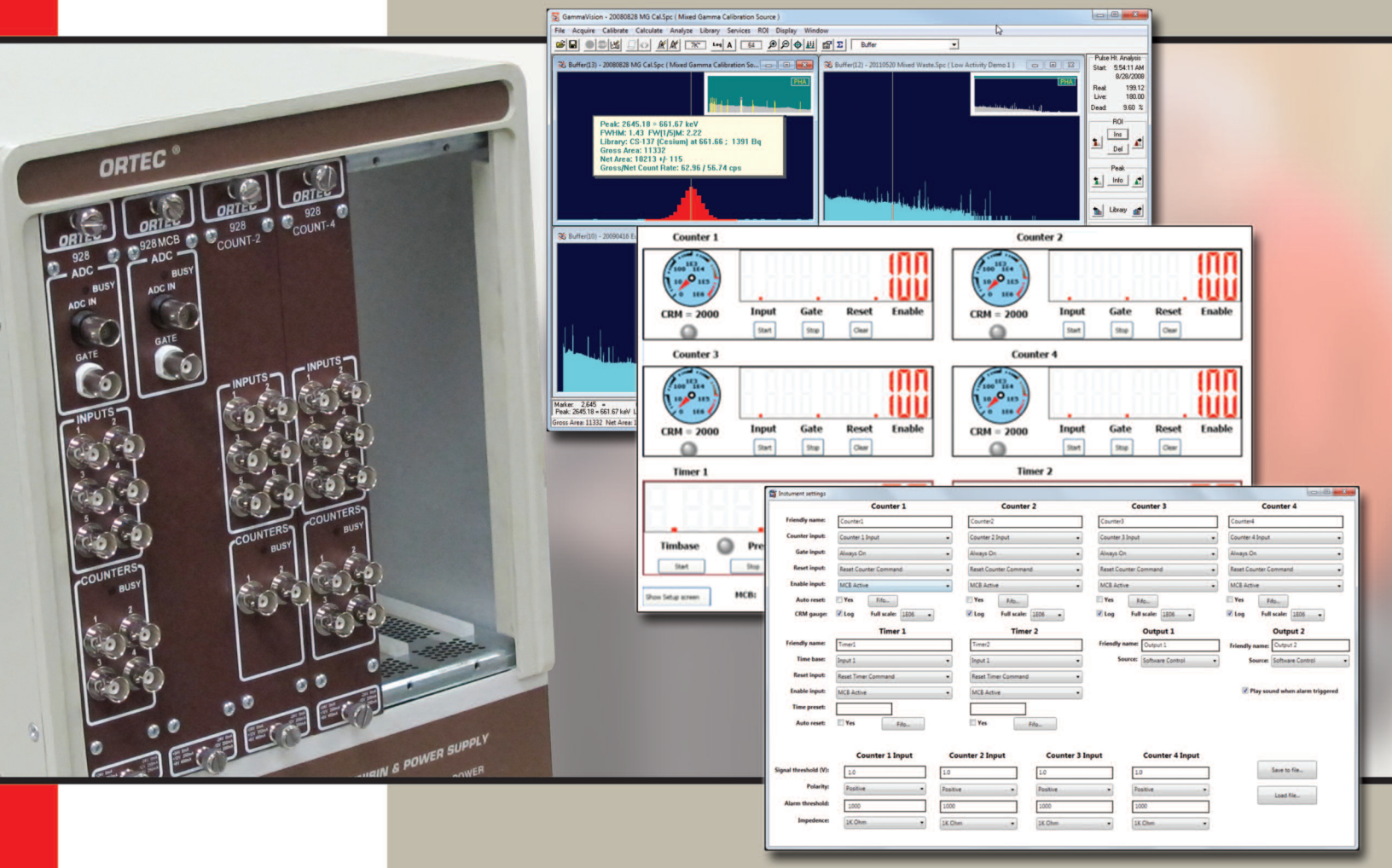
ORTEC®

EASY-NIM 928 Suite

High Performance, Multi-Function Nuclear MCA/Counter/Timer/Rate Meter



"A unique, PC-enabled NIM solution delivering unmatched flexibility, reliability, and ease-of-use."

AMETEK®
ADVANCED MEASUREMENT TECHNOLOGY

EASY-NIM 928 Suite

Introduction

The ORTEC EASY-NIM 928 suite of instruments offers a new approach to nuclear pulse counting and pulse-height analysis for a variety of applications in nuclear science, providing customers flexibility, reliability, and ease-of-use in a cost effective package.

Each member of the family comprises hardware in the form of a compact single-width NIM module; software in the form of a "front panel emulator" for the Windows environment, and an optional toolkit to enable the user to integrate the hardware into his own experiment or instrumentation system.

Benefits	Features
• **Flexibility** • **Reliability** • **Ease-of-Use** • **Cost Effective**	• HIGH PERFORMANCE, Multi-Function Nuclear MCA/Counter/Timer/Rate Meter in a 1-wide NIM. • 200 MHz Counter performance, Log/Lin alarming rate meters, fast (1.25 µs) 16k MCA, USB2.0 connectivity. • HIGH VISIBILITY Front Panel Emulator software and optional programmer's toolkit support. • POWERFUL Flexible internal interconnection. • PROGRAMMABLE external inputs and outputs. • NETWORK capable through ORTEC CONNECTIONS architecture. • EASY TO INTEGRATE into measurement systems and experiments.

Hardware Summary

The range of hardware functions incorporated within the EASY-NIM 928 family members are:

- Multichannel Analyzer
- 200 MHz Pulse Counter
- Timer with internal or external timebase capability
- Rate Meter with adjustable alarm threshold
- 6 configurable general purpose inputs
- 2 configurable outputs (rear panel)

Software Summary

Individual "front panel emulators" provide display and user control of the MCA and Counter/Timer/Rate Meter sections. Through the design architecture of ORTEC *Connections*, the EASY-NIM 928 suite of hardware can be controlled from these applications installed locally or remotely across a network. The optional Programmer's Toolkit allows custom, user-written programs and control.

EASY-NIM 928 Suite

EASY-NIM Models at a Glance

The 928 model is a combination of a quad counter/dual timer and multichannel analyzer function. The 928-MCB model is a MCA only instrument while the 928-COUNT2 and 928-COUNT4 models are counter/timer only instruments. Each model, except the 928-MCB, is equipped with two programmable outputs and 6 inputs for internal connection or for connection to external devices which may be assigned to a variety of sources.

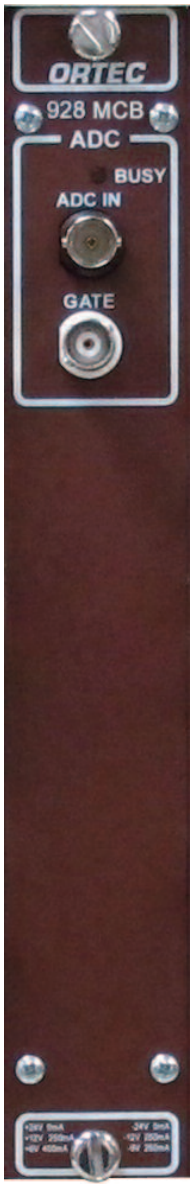
All-in-One

928
Combination MCB/ Quad Counter/ Dual Timer module.

928
Rear Panel

Stand Alone

928-MCB
MCB portion of the instrument only (no Counter/Timer features).



928-MCB
Rear Panel

928-COUNT2
2-Counter/1-Timer portion of the module only (no MCB features).

928-COUNT2 and 928-COUNT4
Rear Panel

928-COUNT4
4-Counter/2-Timer portion of the module only (no MCB features).

MCB Specifications

(928 and 928-MCB Models)

ADC Successive-approximation type with sliding scale linearization.

Max Resolution 16,384 channels, software selectable as 16,384, 8,192, 4,096, 2,048, 1,024, and 512.

Dead Time Per Event 2 µs including memory transfer.

Integral Nonlinearity <+0.025% over the top 99% of the dynamic range.

Differential Nonlinearity <±1% over the top 99% of the dynamic range.

Gain Instability <+50 ppm/°C.

Dead-Time Correction Software selectable for extended Live-Time correction according to the Gedcke-Hale method or ZDT Live-Time corrections which monitors the counting rate and adjusts the dead-time for fluctuating counting rates.

Data Memory 512 kb.

Inputs and Outputs

ADC INPUT Accepts positive unipolar, positive gated integrator, or positive leading bipolar analog pulses in the dynamic range from 0 to +10 V; +12 V maximum; semi-Gaussian-shaped time constants from 0.25 to 30 µs, gated-integrator-shaped time constants from 3 to 30 µs, or delay-line-shaped with widths >0.25 µs. Z_{in} = 1 kΩ dc-coupled. No internal delay, BNC connector.

ADC GATE Optional TTL input. Computer selectable Coincidence mode, Anti-coincidence mode, or Off. Signal must occur prior to and extend 0.5-µs beyond the peak of the pulse; BNC connector. Z_{in} = 1 kΩ.

Optional TTL Input Computer selectable Coincidence mode, Anti-coincidence mode, or Off. Signal must occur prior to and extend 0.5-µs beyond the peak of the pulse; BNC connector. Z_{in} = 1 kΩ.

PUR Pile-up rejection input; accepts TTL signal; signal must occur prior to peak detect. Z_{in} = 1 kΩ. BNC connector.

BUSY Busy input used by live-time correction circuits. Accepts TTL signal; signal must occur prior to peak detect. Z_{in} = 1 kΩ. BNC connector.

Presets

Presets may be set which will automatically stop MCB acquisitions. In addition, the Counters and Timers may be configured to start and stop in synchronization with the MCB.

Real Time/Live Time Multiples of 20-ms.

Region of Interest Peak count/Integral count.

Data Overflow Terminates data collection when any channel exceeds $2^{31}-1$.

Peak Uncertainty Stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the specified value.

Nuclide MDA Stops data collection when the value of the Minimum Detectable Activity (MDA) for a user-specified MDA reaches the specified value.

Counter/Timer/Rate Meter Specifications

(928, 928-COUNT2, 928-COUNT4)

Maximum Counting Rate 200 MHz.

Number of Counters 4 (2 in 928-COUNT2).

Number of Timers 2 (1 in 928-COUNT2).

Count Capacity 32-bits.

Pulse Pair Resolution 7 ns.

Inputs and Outputs

Counter Input 1, 2, 3, 4 Fast analog signal input accepts analog or digital pulses up to ±5 V in amplitude on a front-panel BNC connector. Pulses are counted as they cross the discriminator threshold. Computer selection of triggering on either positive or negative slope. Threshold is computer adjustable from –1.6 V to +3 V in steps of 1.5 mV (minimum pulse 30 mV). Computer selection of either 50-Ω or 1000-Ω input impedance, dc-coupled. Minimum input pulse width is 3.5 ns at the discriminator threshold. Maximum counting rate is 200 MHz.

Input 1, 2, 3, 4, 5, 6 Rear panel BNC inputs which accept TTL input signals. Each input is considered low when <0.8 V and high when >2 V. Input impedance is 1000 Ω to ground. Each input may be configured as described earlier in the Counter and Timer Setup.

Output 1, 2 Rear panel BNC outputs which act as general purpose TTL outputs. Low is indicated by <0.4 V. High is indicated by >+2.4 V. The outputs can drive 50 Ω. The outputs may be configured under software control as described previously.

Counter/Timer Software Control

Readout Control Timer and Counter live values may be polled at any time from the computer. In addition, each Counter or Timer has a 128 word Fifo (First in first out) buffer which holds the previous final Counter result at the moment the Counter or Timer was reset. Using the Fifo, Counters can be configured to be reset once a Timer reaches a preset value. The current Counter value is stored in its Fifo so that the computer can read successive values without the fear of losing results because of sluggish computer operation.

Electrical and Mechanical

USB-2.0 Standard USB connection via a supplied 10-ft. cable.

Indicators

ADC Indicates activity for ADC-1.

Counter Illuminated if any of the four Counters is actively counting.

MCB Software Controls
(Operates with included MAESTRO — see data sheet for details.)

ADC LLD Computer controlled from 0 to 100% full scale.

ADC ULD Computer controlled from 0 to 100% full scale.

Live Time Correction Gedcke-Hale, ZDT.

Gate Coincidence, Anti-Coincidence, Off.

Power Required: +6 V, 350 mA; –6 V, 225 mA; +12 V, 100 mA; –12 V, 100 mA.

Weight

Net 0.9 kg (2 lb).

Shipping 2.25 kg (5 lb).

Dimensions NIM-standard, single-wide 3.43 x 22.13 cm (1.35 x 8.714 in.) front panel per DOE/ER0457T.

Ordering Information

Model	Description
928	Combination MCB/Quad Counter/Dual Timer module. Includes MAESTRO MCA Emulation software, Front Panel software and USB cable.
928-MCB	MCB portion of the instrument only (No Counter/Timer features). Includes MAESTRO MCA Emulation software, and USB cable.
928-COUNT2	2-Counter/1-Timer portion of the module only (No MCB features). Includes Front Panel software and USB cable.
928-COUNT4	4-Counter/2-Timer portion of the module only (No MCB features). Includes Front Panel software and USB cable.
Options	
A11-B32	UMCBI Programmer's Toolkit

Operating Overview

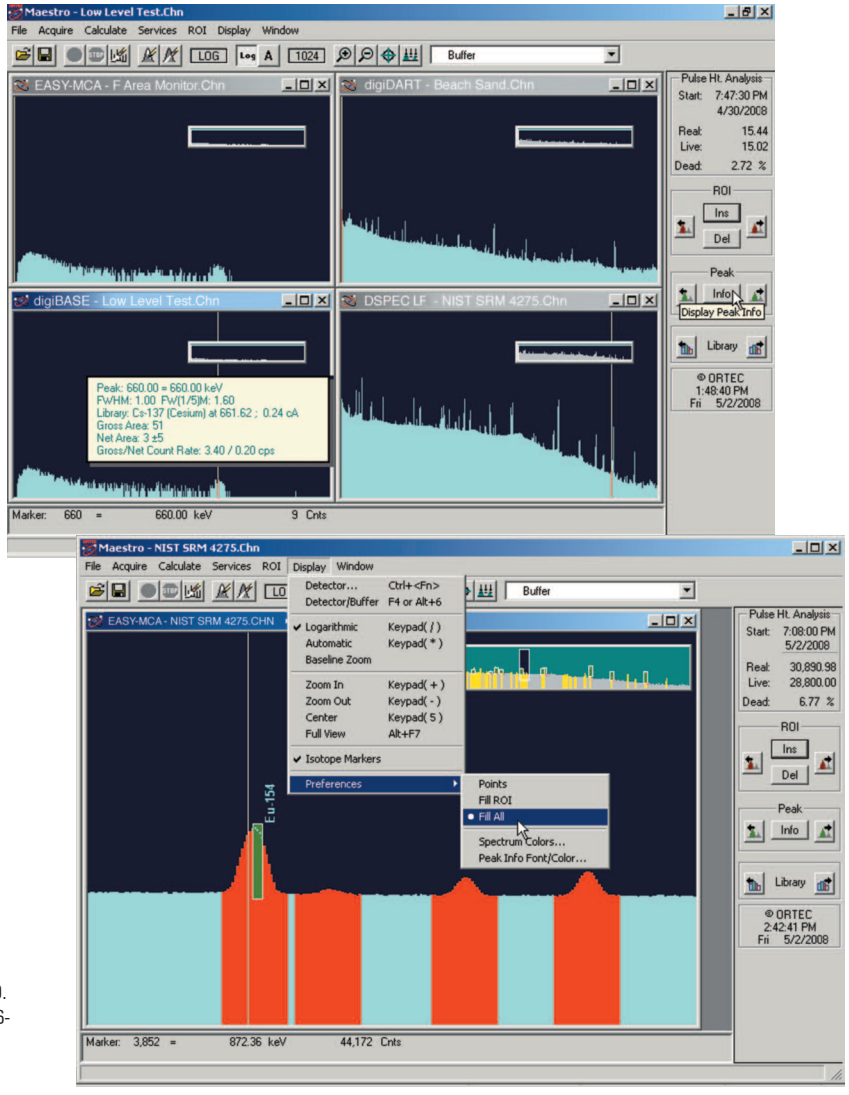
MAESTRO MCA Emulation Software (Models 928 and 928-MCB)

MAESTRO is an ORTEC *CONNECTIONS* product, providing industry leading advanced connectivity features within the Windows Network environment. Any networked ORTEC instrument can be controlled from a single PC over your existing Ethernet.

- Multi-Detector Interface
- Seamless Networking for Remote Detector Systems
- Secure Data with Personal Password Protection
- Advance Peak Analysis Features
- Complete Interactive Control of MCB Hardware Features

Advanced Features of MAESTRO

- Mariscotti fast peak search, with nuclide identification by library lookup
- Activity, net and gross areas (with uncertainty), centroid and shape for peaks
- Data protection with "detector locking" by name, not by workstation
- Comprehensive Job Streaming
- Integrated Local Area Network (LAN) support
- Single key or mouse button for:
  - Setting/deleting ROIs
  - Indexing to next ROI
  - Indexing to next peak
  - Indexing to next library energy
- Logarithmic and auto-scaling-linear vertical display
- True live display on any mix of MCBs
- Identical operation for local MCBs and remote MCBs

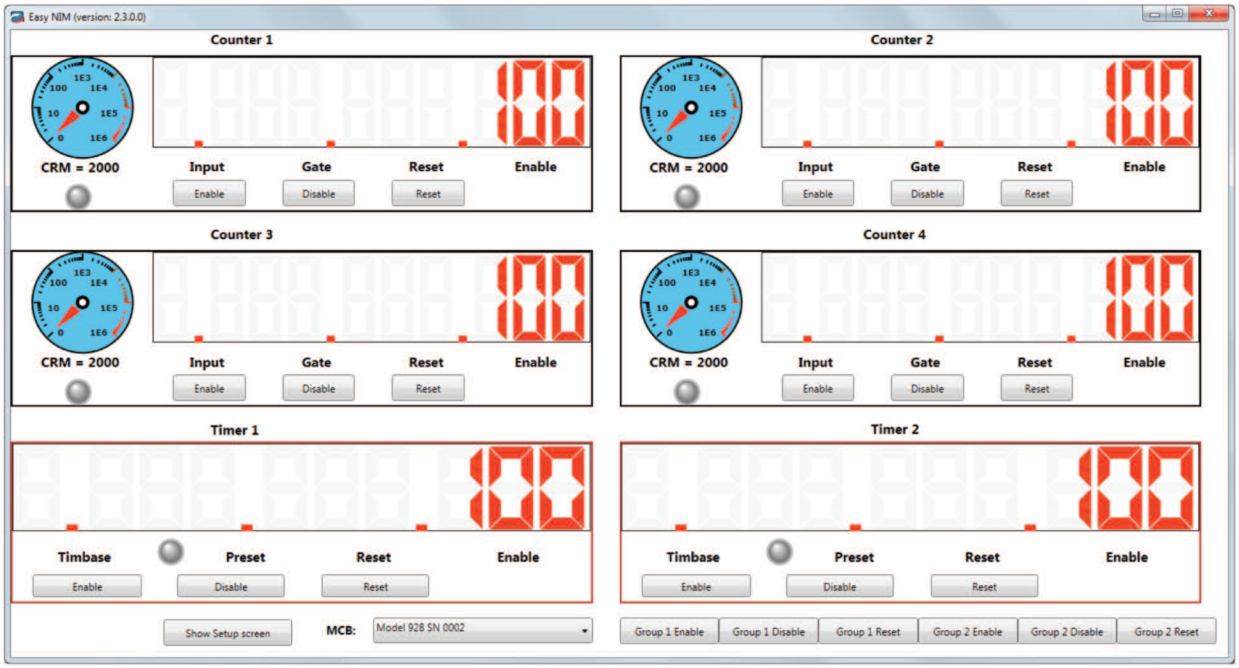


[1]Zero dead-time or loss free counting. ORTEC Psatent no. 6,327,549. See http://www.ortec-online.com/download/Application-Note-AN56-Loss-Free-Counting-Uncertainty-Analysis-Using-Innovative-Zero-Dead-Time-Technique.pdf

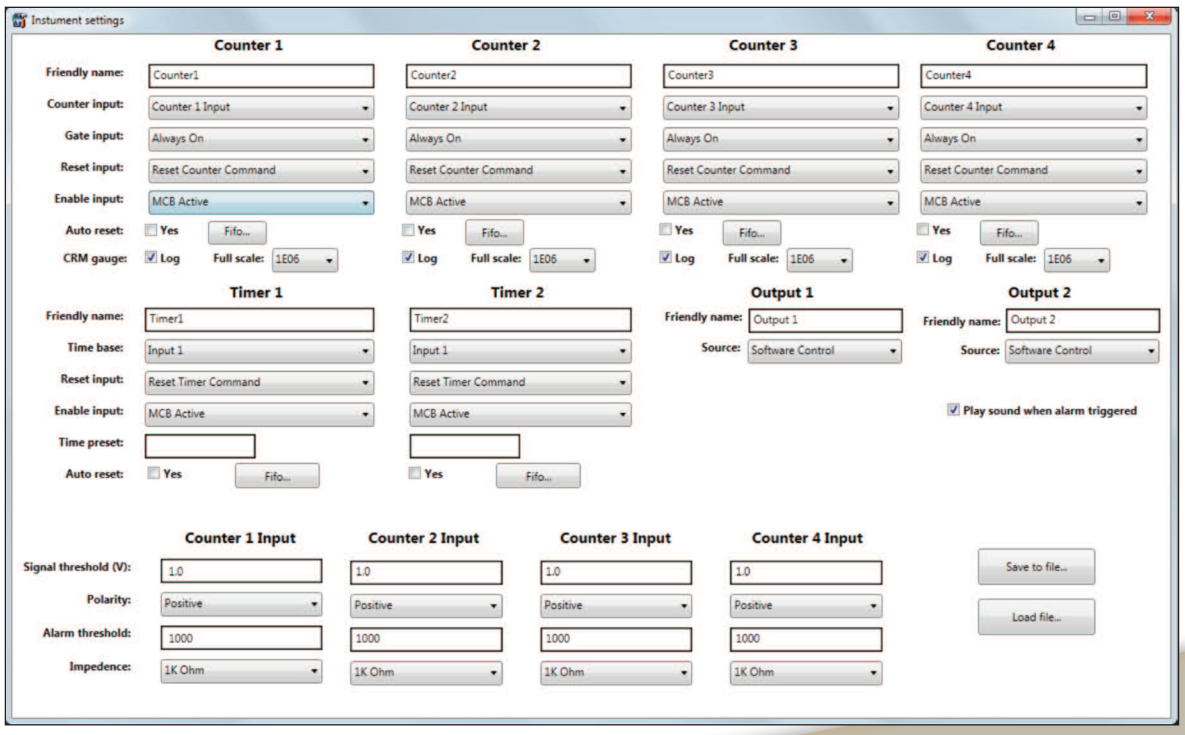
Counter/Timer/Rate Meter Section (Models 928, 928-COUNT2 and 928-COUNT4)

Each model allows internal configuration of the signals to simplify the setup of a measurement system. (For example, through the setup menu, one counter can be configured to count the overflow counts from another, or the MCA "acquire" signal may be used to gate a counter with no cabling needed.)

Front Panel Emulator: Counters 1–4 Main Display Detail



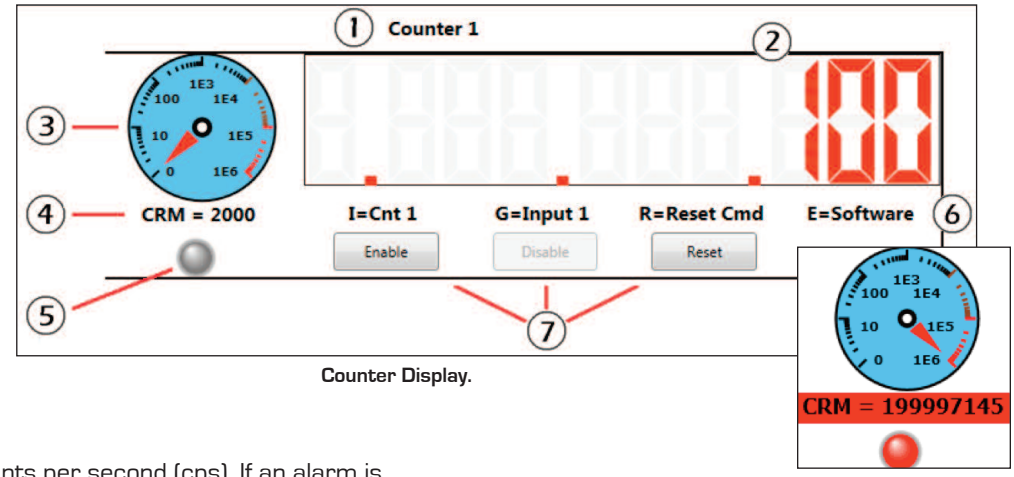
Main Screen Counter/Timer/Rate Meter Display.



Setup Screen for the Counter/Timer/Rate Meter.

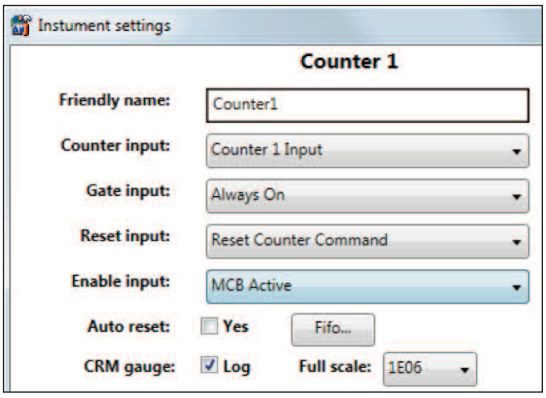
Counter Display Legend

1. Counter "Friendly name". Can be changed in the setup screen.
2. Counter value digital display. Maximum value is 4294967295.
3. Alarming Counter/Rate Meter. The analog meter can be set as logarithmic or linear. The alarm threshold is variable and can be set to create an audible and a hardware alarm signal for external equipment.



Counter Display.

4. Count Rate Meter (CRM), in counts per second (cps). If an alarm is triggered, this field will flash red. The count rate can be read from user written software.)
5. Data acquisition indicator. When counter is enabled, the "LED" blinks red.
6. Counter settings indicators. I = Counter input, G = Gate input, R = Reset input, E = Enable input.
7. Counter Enable, Disable, and Reset buttons.



Counters 1–4 Setup.

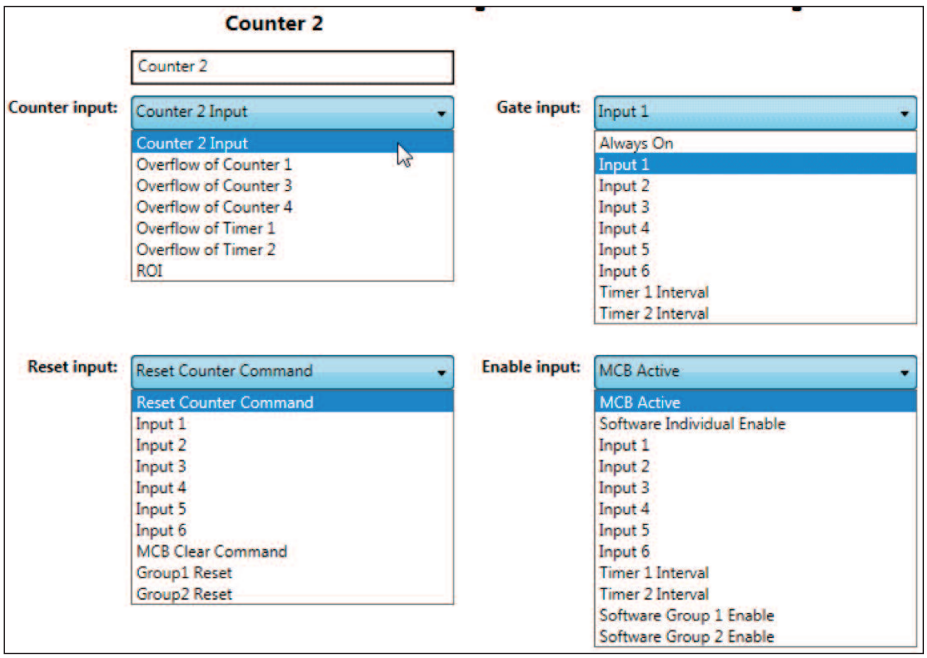
Counters 1–4 Setup and Options

Counter input: A counter input can be used simply as a pulse counter, or can count any of the internal signals on the list shown in the figure. If ROI is selected, the counter will register the counts occurring in the first (lowest energy) ROI set by the MAESTRO MCA software in the active MCA memory. This function is useful in peak count-rate monitoring (Model 928 only).

Gate input: The gate can be set as inactive (always on), connected to the interval signal from either of the timers, or controlled from any of the six front-panel inputs.

Reset input: A counter may be reset from the main screen by selecting the Reset Counters Command, a "clear MCB spectrum memory" command from the MCB (Model 928 only) with the MCB Clear Command reset, a signal from any of the six front-panel inputs, or the Group 1 or Group 2 reset signal.

Enable input: The Software Control option allows starting and stopping the counter from the main screen. The MCB Active option starts the counter when the MCB begins data acquisition (Model 928 only).

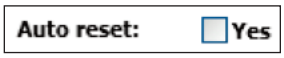


Counters 1–4 Setup Options.

Software Group n Enable (n = 1 or 2): Starts the specified counter when the corresponding "group enable" control is activated form the front panel.

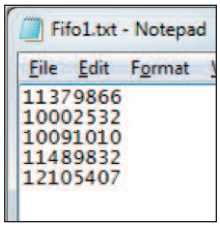
Enable Input Options.

Auto reset: When this box is marked, the counter counts up to overflow (4294967295 counts) then automatically resets to zero and continues to count up.



Auto Reset.

Fifo (first in first out buffer): Holds a maximum of 256 entries. The FIFO is designed for the "Continuous Mode" scenario where a timer interval is selected as the counter Gate input and Auto Reset is selected for both the counter and the timer.

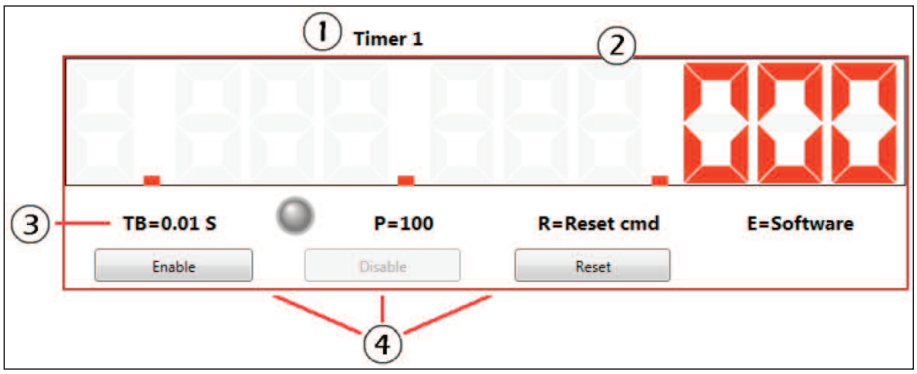


Fifo Contents Saved as Text File.

Timers Display

Timer Display Legend

1. User-defined timer Friendly name.
2. Timer value digital display. Maximum value is 4294967295.
3. Timer settings indicators. TB = Time base, P = Time preset, R = Reset input, E = Enable input.
4. Enable, Disable, and Reset buttons.



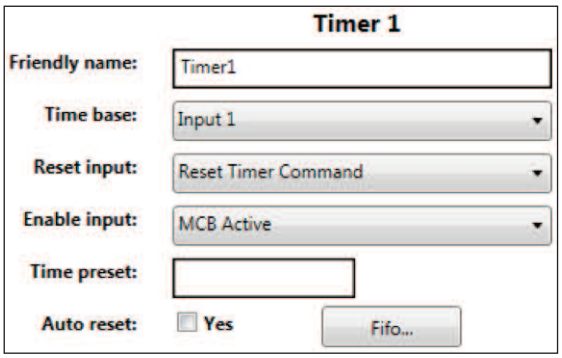
Timer Display.

Timers 1 and 2 Setup and Options

Time base: The time base clock can be derived from any of the external inputs 1–6, or set internally from the selections on the list.

Reset input: A counter may be reset from the main screen by selecting the Reset Counters Command, a "clear MCB spectrum memory" command from the MCB (Model 928 only) with the MCB Clear Command reset, a signal from any of the six front-panel inputs, or the Group 1 or Group 2 reset signal.

Enable input: Software Individual Enable starts the counter from the Easy NIM application main screen. Software Group n Enable (n = 1 or 2) starts all counters for the specified group from the main screen. **MCB Active** starts the counter when the MCB begins data acquisition (Model 928 only).

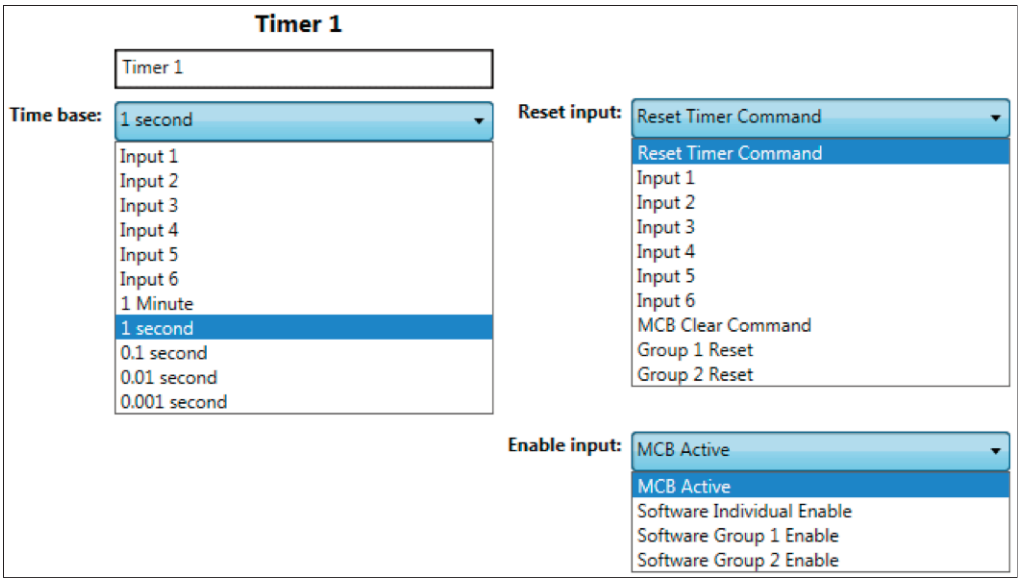


Timers 1–2 Setup.

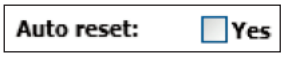
Time preset: Enter the duration of the event as a multiple of the currently selected Time base (e.g. a time base of 0.1 s and a time preset of 100, the timer interval will be 10 s).

Auto reset: When this box is marked, the timer counts up to its time preset then automatically resets to zero and continues to count up.

Fifo (first in first out buffer): Holds a maximum of 256 entries. The Fifo is designed for the "Continuous Mode" scenario where a timer interval is selected as the counter Gate input and Auto Reset is selected for both the counter and the timer.



Timers 1–2 Setup Options.



Auto Reset.

Fifo.

Counter/Timer Group Controls

These Enable/Disable/Reset buttons operate with the Group 1 and 2 enable and reset options on the Instrument settings screen. This makes it easy to control a group of counter/timer functions from a single front panel button. The use of the input and output functions allows the control of multiple counters from a single front panel button group.

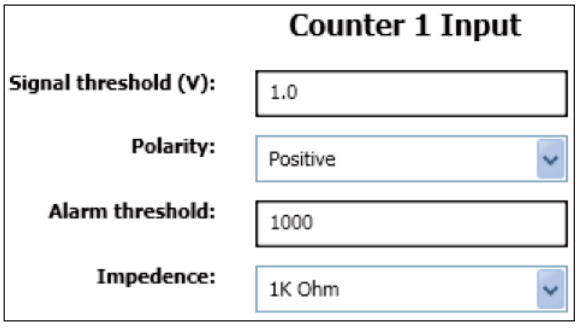
Counter/Timer Group Controls.

Output 1 and 2

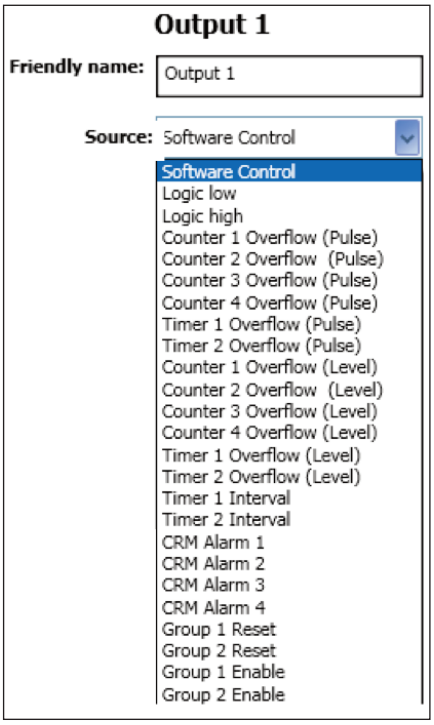
Output 1 and 2 do not appear on the software front panel. They may be configured to perform a variety of logic functions. The logic high and logic low states are included primarily to allow setting from user-programs.

Other Counter Input Settings

1. Signal threshold (V): the valid range is –1.6 V to 3.5 V.
2. Polarity: Positive or Negative.
3. Alarm threshold: if the CRM (count rate meter) exceeds this number, the alarm is triggered. When this occurs, the CRM number on the main screen will flash red and an alarm will sound. If the output is configured to CRM Alarm, then the output will be Logic high.
4. Impedance: Choice of 50Ω or 1000Ω.



Other Counter Input Settings.



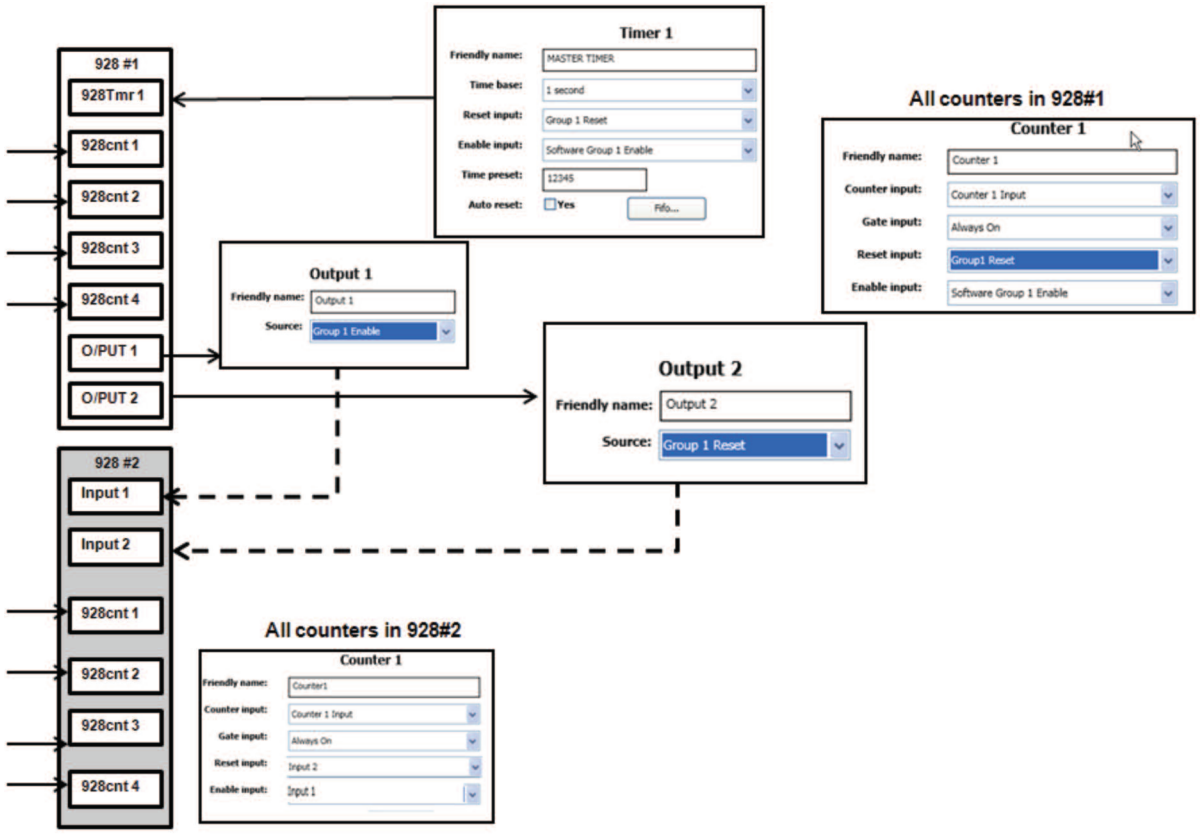
Output Setup.

Application Example:
Two 928 COUNT-4 Modules Configured to Operate as a Single 8-input Counter/Timer

As has been stated "the EASY-NIM 928 modules offer a highly flexible and efficient means of configuring experimental measurement systems". As an example, the figure below shows how two 928 COUNT-4 (or 928) modules can be configured to operate as a single 8-input counter/timer.

The group controls on the first 928 are used to control the entire measurement. The second 928 is controlled via the output 1 and 2 of the first unit through its own general purpose inputs 1 and 2.

EASY-NIM is a concept which makes such configurations "EASY"!



UMCBI Programmer's Toolkit with ActiveX Controls (optional)

The ORTEC EASY-NIM 928 suite of instruments are members of the ORTEC "*CONNECTIONS*" software architecture. *CONNECTIONS* is a unified scheme under which all instruments communicate. Under the *CONNECTIONS* scheme a single software component, the "UMCBI", is used to transmit and receive instrument commands and responses.

The UMCBI is the lowest level software component that ORTEC applications use to communicate with hardware. The UMCBI finds and establishes communication with ORTEC instruments that are directly connected to the computer, connected to other computers in the network, or freestanding. It handles all of the details of network communication.

The UMCBI handles the sending of commands to the hardware and the receipt of responses. The Command syntax of commands sent through the UMCBI conforms with the traditional NIM Digital Bus NIM/488 per DOE/ER-0457T (formerly NIM-GPIB) protocol[2] used for several years in all ORTEC MCB products.

In the case of the EASY-NIM 928 suite, the module itself uses these protocols; in certain other instrument the UMCBI translates to and from these protocols via a loadable driver, specific to that instrument. The syntax is simple, for example:

START_COUNTER n1 START_TIMER n1	Where n1 is the index of Counter 1 to 4 or Timer index 1 to 2.
STOP_COUNTER n1 STOP_TIMER n1	Where n1 is the index of Counter 1 to 4 or Timer index 1 to 2.

are the start and stop commands sent to the instrument counter and timer from a user program.

The optional toolkit has two options for programming. For programmers familiar with Dynamic Linked Libraries (DLLs), it provides DLLs and supplemental Windows application programming interfaces, which can be called from C, C++, or Visual Basic. For programmers using ActiveX controls, all the functionality can be accessed more conveniently through ActiveX methods, properties, and events. The ActiveX capability makes it easy to program the ORTEC products from LabVIEW (Version 5.1 or later), Visual C++, and Visual Basic. Simple example programs are supplied with both programming options.

A sample program for the 928 is provided, written in Visual Basic .NET.

An automatic configuration program is included. The program will search the network for hardware and produce a list, including the hardware type and the PC node to which it is connected. Also included is a Hardware Server program, which is the server for remote access to the hardware.

ORTEC-written and user-written software may be combined by using the ORTEC standard software to setup the hardware, followed by implementation of the special operations of the user-written application. For example, the included MAESTRO MCA software or the EASY-NIM front panel emulator can be used to configure the system and perform most of the interactive functions. The user-written application can then be used to handle the unique functions of the system.

[2]See "Standard NIM Digital Bus (NIM/488)," DOE/ER-0457T, U.S. NIM Committee, May 1990; Standard NIM Instrumentation System, NTIS, U.S. Department of Commerce, Springfield, Virginia 22161.

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