Prodata, a subsidiary of ERG of Perth, Western Australia, is leading a consortium to develop a dual contact/contactless Smart Card for bus, train, parking and road toll payments in the French city of Valenciennes, near the Belgian border.

The first hybrid Smart Card project of its type in Europe has won ERG, the inaugural *Europe Business Review* Award for the "Best Australian high-tech achievement in Europe." This and three other awards sponsored by the European Union, through the Delegation of the European Commission to Australia, were presented last month.

The R&D contract in France involves a multi-modal transport system and a multi-service use of the card, covering a population of 340,000 people.

ERG says the project is on track and expected to be ready for commercial operation in June 1997 and could become a model for Europe.

3.5 billion Smart Cards in 2001

There will be 3.5 billion Smart Cards worldwide by the year 2001 with financial services applications the second most important vertical market after phonecards, forecasts Datamonitor in it's new report *Opportunities in Global Smart Card Markets*.

Although the number of phone cards will continue to grow, massive increases in the use of Smart Cards for other applications will cause their percentage of market share to fall, says the report.

It believes that banks and the international card issuers will drive usage of Smart Cards but the conversion of consumers for applications such as an electronic purse, is expected to take a number of years and will be a steady rather than exponential uptake.

The only exception to this scenario is likely to be if there is an industry-wide co-ordinated effort to switch from magnetic stripe solutions, similar to

the French government's drive for the adoption of Smart bank cards. The EMV specifications could be the catalyst for such a scenario internationally.

Other potentially large uses of Smart Cards are as health or ID cards and these are estimated to increase steadily, but decisions to roll out a national card in large countries could change the structure of the market extremely quickly.

Datamonitor expects overall growth of the market to be increasingly driven by the more complex cards. Basic memory cards will continue to be a substantial segment of the market, but higher value-added cards will take an increasing share.

Contactless cards for transport applications are expected to become more prevalent as the technology becomes less expensive and the benefits of the cards are made clear in trial results.

Opportunities in Global Smart Card Markets, *priced £1,995, from Datamonitor, UK -* **Tel: +44 (0)171 625 8548. Fax: +44 (0)171 625 5080.**

Global market segmented by application *(Datamonitor Forecasts):*

units (m)	1995	2001
Phone cards	500	1,500
Banks (purse, credit/debit)	30	450
Healthcare	90	400
ID Cards	5.7	330
Other	7.7	220
Pay TV	16.6	150
Transport	2.5	150
City Cards	5.3	120
Vending	5.8	100
SIM Cards	24	60
Access Control	0.7	10
Retailers		10
Total	688	3,500

Visa Launches Multi-function Card

Visa International last month launched its first multi-function Smart Card in partnership with two South African banks, First National Bank (FNB) and Nedcor Bank. The new cards combine debit, credit and pre-paid facilities.

The two banks currently have more than 200,000 chip cards in use under their own brands since the South African banking industry agreed interbank standards in 1995. In the first phase of the partnership with Visa, both banks will brand their existing chip cards with Visa and offer extended functionalities including stored value, debit/credit.

FNB and Nedcor are committed to extending their current national card base to one million cards by the end of 1997, and to upgrading their existing ATM and point of sale infrastructure.

The multi-functional chip card system developed by Nedcor and FNB will be converted to the EMV (Europay/MasterCard/Visa) specifications under the Visa banner by the end of 1997.

Two other South African banks have also announced that they will participate in the project. Boland Bank said it would be upgrading their ATM and POS infrastructure as well as issuing chip cards under the Visa banner, while NBS Bank has also committed to the card as part of its on-going strategy.

Currently, the four banks hold about 60 per cent of the card reader market at point of sale and operate over 60,000 point of sale devices and 2,700 ATMs capable of reading the new cards.

The new card is Visa's "vision for the future of card payment products," and will allow customers access to multiple accounts at their financial institution and eventually to other functions such as loyalty programmes and the storage of personal information. Visa says it provides the platform for global interoperability enabling customers to take their bank with them wherever they go, and access their accounts anytime, via any device.

Visa Cash issuing banks in Hong Kong - Bank of China Group and Standard Chartered Bank - report a quarter of a million transactions with a total value of HK $7 million in just over three months since the launch.

Ivan Yim, Visa International Country Manager, Hong Kong and Macua, said this confirmed the large market potential for the reloadable card, to be launched in 1997.

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Patient Identification Card

In what is believed to be the biggest procurement of a photo ID system by a US Government Department, the US Department of Veterans Affairs has selected DataCard Corporation to provide the card personalisation systems and magnetic stripe card readers for its Veteran's Identification Card (VIC) programme.

The VA will issue multi-purpose patient ID cards to more than 2.3 million veterans. The cards will feature cardholder photos, encoded magnetic stripes, bar codes, printed information and embossed data and will be used to automate and speed the application/registration process at all VA health card facilities.

Long-term plans call for the cards to be used for a variety of automated systems to improve service, reduce costs and fight fraud and abuse. The VA plans to look at the feasibility of using the VIC card for other applications including credit and debit in canteens and pharmacies and automated scheduling in service areas, such as radiology centres and laboratories. DataCard will supply its QuikWorks image capture stations, 280 Series card personalisation system and 110 card readers.

Bob Zangueneh, DataCard Program Manager, said: "The modular design lets VA start with the card issuance capabilities they need today. Then, they can simply add new capabilities such as Smart Card personalisation modules as the programme expands."

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Japanese Buy Into Gemplus

Kokusai Denshi Denwa Co. Ltd. (KDD), the Japanese telecomms operator, has taken a share holding in French Smart Card manufacturer Gemplus with a multi-million dollar investment.

Marc Lassus, Gemplus Chief Executive Officer, said: "This move reflects our total commitment to succeed in this market, as well as in Asia as a whole, which currently is the fastest growing area for the Smart Card industry."

KDD will gradually integrate Smart Cards into the telecommunications and multi-media area. The leading telecom operator in Japan for international communications, it has more than 70 per cent of the Japanese market, employs 5,500 people and its revenues for 1996 amounted to 248.3 billion Yen (US $2.5 billion).

One of its shareholders is Nippon Telegraph and Telephone Corporation (NTT) with a 25 per cent share holding and currently subcontracts the manufacturing of its S-type Smart Cards.

Contacts: Masahiro Furuya, KDD, Japan - Tel: +81 3 3347 5707. Flavie Gil, Gemplus, France - Tel: +33 (0)4 42 36 56 83.

Electronic ID Trial in Singapore

An electronic identity card for use on the Internet is to be tested in Singapore starting in March next year. According to Environment Minister Teo Chee Hean, Chairman of the National Information Technology Committee, the new cards may replace current plastic identity cards within a generation.

Fifty thousand people will take part in the trial of the card which is intended to be used for transactions over the Internet with government agencies, for example when applying for passports.

Announcing the trial at the National IT Forum in Singapore last month, the Minister said the electronic ID will either be a Smart Card or a floppy disk. Each will have a unique ID number which will be encrypted for protection against hackers and will be used to verify the user's

identity and authorise transactions on the Internet.

The Smart Cards are being supplied by Gemplus Technologies Asia and will use advanced 1,024-bit encryption to protect the ID number against tampering.

Future ICs may have microchips with the encoded identification number and a special card reader will be required to use them at home or in the office. People with electronic IDs stored on floppy disks can use the normal disk drive on personal computers and will not need the card reader.

Contact: Chou Fang Soong, Gemplus Technologies Asia - Tel: +65 776 1989. Fax: +65 773 0648.

VeriFone Portable Terminal

VeriFone's new portable Smart Card terminal is designed to enable consumers to use electronic cash at venues where they would traditionally use cash, such as in taxis, buses, fast food outlets, dry cleaners, news stands and market stalls.

Called the OMNI 1250, it provides cash-only merchants with a way of participating in the electronic cash payment marketplace, enabling them to increase sales through faster-than-cash transactions and customer loyalty programmes.

The terminal is battery-powered and designed to accept multiple electronic payment and loyalty Smart Card applications. It also enables money to be transferred from the consumer's card to the merchant's card making end of the day deposits easy and convenient.

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Estonia Christmas Phone Card

Estonia Telephone Company has ordered 50,000 Smart payphone cards with Christmas designs from GPT Card Technology, Schlumberger and dz danmark. The card shown on the front page is from GPT and has a Siemens SLE 4436E Eurochip.

Chelmsford Star Update
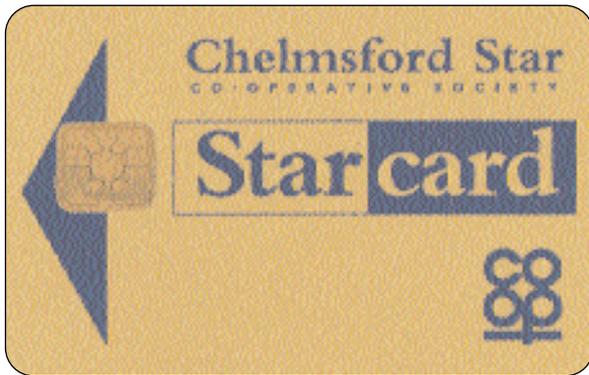
The Chelmsford StarCard was first launched to customers in April 1995, having previously been trialed on staff (*SCN Jan 1994*). The society originally set itself a target of 5,000 cards to be issued during the first year. This was passed within 5 months and today in excess of 17,000 cards are in circulation.

The Chelmsford Star Co-operative Society is a long established retailer which operates in Chelmsford and the surrounding towns and villages. Its outlets include food centres, department stores, travel centres, motor trades and funeral services.The Co-operative Movement is perhaps automatically linked with the members dividend or "divi." This means trading surplus is distributed according to members' purchases, rather than in relation to Capital holding.

The Co-op "divi" is probably the first example of a customer loyalty scheme. The "divi" in its original format had almost disappeared from most Co-operative societies. The introduction of the Chelmsford StarCard heralded its return, fuelled by the use of Smart Card technology.

According to Chris Turner, StarCard Marketing and Development Controller, the StarCard has had a very positive impact on the Society's business. StarCard holders spend, on average, twice as much as non-card holders per visit to the food outlets. By increasing their StarCard capital holding a member can increase the rate of dividend they receive.

Since the scheme began further functions have been added. Most notably the launch of the StarCard Option Account on 7 May 1996. This provides, subject to status, access to fixed term credit and a monthly charge account which operates

in a similar way to Visa, but is incorporated as a facility on the StarCard.

Five different payment methods

By the end of this year the Society plans to have incorporated a direct debit facility, exclusively for 500 Club members initially. This will provide members with the ability to pay by five different methods; Dividend, Electronic Purse, Fixed Term Credit, Monthly Charge and Direct Debit using one card.

The Chelmsford Co-operative society is also investigating the possibilities offered by interactive multi-media facilities to provide enhanced customer service, membership information, and to broaden product offerings beyond the physical restraints of the stores. Chris Turner added that the society sees "this as a natural progression towards home shopping" in the future.

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A Card of Gold

Hungarian telecommunications company MATAV claim "sometimes that which glistens *is* gold." In an attempt to reinvigorate the telephone card collectors market MATAV is implementing an idea which combines the purchase of telephone cards with a lottery. The main prize is a telephone card made of pure gold worth approximately £19,000 pounds sterling.

MATAV is producing one million Smart telephone Cards. One side of the card features a game description, a lottery number and a serial number. The other side of the card features one of ten gold motifs. Each card is sold in a printed paper sleeve so the customer does not know which motif they are buying. The aim for collectors will be to obtain the entire series before time runs out. The project began on 15 July 1996 and finishes at the end of the year.

The winning lottery numbers are announced in newspapers, department stores and on both radio and television. A number of different prizes are on offer. For example certain newspapers are giving away subscriptions, discounts are available at participating stores and a cash prize of approximately £40 may be won each week. Every week's winning numbers are also entered in the final draw for the gold telephone card.

According to the German company ODS R. Oldenbourg Datensysteme GmbH, who fabricate the cards, even those who buy "dud" cards cannot lose. They remind the Hungarian public that each card is a limited edition and will therefore have high value with collectors. Used cards can be sold back to Centrum, a department store, for at least £4.50 if a purchase of over £75 is made. Depending on the collectors value and the face value of the motif the re-sale value can increase up to as much as £75.

The project clearly works on a number of levels. It aims to bring interest and business back to the card collectors market, and also works as a customer loyalty and promotional instrument for all the companies involved.

According to ODS, by the end of 1996 MATAV will have sold almost double the number of phone cards they sold in 1995.

Finally it does seem to be a promotional scheme where the customer cannot lose. Although one question remains, what would you do with a phone card worth £19,000 ?

Contact: Eva Keil, *Marketing and Communication, ODS.* ***Tel: +49 8165 930 163. Fax: +49 8165 930 202.***

Disney Update

Smart Cards were introduced to Euro Disney's video game machines in 1993 - one year after the park opened. Since that date some 600,000 cards have been issued.

The cards are fabricated by TRT Philips and the chip is supplied by Siemens. The card reader terminals are provided by CashCard Systems.

The project was initially introduced in an attempt to eliminate the problems of vandalism and theft from the machines. Following the introduction of the CashCard system both problems have, according to Charles Bond, been completely eradicated.

The project started in two hotels and has since expanded to five hotels and the Disney theme park. Between 150,000 and 200,000 cards are expected to be issued annually.

The continuing success of Smart Cards at Euro Disney reflects the theme parks recent wider success. In November Philippe Bourguignon, chairman and chief executive of Euro Disney, announced profits of £25.5 million and a record 11.7 million visitors.

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A French Smart Card Pioneer

An interview with
Michel Ugon
Vice President of Bull CP8

by Anna Ronay

Michel Ugon has been involved with Smart Cards for a long time. In effect he has been involved with Smart Cards since before they existed. This may sound impossible, but that is a reaction Michel Ugon is familiar with.

Twenty years ago Michel announced his wish "to put a computer in plastic in a wallet". At this time computers were mainframe and huge. Not surprisingly the common reaction was a resounding "he's crazy" and the idea was regarded as impossible by colleagues and competitors alike.

Prior to this declaration Michel Ugon worked for CII-Honeywell-BULL, a computer company. This background has proved highly influential throughout Bull CP8 Transac's history and is clearly an influence still felt today. Michel Ugon insists the company is primarily "a computer company" and explains that these origins led to Bull CP8's interest in security and secure payment systems, such as the electronic purse.

In 1976 Michel put together his first development team and almost immediately proposed a microcomputer card. Ugon described their next task as proving the feasibility of his idea and developing the prototype which took a further five years.

When Michel's team began their research into what later became the Smart Card, others too were exploring the possibilities. Indeed an unresolved dispute as to the original inventor of the Smart Card still exists today. Various patents and claims were made by Pomeroy (1967), Ellingboe (1970), Arimura (1970), Halpern (1972), Moreno (1974), Dethloff (1977) and Guillou (1979).

Interestingly Michel Ugon considers the first ever description of the Smart Card to have been written by Sci-fi author Rene Barjavel in his 1968 novel *The Dawn of Time*. Barjavel describes an ancient, yet highly advanced civilization named Gondas. The people of this imaginary time used "a magic ring endowed with the power of memorization and telecommunication." To pay for goods or services the Gonda would simply bend their middle finger, enter their key in a location chosen by this movement and the central computer would immediately reduce their account by the correct value.

Despite the opposing patents and descriptions, Roland Moreno is, arguably, the most widely recognised creator of the Smart Card. However Michel Ugon stated his position clearly with the words, "I realised the first Smart Card on the 21st March 1979" through strong co-operation with Motorola.

Regardless of the dispute Michel Ugon was clearly involved with Smart Card technology from it's earliest days. Asked if there had been any surprises in the technology's development he replied with a definite "no." Michel explained that the industry worked according to a 10 year cycle between laboratory and real world, allowing innovators to see the future possibilities long before they are realised. This cycle is directed largely by cost, not technology because semi-conductor manufacture demands advanced and expensive factories.

The 10 year cycle consists of a number of lengthy stages; firstly the development of the prototype, next the realisation of the product before factory work can begin. Michel added that this cycle had probably extended with the years as accuracy and detail had increased. For example in the past a chip had a feature size of 3.5 microns, today it is only 0.3 microns.

When asked whether Smart Card technology would meet needs in the year 2000, Ugon began his answer with the statement, "cost is the key point". He explained that cards and systems must be feasible economically. Currently some systems are designed with no idea of cost, the approach is technology first and cost second. Cost, as the 10 year cycle proves, is as fundamental as the technology itself.

He identified this unawareness of expense as one of the most important reasons in explaining why Smart Card technology is slow to become established. He suggested that the same story is repeated in the majority of countries worldwide, even when political systems are different. He proposed the exception to the rule as China, a country where decisions are able to be taken very quickly.

When asked about the acceptance of Smart Card technology around the world Michel Ugon gave *SCN* the following predictions. He sees Africa as a country which will not develop Smart Card technology very rapidly. Despite the electronic purse system in Nigeria (*SCN Feb '96*) he predicted that Africa would not truly be in the Smart Card arena before the next century. Michel describes a political interest in Egypt in Smart Card technology and a perhaps surprising lack of interest in Japan. He explained this by reiterating that Smart Cards are a secure device for securing a system. The Japanese however have little or no security problems and are therefore not security minded or interested in Smart Cards. If and when they did accept the technology Ugon predicted that it would develop very rapidly.

Michel identified electronic purse systems as the most important Smart Card development today and said this would be a major growth area in the near future. Michel acknowledged the success and size of telephone Smart Cards but suggested that this market had already been saturated. He added that CP8 find their biggest demand is for electronic purse systems.

Following Michel's identification of electronic purses as a major growth area *SCN* asked if this meant we were heading for a "cashless society." He replied in careful and measured tone that he suspected technology, or the acceptance of technology would move more slowly than expected. He suggested that the security issue is under-estimated (*SCN Oct '96*) as, unfortunately, money will always bring threat. Michel proposed electronic purses as a possible way to launder money, although he also admitted he was maybe "a little bit prudent." He countered this by saying that he was not ruling out a "cashless" or "less-cash" based future but was simply saying it would happen more slowly than anticipated. He stressed

the need to experiment, educate and involve the banks in the future of Smart Card technology.

SCN questioned Michel Ugon further about his views on the security of Smart Card technology, asking the basic, but fundamental question, "How secure is a Smart Card?" Michel replied "that is a vast question" followed by the brief, but definite answer, "very secure." He described Smart Card technology as more secure than any other device used for payment at any other time.

SCN asked Michel if he thought Smart Cards would ever be completely accepted by the public. He replied succinctly "I think yes," describing the public as "very confident." Michel mentioned the French healthcard introduced in Lille seven years ago. The card was designed for the elderly, a sector recognised as a difficult target group for new technology. According to Michel the results were very good; much better than expected.

Recent articles in the British press however, suggest that the French may be far less conservative than the English. The *Financial Times* reported that English travellers are suspicious of AirJet's ticketless travel (*SCN Oct '96*), whilst *The Brighton Evening Argus* printed a letter from a woman who expressed her dread that senior citizens would be issued with Smart Cards as a replacement for the traditional pension book. Perhaps such examples indicate that some nationalities will be easier to convince than others.

Finally *SCN* asked Michel Ugon who would be the major card companies of the future. He answered that it was difficult to say as it depended which area one considered. For example in the telephony market he suggested Schlumberger and Gemplus would continue their leading roles. He also mentioned ORGA, Delphic, Soliac and De La Rue as important companies in a variety of markets.

When considering the banking sector the answer, according to Michel Ugon, is clear. He said, "this is our domain" adding that Bull CP8 Transac wants and intends to remain. Looking beyond the millennium, however, the answers are not quite so straightforward. He predicted that the next century would be very different in terms of companies involved in Smart Card technology. Michel stated, "after the year 2000 the landscape will change."

CashCard Aims High in Singapore

Singapore's cash-in-a-card payment scheme, called CashCard, was officially relaunched last month by Finance Minister Richard Hu. CashCard began with a six-month pilot in 1994 and was launched nationwide in 1995. It has now been relaunched with extra security.

The scheme was developed at an estimated cost of HK $40 million by NETS, the network for Electronic Transfers Systems, and its seven local share holding banks - DBS, Keppel, OCBC, Overseas Union, Tat Lee Bank, United Overseas Bank and POS Bank.

More than 60,000 CashCards are now in the market and a further 100,000 are expected to be issued by the end of this year.

CashCard is aiming high and hopes to capture 30-40 per cent of the estimated HK $30 billion-a-year cash-paying market in 10 years.

Consumers can buy the cards with an initial value of HK $20 at bank branches, Singapore Post outlets and CashCard Auto Machines and there is a HK $2 refundable deposit. The card can be reloaded with value up to HK $200. and no PIN is required at the point of transaction. Users can also obtain printed statements of the last 10 transactions.

Five hundred CashCard terminals will be in use in 300 merchant outlets initially. The next phase will see more retailers offering CashCard services, Singapore Telecom will be phasing in public telephones which will accept the card and discussions are being held with transport operators to enable the cards to be used to pay for road tolls and tickets on the mass transit (trains and buses) system.

CashCard is available to everyone, including children and tourists. In addition, the seven participating banks will issue a Smart ATM card to their account holders. A third card is the Organisation CashCard where bodies such as Universities, the Singapore Armed Forces and government departments can add functions.

The Smart Cards are supplied by Gemplus Technologies Asia with an SGS-Thomson chip.

Currently, card reader terminals are supplied by Hypercom and Ingenico.

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Pre-paid SIM in Hong Kong

Pre-paid SIM (Subscriber Identity Module) Smart Cards from Schlumberger are being used by Hongkong Telecom CSL to launch Asia's first mobile phone rental scheme.

Customers renting GSM handphones can purchase a SIM card loaded with a number of call units and programmed for the services required. Initially cards will be available in two values - HK$500 and HK$1000, with further card values planned.

The handphone displays the unused value remaining. When the phone is returned, the unused value on the card can therefore be refunded easily, eliminating billing delays and potential for fraud.

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Gemplus/Mondex Agreement

Gemplus and Mondex International have announced an agreement which enables Gemplus to supply Smart Cards for the global implementation of Mondex following the approval of Gemplus for card manufacturing and its GCR400 card reader. Certification of other Gemplus readers in on-going.

The announcement last month also said the two organisations are planning to develop their partnership in the field of Smart Card personalisation services, and forecast the first implementation as a live test early next year.

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MasterCard/Eurocard Logo

A MasterCard-Eurocard acceptance logo has been announced after the signing of a ten-year agreement between the two card issuers. They will appear first in all European countries starting during 1997 and, over a two-year period, will cover more than three million retail locations and 142,300 ATMs.

Seven million Access cardholders have already started to see their Access cards being replaced by new cards bearing only the MasterCard logo following an agreement with the UK banks that owned the Access brand. The Access signs in retail outlets are to be phased out and be replaced with the new MasterCard-Eurocard logo.

What will interest *SCN* readers is what branding will appear on electronic purse cards as MasterCard is now committed to the Mondex brand and Europay has its own Clip card.

A Europay spokesman said: "Separate discussions are underway concerning the debit and electronic purse sides of the product range and are expected to be announced next year."

"Cracking" Smart Card Secrets

Two computer scientists claim that they can crack the secret codes protecting Smart Cards using easily built equipment costing around £200.

Dr Ross Anderson of Cambridge University and Markus Kuhn of Purdue University, Indiana, made the claim last month and said they had kept their work secret for six months to allow institutions like the Bank of England to review security.

According to Dr Anderson: "Breaking the average Smart Card can be done by anyone with a modicum of technical knowledge. The expense is negligible, but it is time-consuming."

One attack relies on feeding "noisy power" to the card causing the power supply or clock to disrupt encryption so it is possible to see what is happening and extract the key. Another method apparently relies on opening the chip and using microscopic probes to interrogate the chip.

John Beric, Head of Security at Mondex, was unconcerned. "I welcome Dr Anderson's work, because it is a benchmark that establishes the difficulty of breaking the system," he said, adding that security was a moving target. "We are ahead of the criminal now, and we believe the technology is there to ensure that we stay ahead."

And at the Bank of England, a spokesman said they had had contact with Dr Anderson from time to time but his report had not been lodged in any official capacity. "We have seen the report and have taken it seriously. Issuers of Smart Cards are always aware that people will try to crack their codes."

APACS, the Association for Payment Clearing Services, which is leading the future change of all bank payment cards from magnetic stripe cards to Smart Cards, commented: "If you throw enough time and technology at this you might end up being able to duplicate a single card - but no others. It would be easier to steal one."

Smart Card Reader for OEMs

Omron's new SHR Smart Card reader for OEMs, has a footprint of just 60mm x 44.5mm and a height off the board of 6mm and is designed to accept all ISO 7816 cards. Applications include ID, access control, time and attendance, telecommunications, vending, data capturing, pre-paid systems and electronic purse.

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Fairy Bridge Card

GPT Card Technology has supplied 5,000 special edition Smart phone cards to Manx Telecom to celebrate Christmas. Called The Fairy Bridge card (*see front page*) it refers to a local bridge where it is said that if you cross without saying "Good Day" to the fairies you cannot be sure of a safe journey. Many people recount stories of their cars breaking down after forgetting to greet the Little People!

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Integrated Circuit Card Standards and Specifications - Part 3

This month we shall carry on looking at the electronic signals and transmission protocols that are covered by part 3 of the ISO 7816 standard. In particular we will take account of the proposed new revision of the standard.

Programming Voltage V_{pp}

This signal is designed to provide the high voltage required to enable writing to the non volatile memory. The more popular IC's use EEPROM memory where the high voltage is generated by a charge pump on the chip. However the EPROM memory type needs the high voltage (usually 12.5V or 21V) to be externally provided on the IC connecter. There have been problems in the past with terminals supplying the wrong programming voltage with somewhat drastic effects. Because of this and the significant advantages of having a rewriteable memory the EEPROM memory is by far the most popular for IC card applications, hence the role of V_{pp} is rapidly diminishing. V_{pp} is not used in the EMV specification.

The Reset Signal

The reset signal is asserted by the interface device and is used to start up the program contained in the chip ROM. Two reset modes are defined, cold reset and warm reset. The cold reset refers to the initial activation of the device whilst a warm reset relates to the actioning of the reset line whilst the chip is in place and the Vcc and clock signal are kept stable. In particular the warm reset allows the chip to be switched between the specific and negotiable modes of operation, which will be described in detail in the next section.

The sequence of the operations for activating and deactivating the IC is defined in order to minimise the likelihood of damage to the IC. In particular the inadvertent corruption of the non-volatile memory (EPROM or EEPROM) must be avoided. The activation sequence for the interface device is defined as follows:

-Take RST low
-Apply V_{cc}
-Put I/O in receive mode
-Put V_{pp} in idle mode
-Apply clock
-Take RST high (active low reset)

The IC deactivation sequence for the interface device is as follows:

-Take RST low
-Take clock low
-Deactivate V_{pp}
-Put I/O in the low state
-Deactivate V_{cc}

Serial Input/ Output (I/O)

The ISO standard defines a single line for the interchange of data between the IC and the interface device. This means that the line must change direction depending on whether the IC is transmitting or receiving. In practice this cannot be instantaneous and the expression 'line turnaround time', is commonly encountered in the modem world. The transmission protocol must take account of this need to turn the line around.

Character Transmission.

The transmission characteristics operated by most microprocessor IC cards are based on an asynchronous half duplex mode of operation. In the T=O communication protocol this involves the transmission of bytes whilst the T=1 protocol defines a block mode of operation. As we have already observed the serial communication is operated by the use of a single chip connector, where the direction of data transmission has to change depending on whether the IC card or interface is transmitting data. This is referred to as half duplex communication whereas two I/O signal connectors would be required for full duplex operation where transmission can take place in both directions concurrently.

The asynchronous type of transmission is similar to that used by the serial RS232C connector met on the personal computer. Although the PC operates in full duplex mode. The transmission of a single character (defined as 8 bits) requires an overhead of several bits as follows:

- Start bit (used for character frame synchronisation)
- Parity bit (for error detection)
- Guardtime (separation between characters)

The format of a character frame is shown in *fig.1*. The receiver examines the I/O looking for the transition from the mark or high state to the space or low state. The sampling of the line is required to be such that the receiver monitors the state of the line in the centre of each bit period with a precision of $\pm 20\%$. The parity bit is defined to achieve even parity which means that the number of 1's in the 8 data bits and the parity bit together results in an even number.
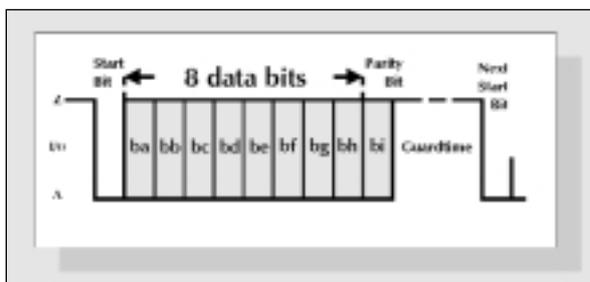
Figure 1
Asynchronous Character Frame

The guard time is defined to be equal to two bit periods (although for block mode it can be changed to a 1 bit period). This is similar to having two stop bits on a UART (Universal Asynchronous Receiver Transmitter) as used in the PC.

A more common definition of the asynchronous serial transmission at reset would be 9600 bits/second, 8 data bits, even parity, 2 stop bits with half duplex mode of operation. The half duplex refers only to data transmissions in one direction at a time which a PC is perfectly capable of managing with its UART. The RS232C interface however defines two separate wires for data transmission and reception which would need hardware modification in order to interface with the single wire IC card directly.

There is a further problem with the asynchronous character transmission that makes life difficult for a PC to act as the interface device. The 7816-3 standard defines an error detection and recovery operation (mandatory for T=0) that cannot be managed by the normal PC UART. When the receiver detects a parity error on reception it takes the I/O line to the space or low state in the middle of the first stop bit guard time. The transmitter is mandated to sample the I/O line at the start of the second stop bit guard time period. When the error condition is sensed then the transmitter should retransmit the erroneously received character. The transmitter cannot be outputting stop bits but must let the line go high during the guard time in order to sense the line state. Given the close coupling normally achieved between an IC card and the interface device one has to question whether this level of error control has sufficient benefits to outweigh the disadvantages. Error control at a higher level in the OSI model is preferable in this situation and although this could be handled at the application level the T=1 communication protocol applies error control at the frame level.

Answer to reset

After the reset signal is applied by the interface device the IC card responds with an answer to reset. The IC

should respond between 400 and 40,000 clock cycles after the rising edge of the reset signal.

-The initial character (TS)
-The format character (T0)
-The interface characters (TA_i, TB_i, TC_i, TD_i,)
-The historical characters (T1, T2....TK)
-The check character (TCK)

Each of these fields are sent in order as shown in *fig.2*. The initial character TS is really a bit synchronisation pattern which may be sent in order to determine the data transmission rate (auto baud rate sensing) and also to determine the sense of the logic. The format of the TS character is shown in *fig.3*. This shows the two possibilities of the direct and inverse convention. In the inverse convention where the logic level 1 is the space or low state the most significant bit is transmitted first.
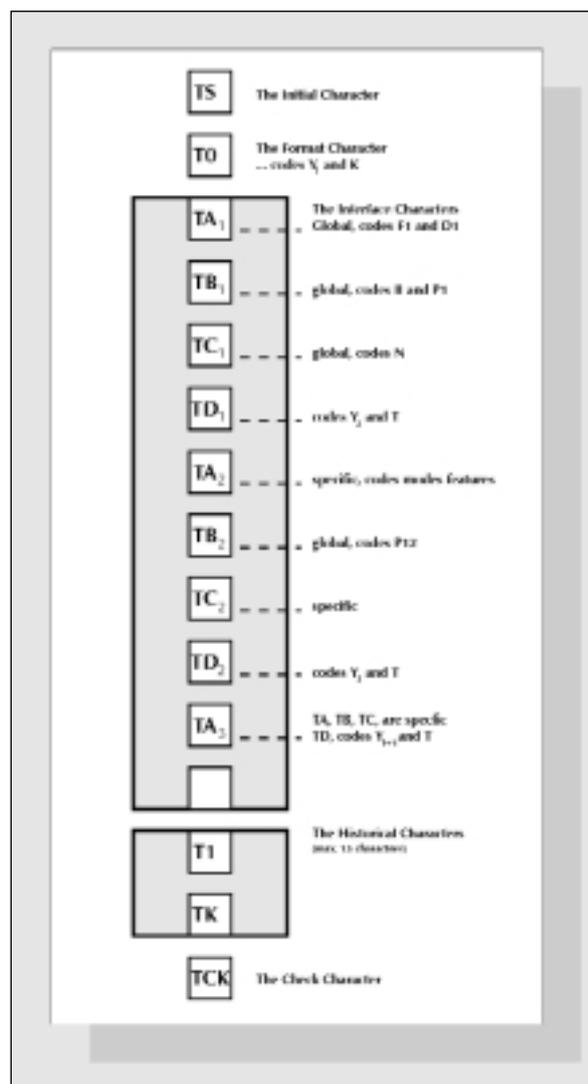

Figure 2
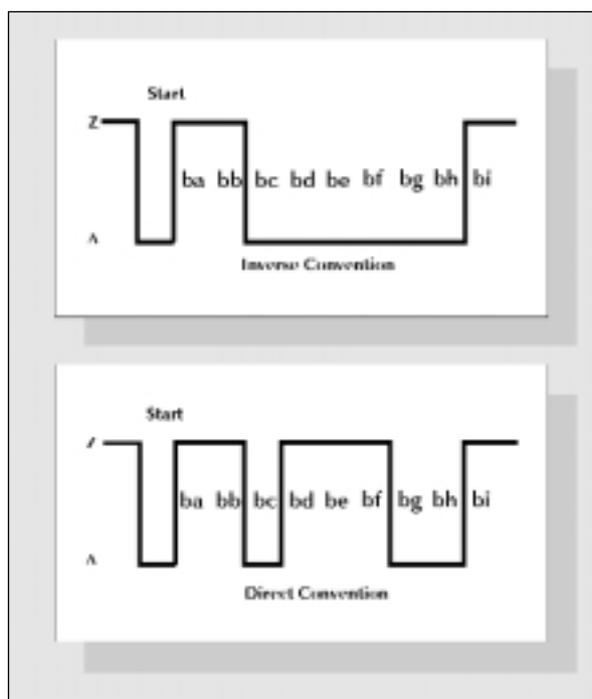**General Configuration of the Answer-to-Reset**

Figure 3
Initial Character TS

With the direct convention where the logic level 1 is the mark or high state then the least significant bit is transmitted first. This means that the selection of the appropriate logic sense will result in the initial character being interpreted as '3F' for the inverse convention and '3B' for the direct convention in hexadecimal coding.

The format character T0 provides information necessary to interpret the remaining answer to reset characters. The most significant 4 bits use a bit map to indicate the presence or otherwise of TA1, TB1, TC1 and TD1. For example if the most significant bit (b8) is set then TD1 is present in the interface characters field. Similarly the presence of TC1 is indicated by the state of the 'b7' bit and so on.

The least significant 4 bits of the TO formal character give the number (binary encoded) of bytes in the historical field. The use of 4 bits restricts the maximum size of the historical character field to 15 bytes.

The interface characters (TA_i, TB_i, TC_i, TD_i,) are the complex part of the answer to reset. They carry information relating to the available communication protocols as well as the programming voltage and current parameters for the EPROM.

The interface bytes (which are optional) are defined in *fig.4*. The T0 and TD_i characters contain bit maps which indicate the presence or otherwise of the following TA_i, TB_i, TC_i and TD_i bytes.

The TA_1, TB_1, TC_1 and TB_2 characters are referred to as the global interface bytes and are fundamental to the operation of the card.

TA_1 defines the basic characters of the serial transmission, FI is the clock rate conversion factor and DI is the bit rate adjustment factor. The binary encoded fields are compared against tables supplied in the standard to achieve actual values for F and D as defined below:

$$Initial\ etu = \frac{372}{f}\ \sec\ (f\ usually = 3.579545MHz)$$

$$Work\ etu = \frac{1}{D} X \frac{E}{f}\ \sec$$

An elementary time unit (etu) is the nominal bit duration used in the character frame. Thus as described previously one character frame is equal to 12 etu (1 start etu, 8 data etu, 1 parity etu, 2 guard time etu).

The default values for F1 and D1 are 1 which is defined in the tables to give a value for F of 372 and D of 1. Hence the work and initial etu are the same. At these default values the frequency of the clock should be in the range 1MHz - 5MHz for 5V operation and between 1MHz - 4MHz for 3V operation.

TB_1 is used to define the EPROM programming voltage and current. The value of 11 and P11 are used against tables to obtain the value of 1 mA and P volts. It should be noted that TB_2 is used to define the programming voltage with higher granularity (8 bits instead of 5).

TC_1 provides the value of N which defines the extra guard time to be used between successive characters. N can be in the range 0 - 254 etu. When N is equal to 255
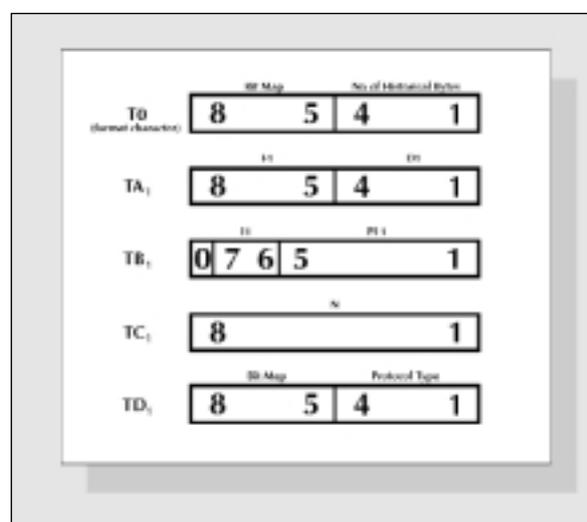

Figure 4
The Interface Bytes

this indicates that the minimum guard time (2 etu for T = O and 1 etu for T = 1) should be used. As noted previously the T = 0 communications protocol requires the extra guard time to enable the parity error detection and signalling to be implemented.

TD_1 indicates the protocol type TD1 as between 0 and 15,

T = 0	Asynchronous half duplex byte transmission
T = 1	Asynchronous half duplex block transmission
T = 2/3	Reserved for full duplex operation
T = 4	Reserved for enhanced half duplex byte transmission
T = 5.13	Reserved for further use (RFU)
T = 14	Non ISO protocols
T = 15	Reserved for future extension

It should be noted that Japan uses T = 14 for a National block asynchronous protocol. The TD_1 byte also contains a bit map that indicates the presence or otherwise of TA_2, TB_2, TC_2 and TD_2. TA_2 when present describes the specific mode of operation.

The Historical Characters

The historical characters may be used to convey information relating to the life cycle of the card. There are clearly other possibilities and the use of these characters is subject to considerable variation.

The Check Character (TCK)
The check character should not be sent when only the T = 0 protocol is indicated in the answer to reset. In all other cases TCK is sent as the last character of the ATR. The check character is calculated such that the Exclusive OR of all the bytes from T0 to TCK inclusive is equal to zero.

David Everett
Next month: Part 4 - Communication Protocols

Hewlett-Packard's ImagineCards

Hewlett-Packard are to introduce a product called ImagineCards which will have the capability to download and run Java applications. The cards will also be used for authentification of users on corporate networks or the Internet using digital signatures and cryptography. Companies Gemplus and Informix are involved in the development of ImagineCards. Announcements can be expected early in the new year.

Award for DANMØNT Card

DANMØNT's innovative wooden card with a chip (*SCN December 1995*) has won the environmental award at the recent Dutch CardEX '96 stored value and telephone cards conference.

The first wooden card to be used as a Stored Value Card was developed by dz danmark, the largest card producer in Scandinavia, in co-operation with its sister company, ECO CARD AB of Sweden.

Jens Tastum, Vice President, Business Development at DANMØNT, said it was a risk to launch the card but Danish consumers and now international judges had appreciated their test of the new technology. "If no one is willing to test new production methods we will never achieve any progress," he said.

Flemming Breinholt, dz danmark Managing Director, commented: "It has been very exciting for us to have the opportunity to be the first company to put a chip in a wooden card, but the production method has to be refined to enable it to compete with the price of traditional plastic cards."

The card reproduces the painting "Sunflower" by the artist Charlotte Thymark (see above). The card is made of birch wood, conforms to ISO ID1 size and contains the Siemens 4404 chip. Ten thousand cards were distributed to consumers in the Spring of 1996 and DANMØNT expects to publish the results of a consumer test in Spring 1997.

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Pocket Card Reader from G&D

A new pocket card reader (shown below)has been developed by Giesecke & Devrient as a complementary product for the eurocheque ec-card with a chip.

The pocket reader is an ideal addition to the electronic purse, says Jürgen K Nehls, a G&D Board member and responsible for the cards and payment systems division.

"A quick glance suffices, and this miniature reader shows the current loaded value on the card, provides information on the last 15 transactions and additionally shows the last three load operations," he said, adding that it was suitable for use as a key-ring and suggested it would be an excellent promotional gift, for example, from banks.

G&D was one of the companies heavily involved in the introduction of the eurocheque chip card. They provided technical know-how for introducing the electronic purse in Austria and played a leading role in the associated pilot project in Ravensburg, Germany by supplying cards and terminals.

Recently, the Munich-based company entered into a co-operation with Enshade / SDU in The Netherlands. The Dutch company will act as the value-added distributor of chip cards based on G&D technology and will concentrate on personalisation and mailing of cards. They will also use each other's personalisation capacities in Belgium and The Netherlands as back-up facilities. The co-operation is focused on complete systems, based on chip and other high security cards.

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