

# APM Neural Spike Discriminator

## with Digital Gain and Filtering

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The APM is a stand-alone digital neural spike discriminator with integrated digital gain and filtering capabilities. It can be used as a direct replacement for existing analog window discriminators. It can detect any activity within an adjustable time/amplitude "window", or up to 4 individual spikes with template matching.

### Features

- Two pre-programmed modes of neural spike discrimination;
  - Slope/Height Window Discrimination** detects and records any waveform that passes through a user-defined time/amplitude window.
  - Adaptive** (follows changes in waveform shape, such as caused by electrode drift) **Template Matching** detects and records up to four different spikes based upon their shape.
- Allows user to implement their own detection/processing algorithms. Growing downloadable library of user-contributed algorithms in standard C programming language located at [www.neurocraft.com](http://www.neurocraft.com).
- 64 or 128 tap bandpass finite impulse response digital filter with continuously adjustable low-pass and hi-pass filters. Frequency range of DC to 20kHz.
- User selectable gain from X1 – X120
- Upgradeable firmware through the user-programmable 256kB FLASH memory.



All functions of the APM are implemented in the hardware and DSP firmware of the unit. The 32 bit DSP allows real time processing of signals on board, with no data processing performed on the host PC. The flexible architecture of the software allows the user to develop customized algorithms. The user-programmable 256kB FLASH memory allows expansion of basic functionality by a simple firmware upgrade process. A web-based users group is established ([www.neurocraft.com](http://www.neurocraft.com)) for a free exchange of software, under an open-source policy.

Two modes of spike discrimination can be selected: Slope/Height Window Discrimination, or Adaptive Template Matching (ATM). In window discrimination mode, an acceptance window is placed in an area where only relevant waveforms pass through it. Only those waveforms will be recorded. The acceptance parameters

(trigger, amplitude etc.) can be changed at any time during the experiment (not allowable in all recording formats). This allows for changes in spike shape due to electrode drift etc.

The ATM mode utilizes a user selected spike to build a template of the waveform shape to be recorded. Acceptance criteria settings are fully adjustable. Parameters can be set to make the template adaptive to automatically follow changes in spike shape.

Inputs are provided for interfacing with available behavioral systems. Trial Gate, Trial Validate, and Event Input are used when recording in gated mode to record only valid trial sections. A Spike Acceptance TTL level output is provided for recording when any waveform is accepted.

*The APM's simple lines belie its enormous capacity as a neuralspike discriminator module with a flexible software architecture that can be customized as needed.*

*Cont. on page 2*

# APM Neural Spike Discriminator

## Product Features & Description (cont.)

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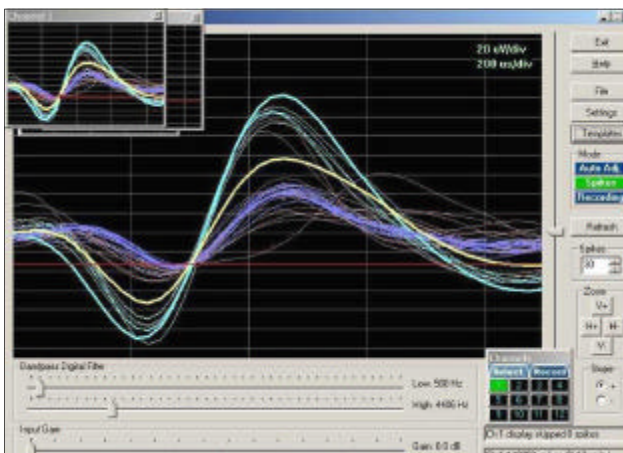
Waveforms are displayed in real time on the host PC. No additional oscilloscopes are required. An analog output of the signal is provided for monitoring (audio or other) or further processing of the conditioned signal.

Data is stored on the PC as timestamps, waveforms, or both simultaneously. The host PC's graphical user interface displays the waveform and settings for the selected channel, as well as thumbnail views for all active channels. (Only one channel is used for each APM) The parameters of spike acceptance can be interactively changed at any time during the experiment to compensate for electrode drift, etc. The interface can simultaneously display up to the last 256 triggered waveforms per channel.

Data can be stored/converted in several formats for use by standard analysis software i.e. Matlab, Neuroexplorer, etc. Acquired data can also be retrieved online over TCPIP networks through the built-in data server. Code samples that retrieve data into Matlab and perform online analyses are provided.

The APM is designed as a one channel module. Multiple module combinations can be run from a host PC using either the two USB ports commonly found on most PCs or commercially available USB hubs. Additional complimentary neuro/craft™ modules will soon be available to expand the APM to include a complete microelectrode recording and electrophysiological analysis system.

A multichannel APC system is also available with built in power and USB hubs for larger electrode count recording applications. (please refer to [www.fh-co.com](http://www.fh-co.com) for more information on this system.



*This view of the Main User Interface shows recording from 3 neurons in Adaptive Template Matching mode.*

### Additional features:

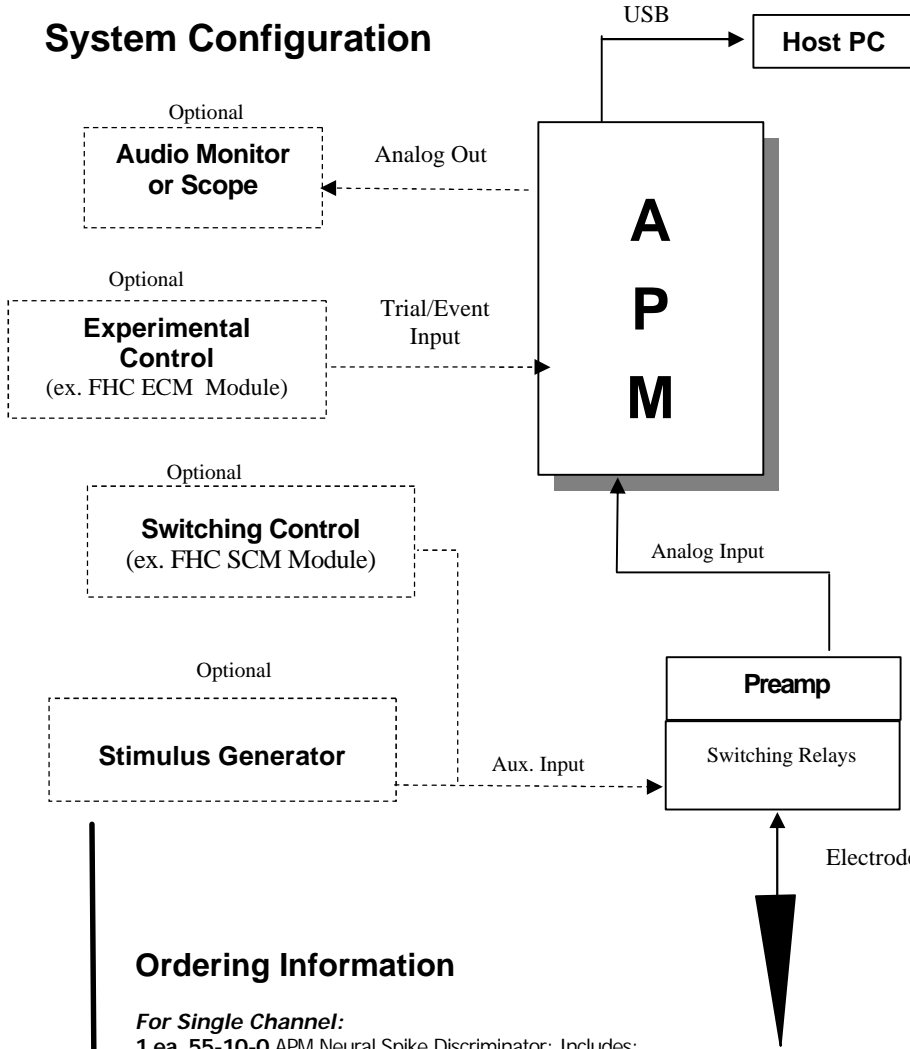
- Automatic trigger mode aids in searching for units.
- Real-time advanced signal processing by a dedicated 32 bit Digital Signal Processor (DSP).
- Up to 48 kHz sample frequency fine sampling of the analog signal, 16 bit digital input and output.
- Real time waveform display; no additional oscilloscope is required.
- Onboard high speed USB port for direct connection to PC. No need for add-on PC boards, no interrupt or address conflicts.
- Multiple data storage options: waveforms and/or timestamps. Data can be saved in several formats for use with standard analysis programs. (Matlab, Neuroexplorer, etc.)
- Compact, modular, desktop or rack mountable.
- Multi-channel backplane version available with built-in power and USB HUB's.

# APM Neural Spike Discriminator

## System Configuration, Specifications & Ordering Information

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### System Configuration



### Specifications

**Input Impedance:** 20 kOhm

**Input Dynamic Range:** 1 V rms (2.83V peak to peak)

**Sampling Resolution:** 16 bits (input and output)

**Sampling Frequency:** 7,040 – 48,000 samples per second, adjustable in 1 sample per second steps. Less than 7,040 s/sec can be achieved with sample averaging performed by the DSP.

**Frequency Response:** 20Hz - 20kHz in AC mode, 0-2kHz in DC mode.

**Memory:** 1.5 MB zero wait state fast SRAM data buffers, 256 kb FLASH.

**Input Voltage Gain:** x10 (20dB) fixed (software selectable) plus X1- X12 (0 - 22.5dB) adjustable in 1.5dB steps.

**Input Signal Filter:** Sharp 64-tap digital bandpass filter in the range of 0Hz to 20kHz

**Analog Output:** Digitally conditioned input signal in the range 0 - 1 V rms (2.83V peak to peak) **Window Size:** 32-128 samples (.67 – 2.6 ms @48kHz)

**Additional Inputs and Outputs:** 3 TTL inputs for behavioral control system interface (Trial Gate, Trial Validate, Event In). TTL spike acceptance output for interfacing with external event recording hardware or legacy systems.

**Display:** Graphic user interface with 1-256 simultaneously displayed waveforms

**Computer Interface:** Full-speed USB 1.1 (12Mbps)

**Dimensions:** 2.05" (5cm) width X 5.22" (13cm) height X 9.6" (24cm) depth

**Weight:** 1.30 lbs (.59 Kg)

**Power Requirements:** Power Supply: 115/230VAC, 50-60Hz, 9W max. Country specific line cord. APM: 12V, 350mA

### Ordering Information

#### For Single Channel:

**1 ea. 55-10-0** APM Neural Spike Discriminator; Includes:  
APM Module, A991 Manual, Accessory Kit (Power Transfer Cord, Software Setup Kit, USB 2.0 Cable, BNC Adaptor Cables (6 ea.), Rubber Feet (4 ea. Use Optional))

**1 ea. 55-00-1** 12V Desktop Power Supply

**1 ea. 55-XXX** Line cord as specified from chart, below:

#### Line cord country codes

55-AUS	Australia	55-JA	Japan
55-CH	China	55-SAF	South Africa
55-DAN	Denmark	55-SWI	Switzerland
55-EURO	Europe	55-UK	United Kingdom
55-ISR	Israel	55-USA	North America
55-ITA	Italy		