Model 550A
Single-Channel Analyzer
Operating and Service Manual

Printed in U.S.A.

ORTEC® Part No. 740260
Manual Revision B

1202

Advanced Measurement Technology, Inc.

a/k/a/ ORTEC®, a subsidiary of AMETEK®, Inc.

WARRANTY

ORTEC* warrants that the items will be delivered free from defects in material or workmanship. ORTEC makes no other warranties, express or implied, and specifically NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

ORTEC's exclusive liability is limited to repairing or replacing at ORTEC's option, items found by ORTEC to be defective in workmanship or materials within one year from the date of delivery. ORTEC's liability on any claim of any kind, including negligence, loss, or damages arising out of, connected with, or from the performance or breach thereof, or from the manufacture, sale, delivery, resale, repair, or use of any item or services covered by this agreement or purchase order, shall in no case exceed the price allocable to the item or service furnished or any part thereof that gives rise to the claim. In the event ORTEC fails to manufacture or deliver items called for in this agreement or purchase order, ORTEC's exclusive liability and buyer's exclusive remedy shall be release of the buyer from the obligation to pay the purchase price. In no event shall ORTEC be liable for special or consequential damages.

Quality Control

Before being approved for shipment, each ORTEC instrument must pass a stringent set of quality control tests designed to expose any flaws in materials or workmanship. Permanent records of these tests are maintained for use in warranty repair and as a source of statistical information for design improvements.

Repair Service

If it becomes necessary to return this instrument for repair, it is essential that Customer Services be contacted in advance of its return so that a Return Authorization Number can be assigned to the unit. Also, ORTEC must be informed, either in writing, by telephone [(865) 482-4411] or by facsimile transmission [(865) 483-2133], of the nature of the fault of the instrument being returned and of the model, serial, and revision ("Rev" on rear panel) numbers. Failure to do so may cause unnecessary delays in getting the unit repaired. The ORTEC standard procedure requires that instruments returned for repair pass the same quality control tests that are used for new-production instruments. Instruments that are returned should be packed so that they will withstand normal transit handling and must be shipped PREPAID via Air Parcel Post or United Parcel Service to the designated ORTEC repair center. The address label and the package should include the Return Authorization Number assigned. Instruments being returned that are damaged in transit due to inadequate packing will be repaired at the sender's expense, and it will be the sender's responsibility to make claim with the shipper. Instruments not in warranty should follow the same procedure and ORTEC will provide a quotation.

Damage in Transit

Shipments should be examined immediately upon receipt for evidence of external or concealed damage. The carrier making delivery should be notified immediately of any such damage, since the carrier is normally liable for damage in shipment. Packing materials, waybills, and other such documentation should be preserved in order to establish claims. After such notification to the carrier, please notify ORTEC of the circumstances so that assistance can be provided in making damage claims and in providing replacement equipment, if necessary.

CONTENTS

SAFETY INSTRUCTIONS AND SYMBOLS

This manual contains up to three levels of safety instructions that must be observed in order to avoid personal injury and/or damage to equipment or other property. These are:

DANGER Indicates a hazard that could result in death or serious bodily harm if the safety instruction is not observed.

WARNING Indicates a hazard that could result in bodily harm if the safety instruction is not observed.

CAUTION Indicates a hazard that could result in property damage if the safety instruction is not observed.

Please read all safety instructions carefully and make sure you understand them fully before attempting to use this product.

In addition, the following symbol may appear on the product:

ATTENTION–Refer to Manual

DANGER–High Voltage

Please read all safety instructions carefully and make sure you understand them fully before attempting to use this product.

SAFETY WARNINGS AND CLEANING INSTRUCTIONS

DANGER	Opening the cover of this instrument is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.

WARNING	Using this instrument in a manner not specified by the manufacturer may impair the protection provided by the instrument.

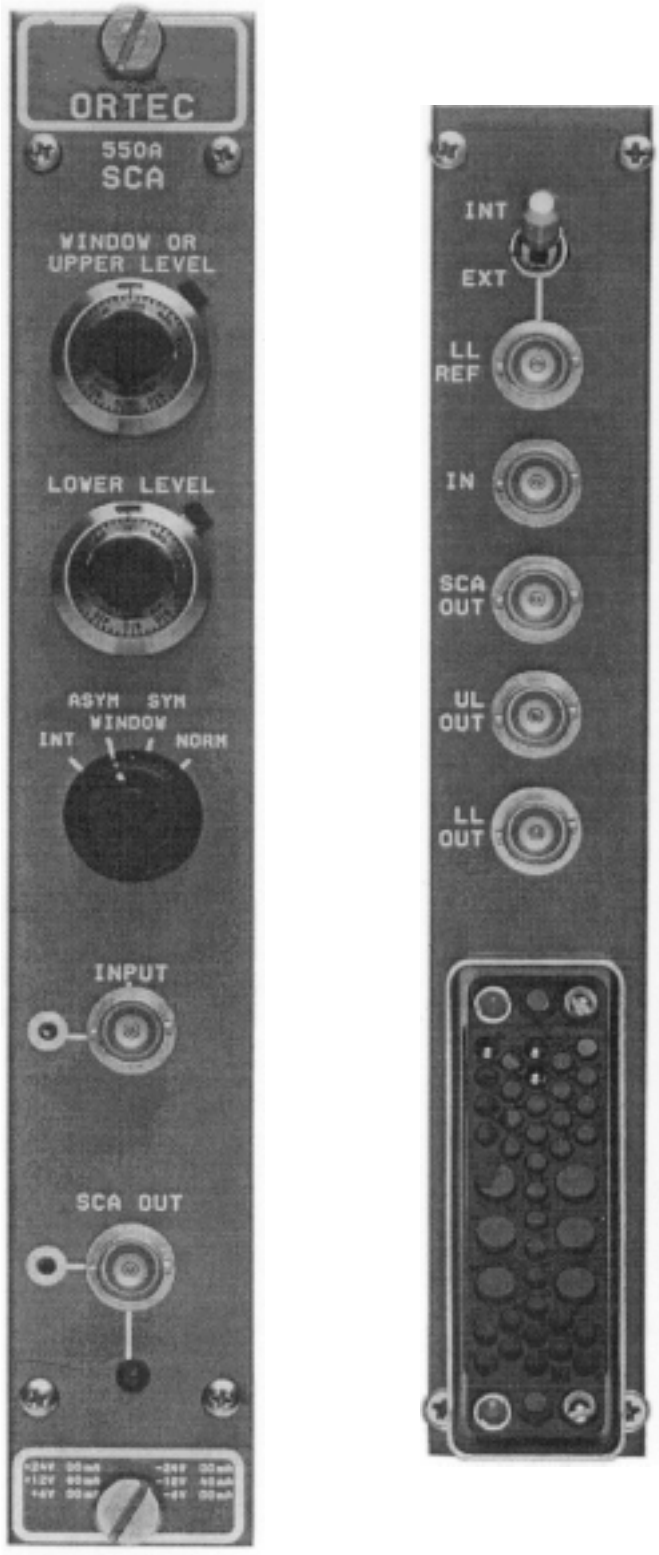
Cleaning Instructions

To clean the instrument exterior:

- Unplug the instrument from the ac power supply.
- Remove loose dust on the outside of the instrument with a lint-free cloth.
- Remove remaining dirt with a lint-free cloth dampened in a general-purpose detergent and water solution. Do not use abrasive cleaners.

CAUTION	To prevent moisture inside of the instrument during external cleaning, use only enough liquid to dampen the cloth or applicator.

- Allow the instrument to dry completely before reconnecting it to the power source.


ORTEC
550A
SCA
WINDOW OR
UPPER LEVEL
LOWER LEVEL
ASYM SYM
WINDOW
INT
NORM
INPUT
SCA OUT
INT
EXT
LL
REF
IN
SCA
OUT
UL
OUT
LL
OUT

ORTEC MODEL 550A
SINGLE-CHANNEL ANALYZER

1. DESCRIPTION

The ORTEC Model 550A Single-Channel Analyzer is ideally suited for selecting a range of output pulse amplitudes from a spectroscopy amplifier for subsequent counting on a ratemeter or a counter/timer. It provides the excellent stability, resolution, and dynamic range needed for measurements with high-resolution-germanium and silicon detectors. These same features provide more than adequate performance with scintillation counters, proportional counters, and ionization chambers. The entire instrument is dc-coupled to ensure that the discriminator levels are not affected by changes in the counting rate, even at very high counting rates.

The versatility of the Model 550A is enhanced by four basic operating modes. In the INTEGRAL mode, all input pulse amplitudes above the lower level produce an SCA output logic pulse. This mode is useful for counting all pulses above the noise level, or above a well-defined lower amplitude limit. The INTEGRAL mode can also be used for leading edge timing, or pulse routing logic. In the NORMAL mode, the upper and lower level discriminators are independently variable over the full +20 mV to +10 V range. The SCA output is generated only for pulse amplitudes that occur between the upper and lower levels. This mode is useful when a wide range of pulse heights must be selected for counting. In the ASYMMETRIC WINDOW mode, the upper level dial becomes a window width control with a 0 to +1 V range. The lower level dial controls the lower limit of the window over a +20 mV to +10 V range. Pulse amplitudes between the upper and lower limits of the window produce an SCA output. This mode is useful when a narrow range of pulse heights must be selected. In the SYMMETRIC WINDOW mode, the upper level dial still controls the window width over the range of 0 to +1 V, but the lower level dial sets the position of the **center** of the window over a range of +20 mV to +10 V. The SYMMETRIC WINDOW mode is useful when the window has been centered on a peak in the spectrum and it is desirable to widen (or narrow) the window to accept more (or less) of the peak width.

Rear-panel connectors provide separate outputs for the upper and lower level discriminators. These logic outputs are generated at the instant the input signal exceeds the corresponding discriminator level. The SCA output logic pulse is generated when the input signal falls through the lower level threshold.

An external input for the lower level setting is switch selectable to allow recording the entire pulse-height spectrum utilizing a scanning technique. A narrow window is selected, and an external voltage source is employed to slowly scan the lower level through the 0 to 10 V range. A ratemeter counts the SCA output and draws the spectrum on a strip chart recorder.

2. SPECIFICATIONS

2.1. PERFORMANCE

DYNAMIC RANGE 500:1.

PULSE-PAIR RESOLVING TIME 100 ns plus output pulse width.

THRESHOLD TEMPERATURE SENSITIVITY <0.01% of full scale per °C, from 0 to 50°C, using a NIM Class A power supply (referenced to -12 V).

WINDOW WIDTH CONSTANCY ≤±0.1% variation of full-scale window width over the linear range of 5 mv to 10 V.

DISCRIMINATOR NONLINEARITY ≤±0.25% of full scale for both discriminators.

2.2. INDICATORS

SCA OUT LED Front-panel LED flashes whenever an SCA output pulse is generated.

2.3. CONTROLS

WINDOW OR UPPER LEVEL Front-panel, 10-turn, locking dial determines the window width (0 to 1 V) in the WINDOW modes, or the upper level threshold (0 to +10V) in the NORMAL and INTEGRAL modes.

LOWER LEVEL Front-panel, 10-turn, locking dial determines the threshold setting (+20 mV to +10 V) for the lower level discriminator when the rear-panel LL REF switch is in the INT position. The LOWER LEVEL control is disabled when the EXT position is selected on the rear-panel LL REF switch.

INT, ASYM WINDOW, SYM WINDOW, NORM Front-panel, four-position rotary switch selects one of four operating modes:

INT In the INTEGRAL mode, the lower level and upper level are independently adjustable from +20 mV to +10 V. The SCA OUT is generated for all pulse amplitudes exceeding the lower level threshold.

NORM In the NORMAL mode, the lower level and upper level are independently adjustable from +20 mV to +10 V. The SCA OUT is generated for pulse amplitudes which exceed the lower level threshold, but do not exceed the upper level threshold.

ASYM WINDOW In the ASYMMETRIC WINDOW mode, the lower limit of the window is adjustable from +20 mV to +10 V using the LOWER LEVEL dial. The WINDOW dial adjusts the width of the window from 0 to 1 V. The SCA OUT is generated for pulse amplitudes between the upper and lower limits of the window.

SYM WINDOW In the SYMMETRIC WINDOW mode, the center of the window is adjustable from +20 mV to +10 V using the LOWER LEVEL dial. The WINDOW dial adjusts the width of the window from 0 to 1 V. The SCA OUT is generated for pulse amplitudes between the upper and lower limits of the window.

INT/EXT LL. REF A rear-panel locking toggle switch selects either the front-panel LOWER LEVEL dial (INT position), or the rear-panel LL REF input (EXT position) for controlling the lower level threshold.

2.4. INPUTS

INPUT Front-panel BNC connector accepts unipolar or bipolar linear signals for pulse amplitude selection in the range of +20 mV to +10 V. The minimum input pulse width is 100 ns. The maximum amplitude of signal plus dc offset is ±12 V. Input impedance is approximately 1000 Ω. Front-panel test point wired to the INPUT connector through a 470-Ω resistor.

IN Rear-panel BNC connector identical to INPUT connector.

LL REF Rear-panel BNC connector accepts a dc voltage from an external source for controlling the lower level threshold when the INT/EXT LL REF switch is in the EXT position. The input range of -20 mV to -10 V corresponds to a lower level threshold range of +20 mV to +10 V. The input is overload protected to ±15 V.

2.5. OUTPUTS

SCA OUT Front- and rear-panel BNC connectors provide a NIM-standard, positive logic pulse output: nominally +5 V amplitude and 500-ns width. Output impedance <15 Ω. Front- and rear-panel outputs have separate output drivers. The output pulse occurs when the trailing edge of the linear input pulse crosses the lower level threshold. See description under CONTROLS for output logic modes. Front- panel test point wired to the SCA OUT connector through a 470-Ω resistor.

LLOUT Rear-panel BNC connector provides a NIM-standard, positive logic pulse output: nominally +5 V amplitude and 500-ns width. Output impedance <15 Ω. The output pulse occurs when the leading edge of the linear input pulse crosses the lower level threshold (INT or NORMAL modes), or the lower limit of the window (WINDOW modes).

UL OUT Rear-panel BNC connector provides a NIM-standard, positive logic pulse output: nominally +5 V amplitude and 500-ns width. Output impedance <15 Ω. The output pulse occurs when the leading edge of the linear input pulse crosses the upper level threshold (INT or NORMAL modes), or the upper limit of the window (WINDOW modes).

2.6. ELECTRICAL AND MECHANICAL

POWER REQUIRED +12 V at 75 mA, -12 V at 35 mA.

WEIGHT
Net 0.9 kg (2.0 lb)
Shipping 2.3 kg (5.0 lb)

DIMENSIONS NIM-standard single-width module 3.43 X 22.13 cm (1.35 X 8.714 in.) front panel per TID-20893 (Rev).

2.7. ORDERING INFORMATION

To order, specify:

Model 550A Single-Channel Analyzer

3. INSTALLATION

The Model 550A contains no internal power supply, but is used in conjunction with an ORTEC 4001 Series NIM Bin and 4002 Series Power Supply, which is intended for rack mounting. If vacuum tube equipment or any other source of heat is operated in the same rack, there must be sufficient cooling air circulated to prevent any localized heating of the Model 550A. The temperature of equipment mounted in racks can easily exceed the recommended maximum unless precautions are taken. The Model 550A should not be subjected to temperatures in excess of 50°C (120° F).

When using the Model 550A outside an ORTEC 4001 Series NIM Bin and 4002 Series Power Supply, be sure that the power extension cable in use properly accounts for the power supply grounding circuits that are provided according to the recommended DOE standards outlined in TID-20893 (Rev). Both high-quality and power-return ground connections are provided to ensure proper reference voltage feedback into the power supply, and these must be preserved in remote cable installations. Be careful also to avoid ground loops when the module is operated outside the bin.

3.1. CONNECTION TO POWER

Turn off the Bin and Power Supply when inserting or removing modules.

3.2. CONNECTION FROM LINEAR AMPLIFIERS

Either of two inputs can be used for the analog signals that are furnished from a linear amplifier. Either input accepts positive unipolar or bipolar

pulses, but only the positive signal lobe will be analyzed. When coaxial cables longer than about 4 ft are connected to the Model 550A input, cable termination may be necessary to prevent reflections from corrupting the signal to be analyzed. In this situation, terminate the cable in its characteristic impedance at the Model 550A input connector. The input operating range is from +20 mV to +10 V, and is compatible with NIM linear and biased amplifiers.

3.3. OUTPUT CONNECTIONS

The logic output pulses generated by the Model 550A are available from both front- and rear-panel BNC connectors for convenience when installing the Model 550A in a system. When the Model 550A is used in the NORMAL or WINDOW modes, a pulse from the SCA output means that the input signal amplitude is large enough to trigger the lower-level discriminator but not large enough to trigger the upper-level or window discriminator. When the Model 550A is in the INTEGRAL mode, an SCA output pulse means that the input signal amplitude is large enough to trigger the lower-level discriminator.

Separate logic outputs are available on the rear panel to indicate the time at which the leading edge of the input signal triggered the level discriminators. These outputs can be used to monitor the discriminator levels during adjustment, counted in external scalers, to provide subgroup routing in a multichannel analyzer, or for other applications as desired.

Each logic output is a NIM-standard slow-positive pulse that is compatible with all ORTEC instruments. The impedance of each output is sufficiently low to drive as many as ten 1000 Ω inputs in parallel.

3.4. LOWER LEVEL REFERENCE INPUT

If the toggle switch on the rear panel of the Model 550A is set to EXT, the front-panel Lower Level control is disabled and the reference level for the lower-level discriminator must be supplied through the adjacent LL REF connector. An input of 0 to -10 V through this connector corresponds directly to a range of 0 to +10 V for the lower-level discriminator threshold. It a signal is connected to the LL REF connector when the INT/EXT switch is in the INT position, the signal through the connector is ignored.

4. OPERATING INSTRUCTIONS

After the Model 550A has been installed in a system according to the installation information in Section 3, the operating mode can be selected and the discriminator thresholds can be adjusted as required for each application.

Figure 4.1 illustrates the timing relationships that will be effective in the Model 550A for each of two possible input pulse conditions. One is a pulse that exceeds the lower-level threshold without exceeding the upper level, and the other is a pulse that exceeds both thresholds. If the front-panel rotary switch selects the INTEGRAL mode, an SCA output pulse is generated when the trailing edge of each input pulse crosses the lower-level threshold. If the NORMAL, SYMMETRIC WINDOW, or

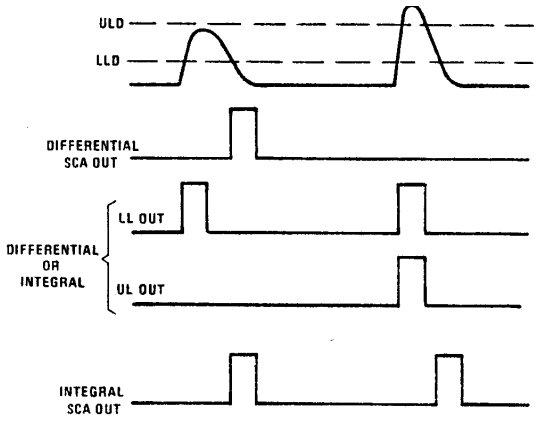


Fig. 4.1. Timing Relationships for Input and Output Pulses.

ASYMMETRIC WINDOW mode is selected, an SCA output pulse is generated only by the pulse which did not exceed the upper threshold or window width. For any of the operating modes, the LL OUT and UL OUT pulses are generated when the leading edge of the input signal crosses the respective threshold.

The lower-level threshold is supplied either by the front-panel Lower Level control or by an external source through the rear-panel LL REF connector, depending on the position of the toggle switch on the rear panel. In either case, the range of the threshold is from 0 to +10 V, referred to the analog input pulse.

The range of the upper-level threshold is determined by the operating mode selected by the front-panel rotary switch. In the INTEGRAL or NORMAL mode, the threshold range is from 0 to +10 V. In the ASYMMETRIC WINDOW mode, the range is from 5 mV to 1 V above the lower-level threshold. In the SYMMETRIC WINDOW mode, the upper-level threshold (window width) can be adjusted over the range of ±2.5 to ±500 mV, but it is always symmetrical about the lower-level threshold.

5. MAINTENANCE AND CALIBRATION

5.1. GENERAL

The basic performance of the Model 550A Single-Channel Analyzer can be inferred from its operating responses.

5.2. FACTORY REPAIR

This instrument can be returned to ORTEC for service and repair at a nominal cost. Our standard procedure that ensures the same quality control and checkout procedures used for a new instrument are used for repairs. Always contact the Customer Service Department at ORTEC (865-482-4411) to obtain the required Return Authorization Number before returning an instrument for repair. To minimize delays, please include the Return Authorization Number on the address label and on the package itself.

5.3. TABULATED TEST POINT VOLTAGES

The voltages given in Table 5.1 are intended to indicate typical dc levels that can be measured on the printed circuit board. In some cases the circuit will perform satisfactorily even though some voltages may differ slightly from the listed values due to component tolerances. The tabulated voltages are intended to serve as an aid in troubleshooting and should not be interpreted as absolute values.

All voltages in Table 5.1 were measured with no input signal and with the front-panel mode switch set for the INTEGRAL mode.

Table 5.1. Typical dc Voltages.

Location	Voltage	Location	Voltage	Location	Voltage
R52-C23 junction	−5.0	Q7B	0.0	IC4(13)	3.7
R64-C33 junction	−5.0	Q7C	0.1	IC4(2)	5.0
Q1B	0.0	Q7E	0.1	IC4(1)	0.0
Q1C	0.1	Q5B	0.0	IC4(12)	5.0
Q1E	0.1	Q5C	0.1	IC4(9)	0.0
Q3B	0.0	Q5E	0.1	IC4(8)	5.0
Q3C	0.1	IC1(3)	0.0	IC4(3)	0.0
Q3E	0.1	IC1(9)	0.2	IC6(3)	0.0
				IC6(9)	0.2

Bin/Module Connector Pin Assignments For Standard Nuclear Instrument Modules per DOE/ER-0457T.

Pin	Function	Pin	Function
1	+3 V	23	Reserved
2	- 3 V	24	Reserved
3	Spare bus	25	Reserved
4	Reserved bus	26	Spare
5	Coaxial	27	Spare
6	Coaxial	*28	+24 V
7	Coaxial	*29	- 24 V
8	200 V dc	30	Spare bus
9	Spare	31	Spare
10	+6 V	32	Spare
11	- 6 V	*33	117 V ac (hot)
12	Reserved bus	*34	Power return ground
13	Spare	35	Reset (Scaler)
14	Spare	36	Gate
15	Reserved	37	Reset (Auxiliary)
*16	+12 V	38	Coaxial
*17	- 12 V	39	Coaxial
18	Spare bus	40	Coaxial
19	Reserved bus	*41	117 V ac (neutral)
20	Spare	*42	High-quality ground
21	Spare	G	Ground guide pin
22	Reserved		

Pins marked (*) are installed and wired in ORTEC's 4001A and 4001C Modular System Bins.