



NEUROtechnology



Smart card
multi-biometrics

MegaMatcher On Card SDK



MegaMatcher On Card SDK

Smart card multi-biometrics

Document updated on January 27, 2011

CONTENTS

Algorithm features and capabilities	3
MegaMatcher On Card 2.1 SDK contents	4
Supported fingerprint scanners under Microsoft Windows	6
Supported fingerprint scanners under Linux	7
Supported face capture cameras	7
Technical specifications	8
Reliability & performance tests	9
System requirements	11
Related products	12
Licensing MegaMatcher On Card	13
Prices	15

MegaMatcher On Card SDK offers matching on card technology that stores person's fingerprint and face templates on a smart card and **performs template matching in a microprocessor embedded in the card** instead of matching biometric information on a PC's processor. This method ensures that personal biometric information does not transfer to an external computer as it would in a more basic template-on-card system.

The MegaMatcher On Card SDK is developed utilizing a set of ISO/IEC standards to enable interoperability with and easy integration into existing smart card and/or biometric systems.

- PC-like verification accuracy.
- Configurable verification modes.
- Multi-biometrics support.
- Security and privacy.
- ISO/IEC standards support.
- Easy integration.
- Different smart card platforms supported.



Algorithm Features and Capabilities

MegaMatcher On Card 2.1 is based on MegaMatcher multi-biometric AFIS technology and provides a number of advantages over a standard fingerprint/face identification system or similar products for smart cards, including:

- **Accuracy.** MegaMatcher On Card provides the same level of accuracy of an AFIS system in a verification process using ISO/IEC 19794-2 compact card minutiae format templates together with the security of storage of biometric templates and matching algorithm on a smart card. See the reliability testing results that compare MegaMatcher On Card with MegaMatcher 4.0.
- **Configurability.** MegaMatcher On Card fingerprint algorithm has different performance configurations that can be chosen according to the operating scenario, the requirements to matching accuracy, the smart card platform speed and memory constraints.
- **Multibiometrics.** The face matching technology can be used as an additional or alternative factor of authentication that enhances the fingerprint verification. A fingerprint and a face template can be stored on a single card together with the fingerprint and face matching algorithms.



MegaMatcher On Card 2.1 SDK Contents

MegaMatcher On Card 2.1 SDK provides a number of advantages over a standard fingerprint/face identification system or similar products for smart cards, including:

- **ISO/IEC standards support.** MegaMatcher On Card 2.1 SDK is compliant with the following standards:
 - ISO/IEC 7816-3
 - ISO/IEC 7816-4
 - ISO/IEC 7816-9
 - ISO/IEC 7816-11
 - ISO/IEC 19794-2 (compact size finger minutiae card format)
- **Easy integration.** Implementing the system will not require major overhauls of existing infrastructure, as MegaMatcher On Card SDK is developed utilizing a set of ISO/IEC standards to enable interoperability with and easy integration into existing smart card and/or biometric systems. The process of fingerprint and face enrollment during the card issuance, often connected to the avoidance of emission of duplicates, can also be developed with VeriFinger, VeriLook or MegaMatcher components that are fully compatible with MegaMatcher On Card. This provides the advantages of both using the whole set of features of Neurotechnology proprietary templates format to improve the accuracy of duplicates searching and the possibility to ensure the quality of the biometric data stored into the card.
- **Cost effectiveness.** A biometric system that uses matching on card can be developed including the fingerprint and face extractor components of MegaMatcher On Card. Those have most of the same algorithm functionalities of MegaMatcher, and they are specifically designed to produce the template formats used by the cards. This gives a cost-effective solution to both integrators who want to test MegaMatcher On Card technology without the necessity of purchasing any additional component, and to the ones who needs to replicate the client part of their matching on card based product on a relevant number of terminals, like the case of a Logon service.
- **Different smartcard platforms supported.** MegaMatcher On Card can be integrated at each stage of the card life cycle for various smart cards platforms. The post-issuance library gives the possibility to integrate fast matching on card in projects where time constraints are critical. On the other hand the possibility to store the code directly into the ROM mask and the partnership with several card vendors offer a faster matching on card solution and the possibility to maintain more EEPROM available for post-issuance applications.
- **Security.** Biometric verification can replace or be combined with less secure (e.g., PIN) authentication techniques to achieve higher security.
- **Privacy.** The original template remains on the smart card, providing a safeguard against misuse of information or fraudulent scanning systems.



The table below lists the components of MegaMatcher On Card 2.1 SDK:

Components	Windows (32 & 64 bit)	Linux (32 & 64 bit)	JavaCard OS
• Smart card with pre-loaded fingerprint and face matching engines			2 smart cards
• Smart card with pre-loaded fingerprint matching engine			1 smart card
• MegaMatcher On Card Fingerprint Extractor	2 licenses		
• MegaMatcher On Card Face Extractor	2 licenses		
• Library for communication with a smart card	+	+	
• Scanners support module	+	+	
• Camera manager library	+	+	
Programming samples			
• C#	+		
• Visual Basic .NET	+		
• JavaCard (enrollment and verification applets)			+
Programming tutorials			
• C	+	+	
• Sun Java SE 6	+	+	
• JCDKv2.2.2 apdutool	+		
• NXP JCOP tools JCSHELL	+		
Documentation			
• MegaMatcher On Card SDK documentation		+	

MegaMatcher On Card fingerprint matching engine

MegaMatcher On Card fingerprint matching engine performs fingerprint template matching in 1-to-1 mode (verification). Being based on the MegaMatcher technology, the engine is tolerant to fingerprint rotations, translations and deformations, and matches flat-rolled, flat-flat or rolled-rolled fingerprints.

MegaMatcher On Card face matching engine

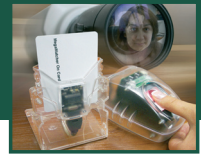
MegaMatcher On Card face matching engine performs face template matching in 1-to-1 mode (verification).

MegaMatcher On Card Fingerprint Extractor component

MegaMatcher On Card Fingerprint Extractor creates ISO 19794-2 fingerprint templates from fingerprint images.

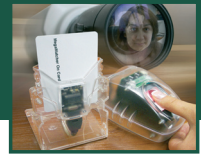
MegaMatcher On Card Face Extractor component

MegaMatcher On Card Face Extractor creates face templates in proprietary format from face images. The Extractor can generalize a face template from several face images to improve the template's quality. The algorithm has also the ability to recognize whether a face in a video stream belongs to a real human or is a photo, in order to improve the overall security of the system.



Supported fingerprint scanners under Microsoft Windows

	Windows XP		Windows Vista		Windows 7	
	32 bit	64 bit	32 bit	64 bit	32 bit	64 bit
• ARH AFS 510	+		+	+	+	+
• Atmel FingerChip	+					
• Athena ASEDrive IIle Combo Bio F2	+	+	+	+		
• AuthenTec AF-S2 / AES4000 / AES2501B	+					
• BioLink U-Match MatchBook v.3.5	+		+			
• Biometri-CS CS-Pass	+					
• Biometrika Fx2000 / Fx3000	+		+			
• Biometrika HiScan	+					
• Cross Match L SCAN Guardian / Verifier 300 / 310 / 320	+	+	+	+	+	+
• Dakty Naos-1	+					
• Dermalog ZF1	+					
• Digent FD1000	+					
• DigitalPersona U.are.U 2000	+		+			
• DigitalPersona U.are.U 4000 / 4500	+	+	+	+	+	+
• Fujitsu MBF200	+					
• Futronic FS50 / FS80 / FS82 / FS88 / FS90 / eFAM (FS84)	+	+	+	+	+	+
• Futronic FS60	+		+		+	
• Green Bit DactyScan 26	+		+			
• Hongda S500 / S680 / S700	+		+			
• id3 Certis Image	+					
• Identix DFR 2080 and DFR 2090	+					
• Identix DFR 2100	+		+			
• Intech SOP1	+					
• Integrated Biometrics LES650	+	+	+	+	+	+
• Jstac Athena 210	+					
• Lumidigm Mercury / Venus Series sensors	+	+	+	+	+	+
• NITGEN Fingkey Hamster / Fingkey Hamster II / Fingkey Mouse III / eNBioScan-F	+	+	+	+	+	+
• SecuGen Hamster III / Hamster Plus / Hamster IV / iD-USB SC / iD-USB SC/PIV	+	+	+	+	+	+
• Startek FM200	+		+			
• Suprema BioMini	+		+		+	
• Suprema RealScan-10 / RealScan-D / RealScan-S / SFR300-S / SFU300	+					
• Tacoma CMOS	+		+			
• Testech Bio-i	+		+			
• TST Biometrics BiRD 3	+		+			
• UPEK Eikon / Eikon To Go / EikonTouch 300 / 700 / TCRU1C / TCRU2C	+		+		+	
• VistaMT Multimodal Biometric Device	+	+	+	+	+	+
• ZKSoftware ZK6000	+		+			
• Zvetco Verifi P4000	+					
• Zvetco Verifi P5000	+				+	



Supported fingerprint scanners under Linux

	Linux	
	32 bit	64 bit
• AuthenTec AF-S2 / AES4000	+	+
• BioLink U-Match MatchBook v.3.5	+	
• Biometri-CS CS-Pass	+	+
• Biometrika Fx2000 / Fx3000 / HiScan	+	
• Fujitsu MBF200	+	+
• Futronic eFAM (FS84)	+	+
• Futronic FS50 / FS80 / FS82 / FS88 / FS90	+	
• Lumidigm Mercury / Venus series sensors	+	
• NITGEN eNBioScan-F	+	
• SecuGen Hamster III	+	
• Startek FM200	+	+
• Suprema BioMini	+	
• Tacoma CMOS	+	+
• Zvetco Verifi P4000	+	+

Supported face capture cameras

These cameras are supported by MegaMatcher On Card 2.1 SDK:

- Any **webcam** or camera that is accessible using:
 - **DirectShow** interface for Microsoft Windows platform
 - **Video4Linux** interface for Linux platform.
 - **QuickTime** interface for Mac platform.
- Also these specific models of high-resolution cameras are supported:
 - Axis M1114 camera (Microsoft Windows only)
 - Cisco 4500 IP camera (Microsoft Windows and Linux)
 - IrisGuard IG-AD100 iris & face camera (Microsoft Windows only)
 - Mobotix DualNight M12 IP camera (Microsoft Windows and Linux)
 - PiXORD N606 camera (Microsoft Windows and Linux)
 - Prosilica GigE Vision camera (Microsoft Windows and Linux)
 - VistaFA2 / VistaFA2E face & iris cameras (Microsoft Windows only)
 - VistaMT Multimodal Biometric Device (Microsoft Windows only)



Technical Specifications

MegaMatcher On Card 2.1 can be configured according to different requirements and smart card constraints, at both pure Java Card level and native code. The summary of average memory requirements is available below. The MegaMatcher On Card 2.1 template matching engines performance was tested for smart cards from several vendors; see the testing results for more information on matching speed for a particular card.

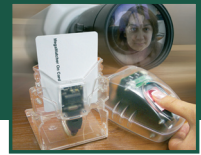
- **500 dpi** is the recommended fingerprint image resolution.
- **640 x 480 pixels** is the recommended image size for face detection. **40 pixels** is the minimal distance between the eyes for face detection.
- MegaMatcher On Card face extraction engine has certain tolerance to face posture that assures face detection:
 - head **roll** (tilt) – ± 15 degrees from frontal position.
 - head **pitch** (nod) – ± 15 degrees from frontal position.
 - head **yaw** (bobble) – ± 15 degrees from frontal position.

MegaMatcher On Card 2.1 fingerprint verification engine memory requirements		
	Native level (maximized accuracy configuration)	Java Card post-issuance library (maximized speed configuration)
Code size	6-8 kilobytes	less than 13 kilobytes
Required RAM for data ⁽¹⁾	960 - 1,700 bytes	less than 600 bytes
Template size ⁽¹⁾	1,300 - 1,700 bytes	less than 1 kilobyte

⁽¹⁾ Depends on the configurable maximal number of minutiae.

MegaMatcher On Card 2.1 face verification engine memory requirements		
	Native level (maximized accuracy configuration)	Java Card post-issuance library (maximized speed configuration)
Code size	Not implemented	less than 3.3 kilobytes
Required RAM for data		15 bytes
Template size ⁽¹⁾		less than 2,700 bytes

⁽¹⁾ Using faces compact card template format.



Reliability & Performance Tests

MegaMatcher On Card 2.1 fingerprint and face matching algorithms were tested on smart cards from several vendors. The matching speeds are available below. Please contact us to get more information about the expectations on a specific platform on which you intend to use it.

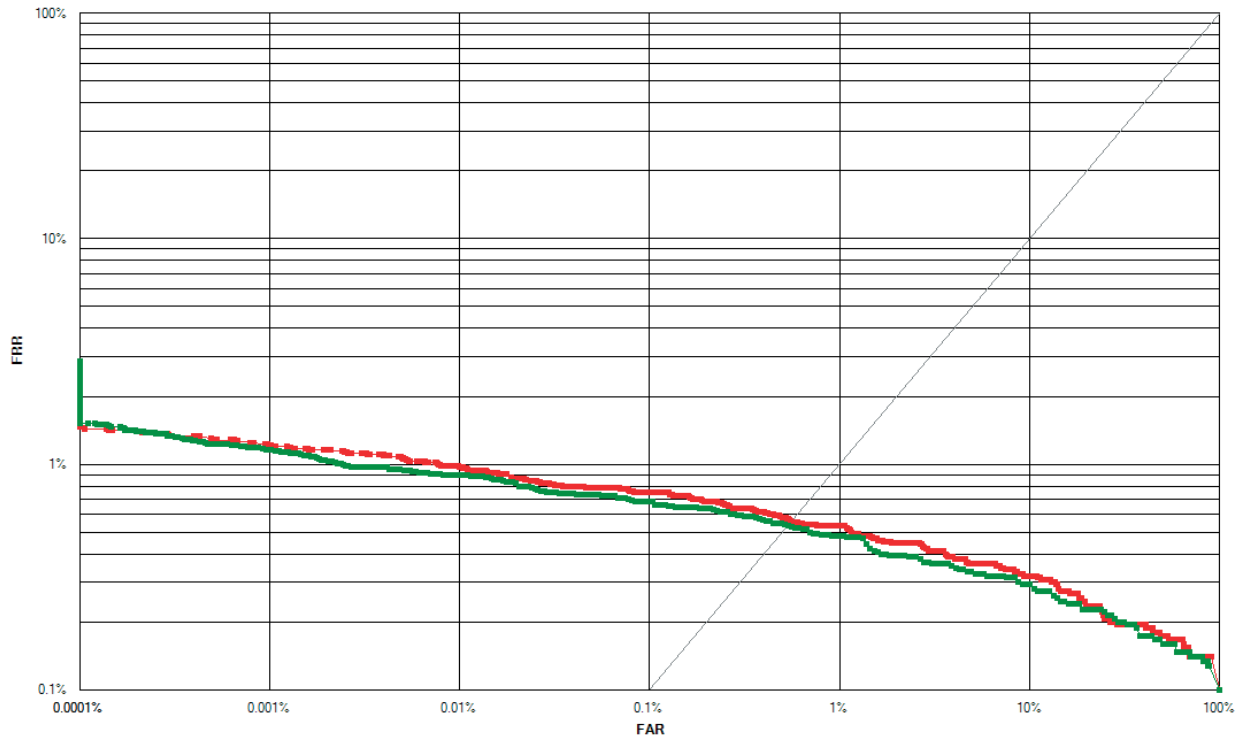
MegaMatcher On Card 2.1 engines performance for biometric template verification		
	Fingerprint matching engine speed	Face matching engine speed ⁽¹⁾
Atmel AT90SC28872RCU (native level, maximized accuracy configuration)	less than 0.3 seconds	-
ATHENA IDProtectV2 (post-issuance application, maximized speed configuration)	less than 0.7 seconds	less than 0.6 seconds
NXP P5CC0037 (native level, maximized accuracy configuration)	less than 1.2 seconds	-
JCOP 2.4.1 R2 (post-issuance application, maximized speed configuration)	less than 4 seconds	less than 0.9 or 1.4 seconds

⁽¹⁾ Performance depends on the baud rate of protocol and APDU type chosen. Performance results correspond to matching compact face card format templates.

The MegaMatcher On Card 2.1 template verification algorithm is a version of MegaMatcher 4.0 algorithm adapted to the limited computational resources of smart cards. The reliability tests compare the original MegaMatcher 4.0 and the MegaMatcher On Card for fingerprint modalities:

- **Fingerprint verification.** The tests were performed using a subset of SONATEQ Fingerprint Database SQ FDB1-75TS1:
 - only **right hand's index fingerprints** were used;
 - ISO/IEC 19794-2:2005 compact card minutiae format was used during testing.

Receiver operation characteristics (**ROC**) curves are usually used to demonstrate the recognition quality of an algorithm. ROC curves show the dependence of false rejection rate (**FRR**) on the false acceptance rate (**FAR**). Charts with ROC curves are available on the next page.



Algorithms comparison using ISO/IEC 19794-2:2005 compact card minutia storage format and a subset of SONATEQ Fingerprint Database SQ FDB1-75TS1:
 ■ MegaMatcher On Card fingerprint template verification algorithm;
 ■ MegaMatcher 4.0 fingerprint template verification algorithm.



System requirements

System requirements for installation and usage of components on JavaCard

- JavaCard 2.2.1 / 2.2.2 compatible smart card
- See the technical specifications section for the required amount of free persistent EEPROM and RAM

System requirements for PC components installation and usage

- PC with **x86 (32bit)** or **x86-64 (64bit)** compatible processors. 2GHz or better processor is recommended.
- At least **128 MB of free RAM** should be available for the application.
- **Free space on hard disk drive (HDD):**
 - at least 1 GB required for the development.
 - 100 MB required for MegaMatcher On Card PC side components deployment.
- **Smart card reader.** An ISO/IEC 7816 compliant smart card reader is required.
- **Fingerprint scanner.** MegaMatcher On Card 2.1 includes support modules for more than 70 fingerprint scanners and sensors under different platforms.
- **Camera or webcam (optional)** for face image capture. MegaMatcher On Card 2.1 supports several high resolution cameras. Any other camera or webcam is supported by MegaMatcher On Card if it provides DirectShow interface for Windows platform or Video4Linux interface for Linux platform.
- **Microsoft Windows specific requirements:**
 - Microsoft Windows 2000/XP/2003/2008/Vista/7, 32-bit or 64-bit. 32-bit platform is recommended for applications with fingerprint scanners, as most scanners have only 32-bit support modules.
 - Microsoft .NET framework 2.0 or newer (for .NET components usage).
 - One of the following development environments for application development:
 - Microsoft Visual Studio 2005 SP1 or newer (for application development under C/C++, C#, Visual Basic .Net)
 - Sun Java 1.5 SDK or later
 - Microsoft Visual Basic 6
 - Delphi 7
- **Linux specific requirements:**
 - Linux 2.6 or newer kernel, 32-bit or 64-bit. 32-bit platform are recommended for applications with fingerprint scanners, as most scanners have only 32-bit support modules.
 - glibc 2.3.6 or newer
 - GTK+ 2.10.x or newer libs and dev packages (to run SDK samples and applications based on them)
 - GCC-4.0.x or newer (for application development)
 - GNU Make 3.81 or newer (for application development)
 - Sun Java 1.5 SDK or later (for application development with Java)
 - PCSC-Lite 1.4.4 or newer
 - ccid-1.3.0 or newer



Related Products

These Neurotechnology products are related to MegaMatcher On Card SDK:

- **MegaMatcher SDK** – intended for development of AFIS or multi-biometric fingerprint, face, iris and palm print identification products. See *MegaMatcher SDK brochure* for more information.
- **VeriFinger SDK** – intended for development of PC-based or Web-based fingerprint identification systems. See *VeriFinger SDK brochure* for more information.
- **VeriLook SDK** – intended for development of PC-based or Web-based face identification systems. See *VeriLook SDK brochure* for more information.



Licensing MegaMatcher On Card

To **develop** a product based on MegaMatcher On Card technology, an integrator should obtain MegaMatcher On Card 2.1 SDK (EUR 439).

Integrators can develop only an end-user product using MegaMatcher On Card 2.1 SDK and sell/install the product to their own customers. If the integrator wants to develop and sell a MegaMatcher On Card based development tool (with API, programming possibilities, programming samples, etc.), he/she will need a permission from Neurotechnology and shall sign a special VAR agreement.

To **deploy** the product that was developed with MegaMatcher On Card 2.1 SDK, the integrator should obtain additional MegaMatcher On Card component licenses. Also the additional MegaMatcher On Card 2.1 component licenses may be required during development of the product. The additional MegaMatcher On Card 2.1 extractor component licenses can be obtained by MegaMatcher On Card 2.1 SDK customers at any time. Prices for the additional extractor component licenses can be found here.

Additional cards with installed fingerprint and/or face matching component for the product development and deployment can be obtained at any time, according to stock and availability of suppliers.

For **large projects** that include more than 100,000 card licenses, MegaMatcher On Card 2.1 matching components are available with different forms of licensing. Please contact us for more information.

The components of MegaMatcher On Card 2.1 SDK are:

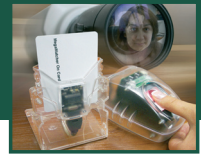
- PC-side components:
 - MegaMatcher On Card 2.1 Fingerprint Extractor component;
 - MegaMatcher On Card 2.1 Face Extractor component.
- Smart card-side components:
 - MegaMatcher On Card 2.1 smart card fingerprint matching engine;
 - MegaMatcher On Card 2.1 smart card face matching engine.

A license for a MegaMatcher On Card 2.1 PC-side component is required for each PC that runs the component. Single computer licenses are available for the PC-side components.

MegaMatcher On Card 2.1 SDK includes:

- 2 smart cards with preloaded MegaMatcher On Card 2.1 fingerprint and face matching engines.
- 1 smart card with preloaded MegaMatcher On Card 2.1 fingerprint matching engine.
- 2 MegaMatcher On Card 2.1 Fingerprint Extractor licenses;
- 2 MegaMatcher On Card 2.1 Face Extractor licenses;

Please also refer to MegaMatcher On Card SDK Software License Agreement at Neurotechnology web site for all licensing terms and conditions.



Single computer license

A single computer license allows to install and run a MegaMatcher On Card Fingerprint Extractor or Face Extractor component installation on a single Personal Computer. The component license will not be lost if computer will be reinstalled.

The following license management options are available:

- license activation online by communicating with Neurotechnology's server;
- license activation by email;
- license activation using volume license manager.

Single computer license activated over Internet or by email is not suitable for virtual environments. Volume license manager used as a dongle would be required.

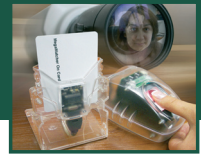
Volume license manager

Volume license manager is used on site by integrators or end users to manage obtained licenses for MegaMatcher On Card PC-side components. It consists of license management software and a dongle, which are used to store the number of obtained licenses. An integrator or an end-user can use the volume license manager in the following ways:

- Activating the single computer licenses. An installation license for a MegaMatcher On Card PC-side component will be activated for using on a particular computer. The license quantity for the MegaMatcher On Card component in the license manager will be decreased by the amount of activated licenses.
- Using a license manager as a dongle. The volume license manager containing at least one license for a MegaMatcher On Card PC-side component can be used as a dongle that allows to run the MegaMatcher On Card component installation on a particular computer.

Additional MegaMatcher On Card component installation licenses for the license manager can be purchased anytime. Neurotechnology will generate a special update file and send it to you. Then you will just have to enter the file to the license manager to add these purchased licenses.

For more information please contact us.



Prices for MegaMatcher On Card SDK

- The prices are **effective from January 11, 2011**. The prices may change in the future, so please **download and review the latest version** of the brochure before making an order.
- Quantity discounts do not accumulate over time.
- The prices do not include any taxes.
- Product shipping cost depends on delivery country
- Our customers can gain a discount for our products by getting the Solution Partner status.

MegaMatcher On Card SDK		
MegaMatcher On Card 2.1 SDK	€ 439.00	
Additional smart cards with fingerprint and/or face matching engines	contact us	
MegaMatcher On Card Extractor components (price per single computer license)		
Quantity	Fingerprint extractor	Face extractor
1 - 9	€ 12.00	€ 12.00
10 - 19	€ 8.70	€ 8.70
20 - 49	€ 7.50	€ 7.50
50 - 99	€ 6.30	€ 6.30
100 - 199	€ 5.40	€ 5.40
200 - 499	€ 4.50	€ 4.50
500 - 999	€ 3.60	€ 3.60
1,000 - 1,999	€ 2.70	€ 2.70
2,000 - 3,999	€ 1.80	€ 1.80
4,000 - 7,999	€ 1.32	€ 1.32
8,000 and more	contact us	
License managment		
Volume license manager	€ 16.00	

MegaMatcher On Card SDK and related products can be ordered:

- online, at www.neurotechnology.com/cgi-bin/order.cgi
- via a local Neurotechnology distributor; the list of distributors is available at www.neurotechnology.com/distributors.html