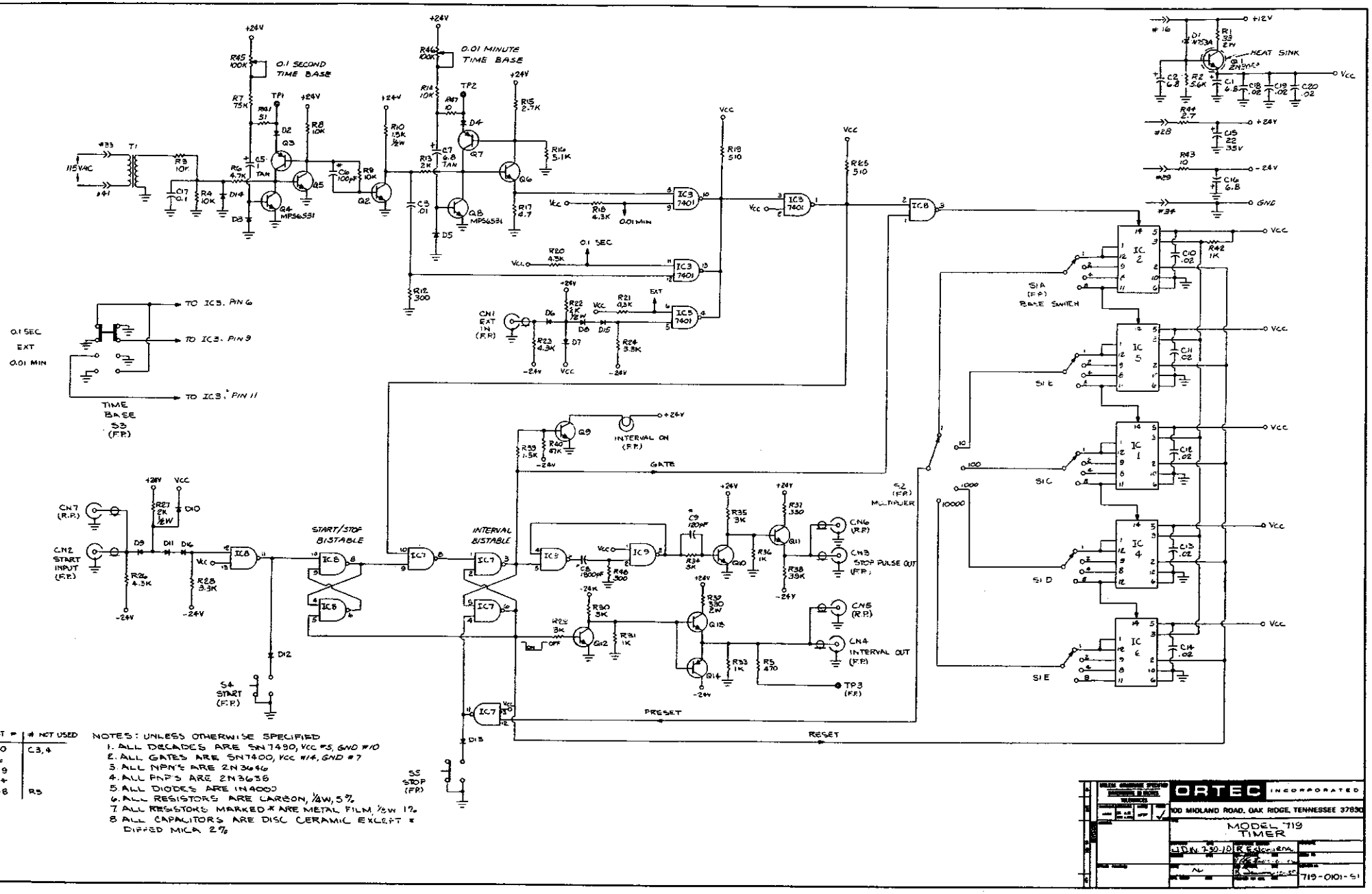
ORTEC

Model 719
Timer

Operating and Service Manual

Printed in U.S.A.

1143 02C 0573 03



LAST #	# NOT USED
C.20	C3, 4
IC.16	
IC 9	
Q14	
R48	R5

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL DECADES ARE SN7490, Vcc #5, GND #10
2. ALL GATES ARE SN7400, Vcc #14, GND #7
3. ALL NPN'S ARE 2N3646
4. ALL PNP'S ARE 2N3638
5. ALL DIODES ARE IN4002
6. ALL RESISTORS ARE CARBON, ¼W, 5%
7. ALL RESISTORS MARKED * ARE METAL FILM, ½W 1%
8. ALL CAPACITORS ARE DISC CERAMIC EXCEPT * DIPPED MICA 2%

ORTEC INCORPORATED
100 MIDLAND ROAD, OAK RIDGE, TENNESSEE 37830
MODEL 719 TIMER
719-0101-S1

ORTEC 719 TIMER

Manual Change Sheet

ECN 719-4
October 2, 1973

Add the following items to the Parts List on pages 11 and 13.

C21	9055 40846	0.1 μF	20%	50V Disc		80183	#C023K101F104M	SPR
R49	9015 40221	620Ω	1/4W	5%	C	01121	CB ABC	

On schematic 719-0101-S1, add C21 and R49 in series with each other from IC3-1 to the base of Q6.

The transistor types installed in your instrument may differ from those shown in the schematic diagram. In such cases, necessary replacements can be made with either the type shown in the diagram or the type actually used in the instrument.

TABLE OF CONTENTS

BIN/MODULE CONNECTOR PIN ASSIGNMENTS FOR AEC STANDARD NUCLEAR INSTRUMENT MODULES PER TID-20893

Pin	Function	Pin	Function
1	+3 volts	23	Reserved
2	−3 volts	24	Reserved
3	Spare Bus	25	Reserved
4	Reserved Bus	26	Spare
5	Coaxial	27	Spare
6	Coaxial	*28	+24 volts
7	Coaxial	*29	−24 volts
8	200 volts dc	30	Spare Bus
9	Spare	31	Spare
*10	+6 volts	32	Spare
*11	−6 volts	*33	115 volts 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 volts	38	Coaxial
*17	−12 volts	39	Coaxial
18	Spare Bus	40	Coaxial
19	Reserved Bus	*41	115 volts ac (Neut.)
20	Spare	*42	High Quality Ground
21	Spare	G	Ground Guide Pin
22	Reserved		

Pins marked (*) are installed and wired in ORTEC 401A and 401B Modular System Bins.
Pins marked (*) and (**) are installed and wired in EG&G/ORTEC–HEP M250/N and M350/N NIMBINS.

LIST OF FIGURES

Replaceable Parts List (continued)

REFERENCE DESIGNATOR	ORTEC PART NO.	DESCRIPTION	MFR.	MFR. PART NO.
719-0200	5007 46530			
cont'd.				
R34	9015 40235	3 K 1/4W 5% C	01121	CB ABC
R35	9015 40235	3 K 1/4W 5% C	01121	CB ABC
R36	9015 40226	1 K 1/4W 5% C	01121	CB ABC
R37	9015 40216	330 Ω 1/4W 5% C	01121	CB ABC
R38	9015 40237	3.9 K 1/4W 5% C	01121	CB ABC
R39	9015 40229	1.5 K 1/4W 5% C	01121	CB ABC
R40	9015 40255	47 K 1/4W 5% C	01121	CB ABC
R41	9015 40271	51 Ω 1/4W 5% C	01121	CB ABC
R42	9015 40226	1 K 1/4W 5% C	01121	CB ABC
R43	9015 40202	10 Ω 1/4W 5% C	01121	CB ABC
R44	9015 43949	2.7 Ω 1/4W 5% C	01121	CB ABC
R45	9051 43786	100 K 1-T 10% Pot.	71450	#U-201 CTS
R46	9051 43786	100 K 1-T 10% Pot.	71450	#U-201 CTS
R47	9015 40202	10 Ω 1/4W 5% C	01121	CB ABC
R48	9015 40215	300 Ω 1/4W 5% C	01121	CB ABC

STANDARD WARRANTY FOR ORTEC INSTRUMENTS

ORTEC warrants its instruments other than preamplifier FET input transistors, vacuum tubes, fuses, and batteries to be free from defects in workmanship and materials for a period of twelve months from date of shipment provided that the equipment has been used in a proper manner and not subjected to abuse. Repairs or replacement, at ORTEC option, will be made on in-warranty instruments, without charge, at the ORTEC factory. Shipping expense will be to the account of the customer except in cases of defects discovered upon initial operation. Warranties of vacuum tubes and semiconductors made by their manufacturers will be extended to our customers only to the extent of the manufacturers' liability to ORTEC. Specially selected vacuum tubes or semiconductors cannot be warranted. ORTEC reserves the right to modify the design of its products without incurring responsibility for modification of previously manufactured units. Since installation conditions are beyond our control, ORTEC does not assume any risks or liabilities associated with methods of installation or with installation results.

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.

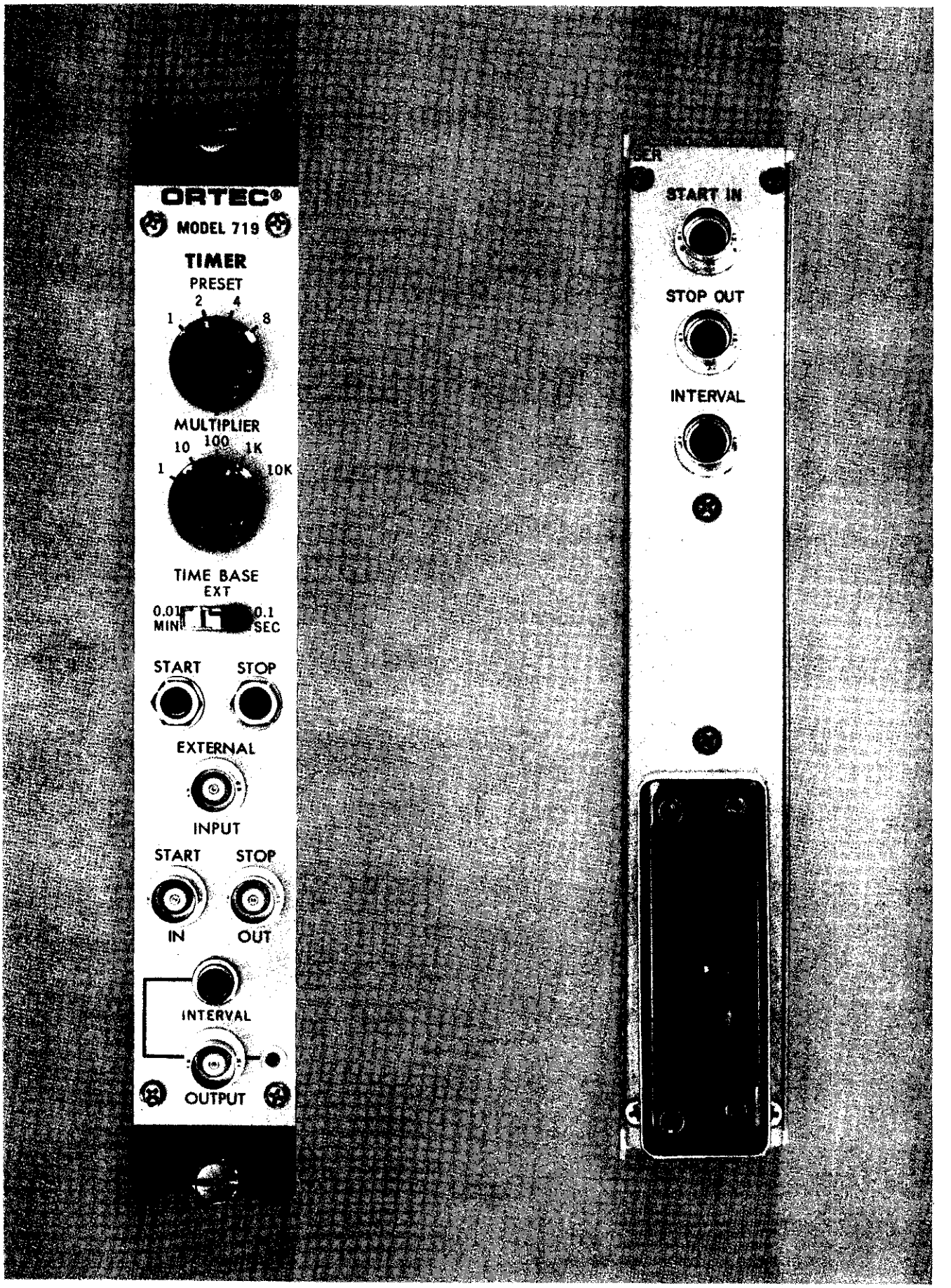
ORTEC must be informed in writing of the nature of the fault of the instrument being returned and of the model and serial numbers. Failure to do so may cause unnecessary delays in getting the unit repaired. Our standard procedure requires that instruments returned for repair pass the same quality control 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 nearest ORTEC repair center. Instruments 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 will be repaired at the standard charge unless they have been grossly misused or mishandled, in which case the user will be notified prior to the repair being done. A quotation will be sent with the notification.

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 we may assist in damage claims and in providing replacement equipment if necessary.

Replaceable Parts List (continued)

REFERENCE DESIGNATOR	ORTEC PART NO.	DESCRIPTION	MFR.	MFR. PART NO.
719-0200	5007 46530			
cont'd.				
Q1	9078 41070	Transistor - 2N3053	86684	RCA
Q2	9078 41086	Transistor - 2N3646	13715	FSC
Q3	9078 41075	Transistor - 2N3638	13715	FSC
Q4	9078 43655	Transistor - MPS6531	80211	MOT
Q5	9078 41086	Transistor - 2N3646	13715	FSC
Q6	9078 41086	Transistor - 2N3646	13715	FSC
Q7	9078 41075	Transistor - 2N3638	13715	FSC
Q8	9078 43655	Transistor - MPS6531	80211	MOT
Q9	9078 41086	Transistor - 2N3646	13715	FSC
Q10	9078 41086	Transistor - 2N3646	13715	FSC
Q11	9078 41086	Transistor - 2N3646	13715	FSC
Q12	9078 41086	Transistor - 2N3646	13715	FSC
Q13	9078 41086	Transistor - 2N3646	13715	FSC
Q14	9078 41075	Transistor - 2N3638	13715	FSC
R1	9020 42588	33 Ω 2W 5% C	01121	HB ABC
R2	9015 40240	5.6 K 1/4W 5% C	01121	CB ABC
R3	9015 40245	10 K 1/4W 5% C	01121	CB ABC
R4	9015 40245	10 K 1/4W 5% C	01121	CB ABC
R6	9015 40238	4.7 K 1/4W 5% C	01121	CB ABC
R7	9015 43951	75 K 1/4W 5% C	01121	CB ABC
R8	9015 40245	10 K 1/4W 5% C	01121	CB ABC
R9	9015 40245	10 K 1/4W 5% C	01121	CB ABC
R10	9017 40327	1.5 K 1/2W 5% C	01121	EB ABC
R11				
R12	9015 40215	300 Ω 1/4W 5% C	01121	CB ABC
R13	9015 40231	2 K 1/4W 5% C	01121	CB ABC
R14	9015 40245	10 K 1/4W 5% C	01121	CB ABC
R15	9015 40234	2.7 K 1/4W 5% C	01121	CB ABC
R16	9015 40239	5.1 K 1/4W 5% C	01121	CB ABC
R17	9015 40295	4.7 Ω 1/4W 5% C	01121	CB ABC
R18	9015 40267	4.3 K 1/4W 5% C	01121	CB ABC
R19	9015 40220	510 Ω 1/4W 5% C	01121	CB ABC
R20	9015 40267	4.3 K 1/4W 5% C	01121	CB ABC
R21	9015 40267	4.3 K 1/4W 5% C	01121	CB ABC
R22	9017 40351	2 K 1/2W 5% C	01121	EB ABC
R23	9015 40267	4.3 K 1/4W 5% C	01121	CB ABC
R24	9015 40236	3.3 K 1/4W 5% C	01121	CB ABC
R25	9015 40220	510 Ω 1/4W 5% C	01121	CB ABC
R26	9015 40267	4.3 K 1/4W 5% C	01121	CB ABC
R27	9017 40351	2 K 1/2W 5% C	01121	EB ABC
R28	9015 40236	3.3 K 1/4W 5% C	01121	CB ABC
R29	9015 40235	3 K 1/4W 5% C	01121	CB ABC
R30	9015 40235	3 K 1/4W 5% C	01121	CB ABC
R31	9015 40226	1 K 1/4W 5% C	01121	CB ABC
R32	9020 42582	330 Ω 2W 5% C	01121	HB ABC
R33	9015 40226	1 K 1/4W 5% C	01121	CB ABC


ORTEC®
MODEL 719
TIMER
PRESET
1
2
4
8
MULTIPLIER
1
10
100
1K
10K
TIME BASE
EXT
0.01 MIN
0.1 SEC
START
STOP
EXTERNAL
INPUT
START
STOP
IN
OUT
INTERVAL
OUTPUT
START IN
STOP OUT
INTERVAL

Replaceable Parts List (continued)

REFERENCE DESIGNATOR	ORTEC PART NO.	DESCRIPTION	MFR.	MFR. PART NO.
719-0200	5007 46530			
cont'd.				
C5	9065 40942	1 uf 20% 35V Tan.	80183	#150D105X0035A2 SPR
C6	9059 40886	100 pf 2% 500V D.M.	84171	#DM15-101G ARC
C7	9065 40948	6.8 uf 20% 35V Tan.	80183	#150D685X0035B2 SPR
C8	9059 47142	1800 pf 2% 500V D.M.	84171	#DM19-182G ARC
C9	9059 40909	120 pf 2% 500V D.M.	84171	#DM15-121G ARC
C10	9055 40849	0.02 uf 20% 500V Disc.	80183	#C023H501J203M SPR
C11	9055 40849	0.02 uf 20% 500V Disc.	80183	#C023H501J203M SPR
C12	9055 40849	0.02 uf 20% 500V Disc.	80183	#C023H501J203M SPR
C13	9059 40849	0.02 uf 20% 500V Disc.	80183	#C023H501J203M SPR
C14	9059 40849	0.02 uf 20% 500V Disc.	80183	#C023H501J203M SPR
C15	9065 40951	22 uf 20% 35V Tan.	80183	#150D226X0035R2 SPR
C16	9065 40948	6.8 uf 20% 35V Tan.	80183	#150D685X0035B2 SPR
C17	9055 40846	0.1 uf 20% 50V Disc.	80183	#C023K101F104M SPR
C18	9055 40849	0.02 uf 20% 500V Disc.	80183	#C023H501J203M SPR
C19	9055 40849	0.02 uf 20% 500V Disc.	80183	#C023H501J203M SPR
C20	9055 40849	0.02 uf 20% 500V Disc.	80183	#C023H501J203M SPR
D1	9080 44218	Diode - 1N753A	HAL	
D2	9080 41125	Diode - 1N4009	14433	ITT
D3	9080 41125	Diode - 1N4009	14433	ITT
D4	9080 41125	Diode - 1N4009	14433	ITT
D5	9080 41125	Diode - 1N4009	14433	ITT
D6	9080 41125	Diode - 1N4009	14433	ITT
D7	9080 41125	Diode - 1N4009	14433	ITT
D8	9080 41125	Diode - 1N4009	14433	ITT
D9	9080 41125	Diode - 1N4009	14433	ITT
D10	9080 41125	Diode - 1N4009	14433	ITT
D11	9080 41125	Diode - 1N4009	14433	ITT
D12	9080 41125	Diode - 1N4009	14433	ITT
D13	9080 41125	Diode - 1N4009	14433	ITT
D14	9080 41125	Diode - 1N4009	14433	ITT
D15	9080 41125	Diode - 1N4009	14433	ITT
D16	9080 41125	Diode - 1N4009	14433	ITT
IC-1	9079 44072	Int. Circuit - SN7490N	13715	FSC
IC-2	9079 44072	Int. Circuit - SN7490N	13715	FSC
IC-3	9079 44074	Int. Circuit - SN7401N	13715	FSC
IC-4	9079 44072	Int. Circuit - SN7490N	13715	FSC
IC-5	9079 44072	Int. Circuit - SN7490N	13715	FSC
IC-6	9079 44072	Int. Circuit - SN7490N	13715	FSC
IC-7	9079 44073	Int. Circuit - SN7400N	13715	FSC
IC-8	9079 44073	Int. Circuit - SN7400N	13715	FSC
IC-9	9079 44073	Int. Circuit - SN7400N	13715	FSC

ORTEC 719 TIMER

1. DESCRIPTION

1.1 PURPOSE

The ORTEC 719 Timer is a single-width NIM module that measures and indicates a timing interval based on the power line frequency. It furnishes two output signals for this purpose: an Interval signal that can be used to gate a counter or a counting system on through a timing interval and a Stop signal that is provided at the end of each timing interval.

A timing interval is defined as the elapsed time from synchronization after a Start signal until a Preset number has been counted in the 719. The Preset number is selected by two front-panel switches at 1, 2, 4, or 8 times the decade Multiplier, for a full range of 1 through 80 000 counts. The time increments that are counted can be either 0.1 second or 0.01 minute and are selected with a front-panel switch.

For greater flexibility the pulses that are counted can be furnished from an external source instead of the internal time base. An external pulse source can furnish any input rate up to 10 MHz, and the 719 then operates as a preset prescaler for any number of input pulses from 10 through 80 000.

1.2 OPERATION

When the 719 is turned on initially, the Stop switch on the front panel can be pressed to reset the counting register to zero and to inhibit it from counting. Then the counting interval can be started either by a signal through a front- or rear-panel connector or by pressing the Start switch on the front panel. The source of pulses to be counted can be selected at any time, but will be made logically during a Stop period.

The start of each counting interval will be synchronized on the first pulse that is furnished after the Start signal. Normal counting will then proceed until the counting register reaches the selected preset. At preset the counting interval is terminated, a Stop output pulse is generated, the counting register is reset to zero, and counting is inhibited until the next Start signal and subsequent synchronization.

Recycling of the 719 counting interval requires an external connection from one of the Stop output connectors to one of the Start connectors. The total dead time for this type of recycled operation will be about 100 ns, depending on the transient delay of the Start circuitry.

1.3 FLEXIBILITY

The 719 can count internally generated time increments of either 0.1-s or 0.01-min (0.6-s) periods, or it can count pulses from an external source. The external input pulses can be either periodic or random. When they are periodic, the 719 will be operating as a timer with some alternate time base and this can be any rate up to 10 MHz. When the external input has a random rate, the 719 will be operating as a preset prescaler for universal counting applications where the maximum input counting rate is based on a 100-ns minimum interval between pulses.

Depending upon the source of external input pulses, the 719 can be operated as a fast prescaler in a nuclear counting system, as a digital delay generator, as a pulse generator, or as any of many other types of instrument applications.

2. SPECIFICATIONS

PERFORMANCE

TIME BASE ACCURACY Same as power line frequency for Internal mode (typically $<\pm 0.1\%$). Same as driving source for External mode.

TIME CAPACITY 0.01 to 800 min, 0.1 to 8000 s, or 1 to 80 000 external time base input pulses.

EXTERNAL INPUT RATE Any rate up to 10 MHz, using NIM-standard positive-logic input signals.

OPERATING TEMPERATURE 0 to 50°C.

CONTROLS

PRESET A 4-position switch selects the most significant digit of the preset count level that will terminate a counting interval; settings select 1, 2, 4, or 8.

MULTIPLIER A 5-position switch selects the decade Multiplier factor to modify the Preset switch setting and determine the effective preset count level; settings are 1, 10, 100, 1000, and 10 000.

TIME BASE A 3-position slide switch selects the source of pulses to be counted; 0.1 s selects an internal source of pulses at 0.1-s intervals; 0.01-min selects an internal source of pulses at 0.01-min (0.6-s) intervals; Ext selects the pulses that are furnished through the Ext Input BNC connector.

START A push-button switch to manually initiate the synchronizing process, after which the actual timing interval is initiated.

STOP A push-button switch can be used to manually stop and inhibit counting and to reset the counting register to zero.

APPENDIX

REPLACEABLE PARTS

ORDERING INFORMATION

The Replaceable Parts List shown below contains information needed for ordering spare and/or replacement parts. Each listing indicates the reference designator number, the part number, a description of the component, and the part manufacturer and manufacturer's part number.

All inquiries concerning spare and/or replacement parts and all orders for same should include the model and serial numbers of the instruments involved and should be addressed to the Customer Service Department at 100 Midland Road, Oak Ridge, Tennessee 37830. The Manager of Customer Services can be reached by telephone at (615) 482-4411. The minimum order for spare and/or replacement parts is $25.00.

ORDERING INFORMATION FOR PARTS NOT LISTED

In order to facilitate the ordering of a part not listed below, the following information should be submitted to the Customer Service Department:

1. the instrument model number,
2. the instrument serial number,
3. a description of the part,
4. information as to the function and location of the part.

Replaceable Parts List

REFERENCE DESIGNATOR	ORTEC PART NO.	DESCRIPTION	MFR.	MFR. PART NO.	
719-0100	5004 46529				
20	9097 41339	Connector, BNC	95712	#UG1094/U	DGE
28	9109 41431	Knob	86797	#RB-750-1/4D	RGN
29	9103 41461	Pilot Lamp Asm. 28V	91802		IDV
R5	9015 40219	470 Ω 1/4W 5% C	01121	CB	ABC
S1	9094 44485	Switch, Rotary, 5P4T	OAK	#5-2733-310	
S2	9094 41296	Switch, Rotary, SP5T	OAK	#261608-A1	
S3	9094 42674	Switch, Slide, DPTT	79727	#G-128L	CWE
S4	9094 41293	Switch, P-B, SPDT	82389	#953	SWC
S5	9094 41293	Switch, P-B, SPDT	82389	#953	SWC
T-1	9090 43466	Transformer	95333	#Y24-147	CET
719-0200	5007 46530				
C1	9065 40948	6.8 uf 20% 35V tan.	80183	#150D685X0035B2	SPR
C2	9065 40948	6.8 uf 20% 35V Tan.	80183	#150D685X0035B2	SPR
C3	9055 40855	0.01 uf 20% 50V Disc.	80183	#C023K101F103M	SPR

INPUTS

EXTERNAL Accepts NIM-standard slow-positive-logic signals, ⩾+3 V to count, ⩽+1.5 V to not count, ±25 V max; pulse width ⩾50 ns, no max limit; Z_{in} 1000Ω to ground; pulse pair resolution 100 ns; BNC connector on front panel.

START INPUT Accepts NIM-standard slow-positive-logic signal, ⩾+3 V to start a counting interval after synchronization, ⩽+1.5 V to not start, ±25 V max; pulse width ⩾100 ns, no max limit; Z_{in} 1000Ω to ground; BNC connectors on both front and rear panels.

OUTPUTS

INTERVAL A logic output that is true only during each preset counting interval, corresponding to the time during which the front-panel indicator light is on; true interval ⩾+3 V into 100Ω; inhibited interval ⩽+1.5 V; width equal to preset interval; Z_0 <10Ω dc-coupled; BNC connectors on both front and rear panels.

STOP NIM-standard slow-positive-logic pulse generated at the end of each preset interval; ⩾+3 V; ⩾500-ns width; Z_0 <10Ω dc-coupled; BNC connectors on both front and rear panels.

ORDERING INFORMATION

POWER REQUIRED +24 V, 75 mA; +12 V, 160 mA; -12 V, 0 mA; -24 V, 40 mA; 115 V ac, 50-60 Hz, 1 mA.

DIMENSIONS Standard single-width module (1.35 by 8.714 in.) per TID-20893 (Rev.).

WEIGHT (Shipping) 5 lb (2.3 kg).

WEIGHT (Net) 3 lb (1.3 kg).

RELATED EQUIPMENT

The 719 is a universal electronic preset timer that measures time based on the input power line frequency of 50 or 60 Hz. It can be used to control the precise time that an entire counting system is gated on, to measure the interval between delayed recycles, or to provide a variety of similar timing functions. It can be used with the 432 or 432A to control a printing loop. It can also be used as a prescaler for random input pulses or can operate as a fast timer when an external time base is used as an input.

Because it has been built according to NIM-standard logic practices, the outputs and inputs are universally interchangeable between all other NIM logic modules. For its basic function of controlling a time interval in a counting system, the Interval Output of the 719 will be used as the Gate Input of the Master Counter in an ORTEC Data Acquisition System, with either printing or nonprinting.

3. INSTALLATION

3.1 GENERAL

The 719 Timer is designed for installation and operation in an ORTEC 401A/402A Bin and Power Supply, or equal. The Bin and Power Supply is intended for relay rack mounting and is usually installed in a rack that houses other electronic equipment. Therefore any vacuum tube equipment or other heat source that operates in the same rack with the 719 must be sufficiently cooled with circulating air to prevent localized heating of the transistorized and integrated circuits in the 719. The temperature of equipment in racks can easily exceed 120°F (50°C), the maximum limit for safe operation of the 719, unless precautions are taken.

3.2 CONNECTION TO POWER

The 719 power requirements must be furnished from a Nuclear Standard Bin and Power Supply such as the ORTEC 401A/402A. Always turn off the power before inserting or removing instrument modules. The ORTEC NIM modules are designed so that a full complement of modules in the Bin will not overload the Power Supply. However, this may not be true when the Bin contains modules of other than ORTEC design, and the Power Supply voltages should be checked for any overloading after other modules are inserted. The ORTEC 401A/402A has test points on the Power Supply control panel to monitor the dc voltages.

When using the 719 outside the 401A/402A Bin and Power Supply, be sure that the extension cable includes the Power Supply grounding circuits specified in the recommended standards of TID-20893 (Rev.). Both high-quality and power-return ground connections are specified to ensure proper reference voltage feedback into the Power Supply. These must be preserved in extension cable installations. Be careful to avoid ground loops when the module is operated outside the Bin.

Some bins and power supplies, as well as extension cables, may not be wired to distribute the 115-V ac power required for the internal time base in the 719. If the instrument fails to operate on either 0.1-s or 0.01-min time increments, check the Bin and/or cable to determine whether it is properly wired.

3.3 CONNECTION FOR AUTOMATIC RECYCLED OPERATION

Connect a coaxial cable from a Stop Output on the 719 to the adjacent Start Input, both of which are BNC connectors.

6. MAINTENANCE AND CALIBRATION

6.1 TESTING PERFORMANCE

The basic performance of the 719 Timer can be tested by following the procedure outlined in Section 4.3, "Initializing the Timing Program." This will not check the unit to its published specifications.

6.2 CALIBRATION ADJUSTMENTS

There are two calibration adjustments in the 719. Each is an adjustment of the natural period of a monostable, to obtain time base signals at intervals of 0.1 s and 0.01 min (0.6 s), based on either a 50- or 60-Hz input power line frequency. See Sections 5.2 and 5.3 for information regarding these circuits. Proper adjustment of the two time base circuits can be made with an oscilloscope such as Tektronix 547 or equal.

Connect the oscilloscope probe to test point TP1 in the 719 to observe the period of the 0.1-second monostable. Figure 6.1 shows this observation for 3 different adjustments of the monostable period. The oscilloscope is set for a horizontal sensitivity of 20 ms/cm, and the first adjustment shows 2 complete monostable periods and the start of a third; this was obtained with an 84 ms period. The center set of waveforms shows proper adjustment of the monostable (100 ms) with the 2 complete periods set for the full 200 ms sweep time through 20 cm. Too long a monostable period is illustrated by the last set of waveforms, where the second period is incomplete within the 200 ms sweep time; this waveform was obtained with a 116 ms monostable period. Adjust R45 to the point in the middle of its range where two complete monostable periods are seen in the 200 ms sweep time.

Connect the oscilloscope probe to test point TP2 in the 719 to observe the period of the 0.01-minute monostable after the 0.1-second monostable has been set correctly. Set the oscilloscope for a horizontal sensitivity of 100 ms/cm and compare the resulting waveform with those in Fig. 6.2. Again, a short, correct, and long period adjustment has been shown. The correct adjustment, at the center, has a period of 600 ms. Adjust R46 to the point in the middle of its range where the monostable period is 600 ms.

6.3 TROUBLESHOOTING SUGGESTIONS

If a 719 does not function properly, it should first be isolated from all other units. The problem may be in the system interconnection, and isolating the 719 from the system is a quick way to check for improper functioning.

Below are listed some of the more common problems that might be encountered, and suggested remedies.

Interval Cannot Be Started

1. Check to see that ac voltage is furnished, if using internal time base, or that proper signals are furnished for an external time base operation.

2. Check the Start signal by using the alternate method to provide Start.

3. Recheck the Interval Out signal and the Interval indicator; these are obtained from opposite halves of the Interval Bistable, and either one may be present even though the alternate is missing.

4. Verify that Vcc is +4.8 V.

Interval Does Not Terminate

1. Set Multiplier switch at a lower setting; try a different setting of the Preset switch.

2. Press manual Stop switch. Retest for normal interval timing.

6.4 FACTORY REPAIR

The ORTEC 719 Timer can be returned to the factory at any time for repair and recalibration. It will receive the same intensive quality control inspection that a new instrument receives. Contact the Customer Repair Department at the factory before shipping your instrument for repair, and arrange the details with them.

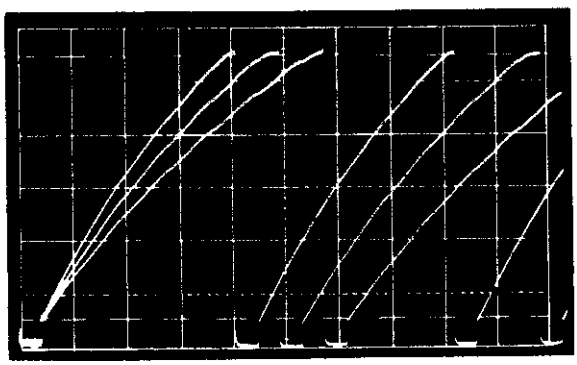


Fig. 6.1. Waveforms at TP1 Showing Short, Correct, and Long Periods for the 0.1-s Monostable.

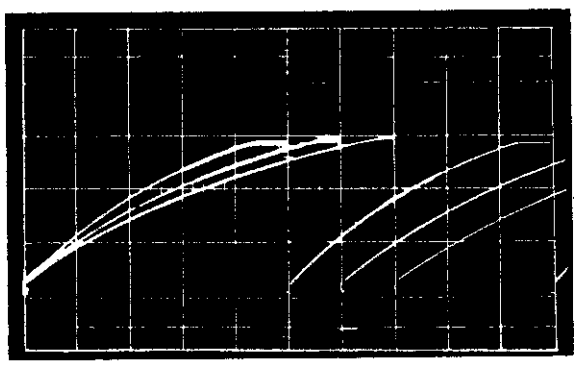


Fig. 6.2. Waveforms at TP2 Showing Short, Correct, and Long Periods for the 0.01-min Monostable.

In this Automatic Recycled mode the 719 operates as a preset prescaler when set for Ext. or as a pulse generator when set for Int. time base. When this connection is made, an alternate pair of connectors is still available for transfer of signals to or from other instruments in the system.

3.4 CONNECTION OF TIME BASE INPUT

Use of an external time base input is optional. The 719 can be operated with either a 50- or 60-Hz ac source from the input power line, and this internal time base connection is made automatically when the module is operated in the 401A/402A Bin and Power Supply.

Use a coaxial cable to connect an external time base input, when one is to be used, to the External Input connector on the front panel. The adjacent switch must then be set at Ext to accept the input signals. The maximum frequency for an external time base input is 10 MHz. A random input rate can be used as the external input signal, in which case the 719 operates as a preset prescaler rather than as a preset timer.

4. OPERATION

4.1 GENERAL

The 719 Timer measures an interval of time from a synchronized start until a preset stop. It indicates the timed interval with a front-panel lamp and with an Interval signal that is available through both front-panel and rear-panel connectors. In addition, a Stop pulse is furnished at the preset stop time for the interval. The selection of these output signals is a function of their applications, and either or both may be used as required.

4.2 TYPICAL APPLICATIONS

Figures 4.1 through 4.8 suggest a variety of applications for one or more 719 Timers. These system arrangements are typical of some of the various operations that can be made with this module in a system. Other ORTEC modules that may be used in the complete systems can be selected from the others that have been designed for system operation, and these include the 434 Digital Ratemeter, 707 Buffer Scaler, 708 Buffer Timer, 430 Scaler, 431 Timer/Scaler, 715 Dual Counter/Timer, 720 Dual Counter, and 432A (or 432) Printout Control.

In Fig. 4.1 a complete printing data-acquisition system with up to 50 scalers can be operated for timed intervals that are measured with the 719. With the 432A (a 432 will work the same) set for External Print and Prompt Recycle, the 719 will control the duration of a counting cycle and all the data except time will be printed out through the 432A. If printout is not required, the interconnection of the scalers into a system loop would be necessary if the 719 Interval signal is to be used as the Gate input to the Master unit in the system to determine the duration of a data-acquisition interval.

In Fig. 4.2 an alternate connection method is shown which does not require system loop connections. A BNC tee connector at each Gate input on the scaler modules will permit the Interval signal to be cabled and applied simultaneously to all the scalers, and each data interval will then be controlled directly by the Interval output of the 719.

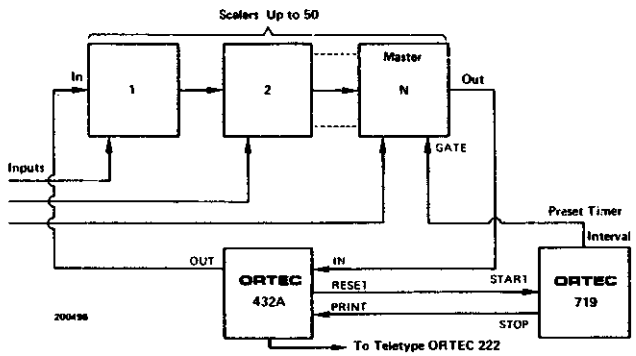


Fig. 4.1. Printing Systems.

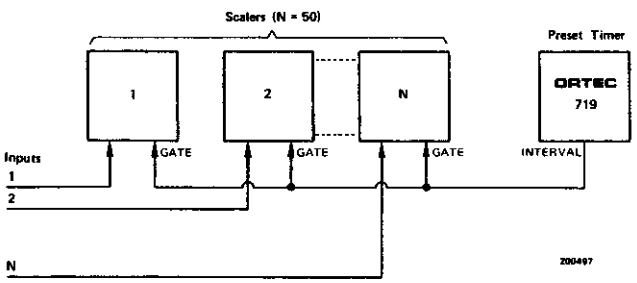
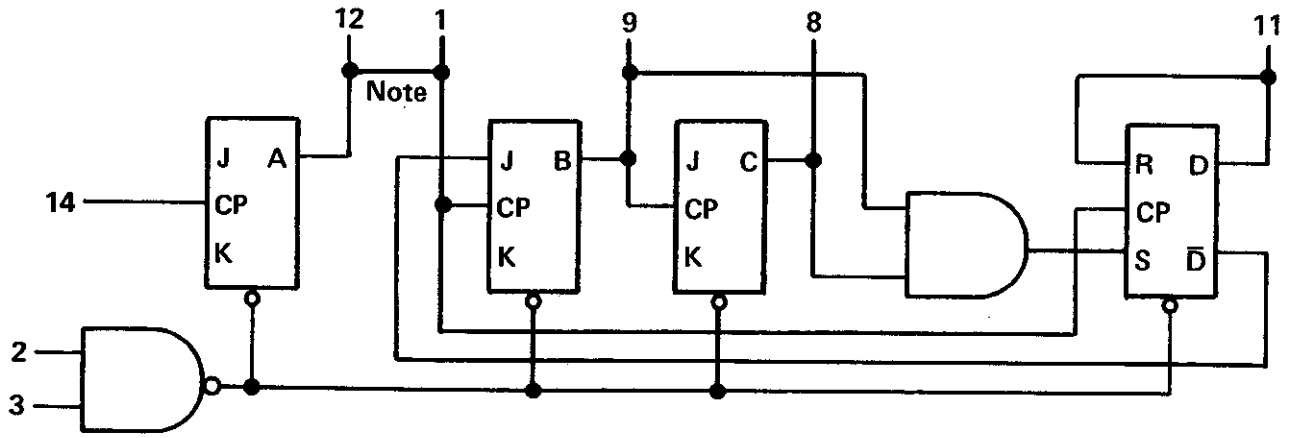


Fig. 4.2. Nonprinting Timer/Scaler.



Note: External connection required from pin 12 to pin 1.

TRUTH TABLES

Reset/Count

Pin 2	Pin 3	State
1	1	Reset
1	0	Count
0	1	Count
0	0	Count

BCD Count Sequence

Count	Outputs			
	Pin 12	Pin 9	Pin 8	Pin 11
0	0	0	0	0
1	1	0	0	0
2	0	1	0	0
3	1	1	0	0
4	0	0	1	0
5	1	0	1	0
6	0	1	1	0
7	1	1	1	0
8	0	0	0	1
9	1	0	0	1

Fig. 5.4. Decade Counter, SN7490, with Truth Tables.

Two 719 Timers are used for the Sampled Counting System in Fig. 4.3. The 719 that is marked (t) will determine the data-acquisition interval duration. At the end of each such on-time for the system, the accumulated data will be read out to a printer through the 432A. The 432A will be set for External Print command and for Delayed Recycle. Then the other 719 that is marked Delay (T) will measure a time delay from the end of the first data-acquisition interval until the start of the next interval. Logically, this delay time must be long enough for the printout of data from the previous cycle to be completed.

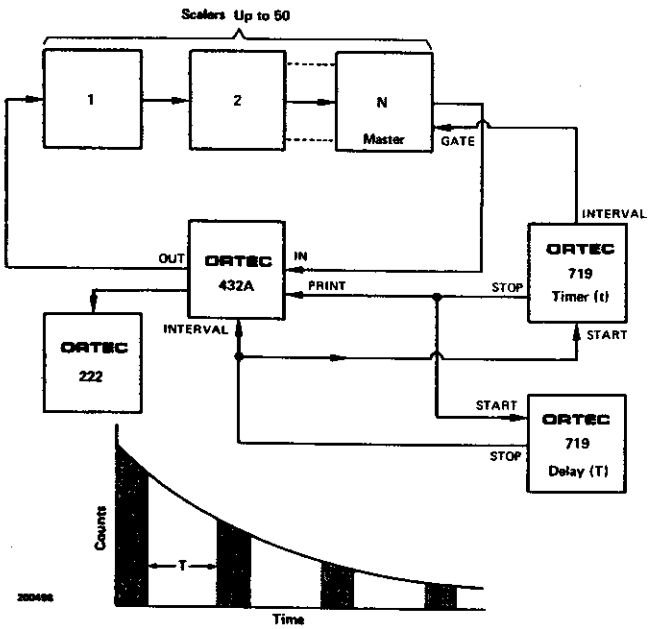


Fig. 4.3. Sampled Counting System.

The two portions of Fig. 4.4 illustrate the basic functions that can be obtained with a 719 Timer that has a direct connection from a Stop output to a Start input. When an External input is used as the source of pulses to be counted, the 719 operates as a preset scaler; when the input pulses are furnished at regular intervals, the preset count can also be interpreted as preset time. When the internal time base is used, the 719 operates as a signal generator and furnishes Stop output pulses at the periodic intervals equal to the preset time.

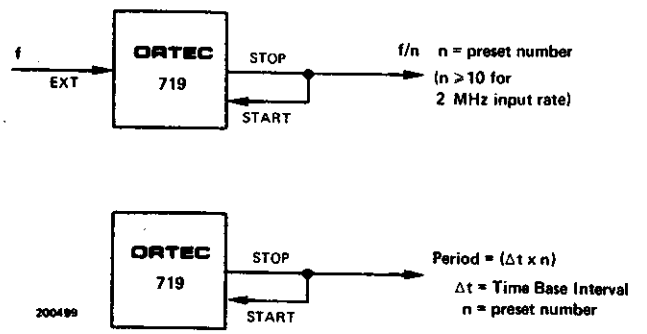


Fig. 4.4. Prescaler/Pulse Generator.

A series of 719 Timers can be connected as shown in Fig. 4.5 to form a gate and delay generator. The return cable from the Stop output of the last 719 in the series can be returned to the Start input of the first module to also provide automatic recycling. The Interval output from each 719 can be used to gate an external function, and these functions can then be programmed for both sequence and duration; the sequence will result from the module that is selected to provide the function, and the duration is the preset time of the selected 719. The delay to each controlled function, measured from the start of the cycle, is the sum of the times that are set on all 719 modules preceding the one that is selected to control that particular function. A complete program of sequenced Interval outputs is suggested in Fig. 4.6.

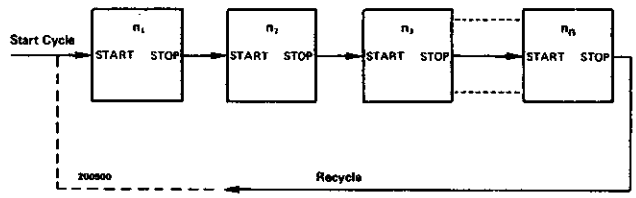


Fig. 4.5. Gate and Delay Generator.

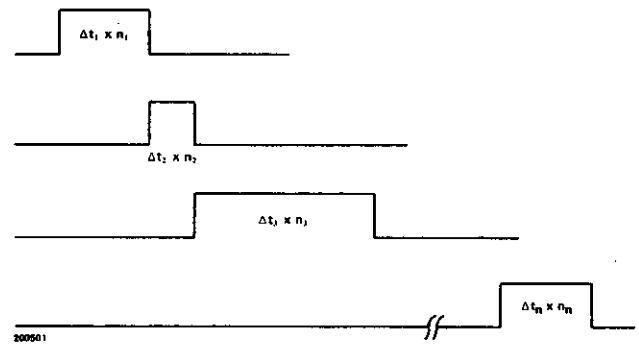


Fig. 4.6. Interval Controller.

The Frequency Measurement System shown in Fig. 4.7 will measure the events per unit time and the time will be set with the 719. By using a buffered scaler and automatic recycling of the 719, the system will furnish an on-line numerical display as well as a flexible serial-by-character digital output to print out on a Teletype or on punched paper tape.

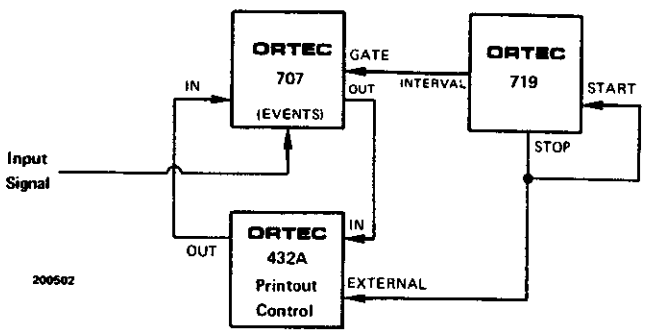


Fig. 4.7. Frequency Measurements System.

5.8 POWER SUPPLY

The power required to operate all of the integrated circuits in the 719 is identified as Vcc. It is obtained from the +12 V dc input from the bin power supply and is regulated to the required level by diode D1 and emitter follower Q1. Capacitors C1, C10, C11, C12, C13, C14, C18, C19, and C20 filter this operating power level as it is distributed throughout the printed circuit.

5.9 INTEGRATED CIRCUIT DESCRIPTION

Two types of TTL integrated circuits are used in the 719. The operating power at 4.8 V (Vcc) is supplied to each of the TTL packages as shown in schematic diagram 719-0101-S1. The logic diagrams of the integrated circuits are shown in Figs. 5.2, 5.3, and 5.4.

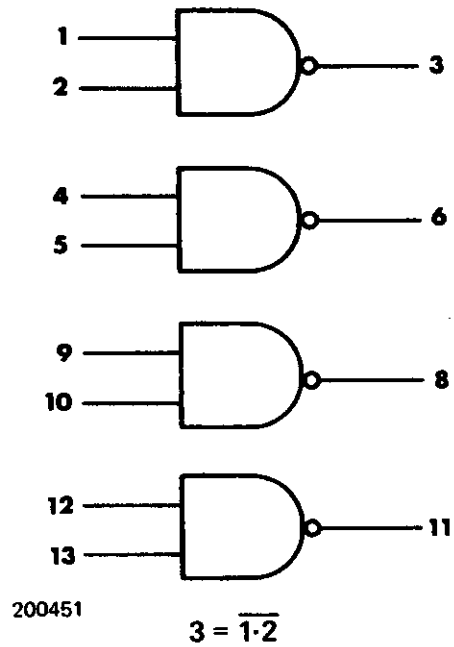


Fig. 5.2. Quadruple 2-Input Positive Nand Gate, SN7400.

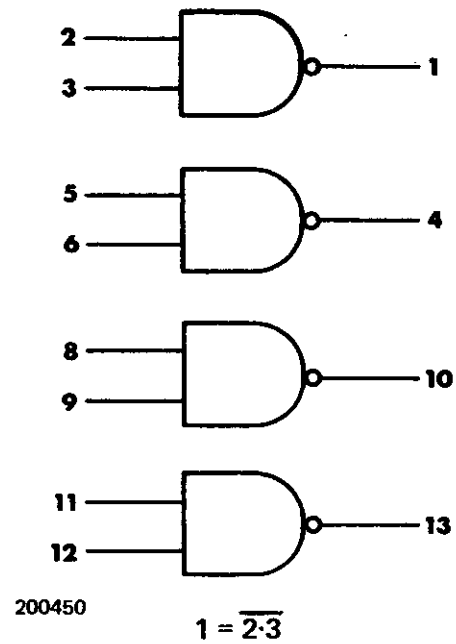


Fig. 5.3. Quadruple 2-Input Positive Nand Gates with Open-Collector Output, SN7401.

A typical setup for a Ratio Measurement System is shown in Fig. 4.8. If the ratio R defines frequency$_1$/frequency$_2$, then

$$R = \frac{f_1}{f_2} = \frac{\text{events}_1/\text{time}}{\text{events}_2/\text{time}} = \frac{\text{events}_1}{\text{events}_2}$$

and this ratio can be calculated from the pairs of data printed from the two scalers in the system. Operate the 432A Printout Control in Prompt Recycle for the connections shown in Fig. 4.8.

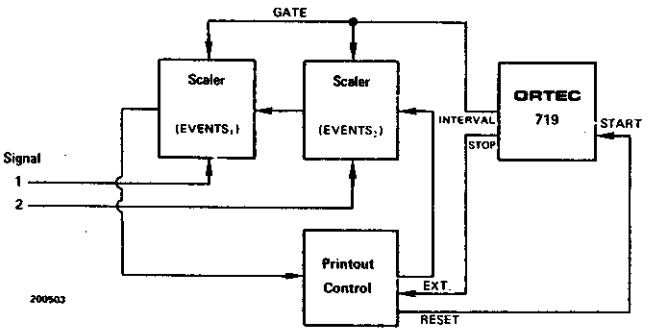


Fig. 4.8. Ratio Measurements System.

4.3 INITIALIZING THE TIMING PROGRAM

Press the manual Stop switch on the front panel of the 719. This will reset the internal counting register to zero and will inhibit it from counting until operation is desired.

Select the total time period that is to be measured. Use the slide switch to select the basic time increment (0.1 s, 0.01 min, or Ext.), and use the Preset selector and Multiplier to select the number of increments in the total interval.

To start timing of the first interval, either press the manual Start switch on the 719 front panel or furnish an external Start input signal. There is a time delay from the start signal to the actual start of timing because the time zero is synchronized on the first input pulse to the timer. The maximum time delay corresponds to one input time increment, either internal or external. It will vary each time, depending on the time phase between the Start push button and the time base pulses.

When the counting register is advanced to the preset count level, the 719 terminates the Interval output, turns off the front-panel indicator lamp, provides a Stop output, and resets the counting register to zero. A new Start signal is required to initiate another timing interval.

4.4 INTERRUPTING THE TIMING INTERVAL

Normal operation requires that the 719 be permitted to continue counting until it reaches preset stop. There is no other indication of timing within an interval. If the counting is to be stopped prior to a preset stop for any reason, press the manual Stop switch on the front panel; this terminates the Interval output signal, causes the indicator lamp to go out, generates a Stop output signal, and resets the internal register to zero. However, there is no indication that the output is not based on a true timed interval, and this condition must be taken into account in the logic of system operation.

5. CIRCUIT DESCRIPTION

5.1 GENERAL

The simplified block diagram for the 719 Timer is shown in Fig. 5.1. The complete schematic diagram is shown in drawing 719-0101-S1 at the back of this manual.

A Start input, or the equivalent signal from the front-panel switch, sets the Start/Stop Bistable. The next pulse that is selected for timing will set the Interval Bistable to enable the Gate to the counter, to provide the Interval output, and to light the indicator on the front panel.

At the selected Preset the Start/Stop Bistable and the Interval Bistable are reset. This terminates the Interval output, turns off the light, generates a Stop output and a reset, and disables the Gate to the counter.

5.2 0.1-s TIME BASE

The 0.1-s Time Base includes Q2 through Q5 and an ac input transformer, T1. The circuit forms a monostable multivibrator which is triggered by the first ac input pulse when power is initially turned on, and by each 6th (for 60 Hz) or 5th (for 50 Hz) subsequent input pulse. Natural recovery for the monostable is set to about 92 ms to permit its operation at either input line frequency rate. This can be observed at Test Point TP1 and adjusted with R45.

The output pulses occur at 0.1-s intervals and are used to drive the 0.01-min Time Base. They are also available for use as the internal 0.1-s time base pulses to be counted.

5.3 0.01-min TIME BASE

The first pulse from Q2 triggers the 0.01-min Monostable, Q6, Q7, and Q8. This circuit has a natural recovery set slightly less than 600 ms for an output pulse that is synchronized on each 6th 0.1-s input pulse. The operation can be observed at Test Point TP2 and adjusted with R46. The output pulses occur at 0.01-min intervals and are available for use as the internal 0.01-min time base pulses to be counted.

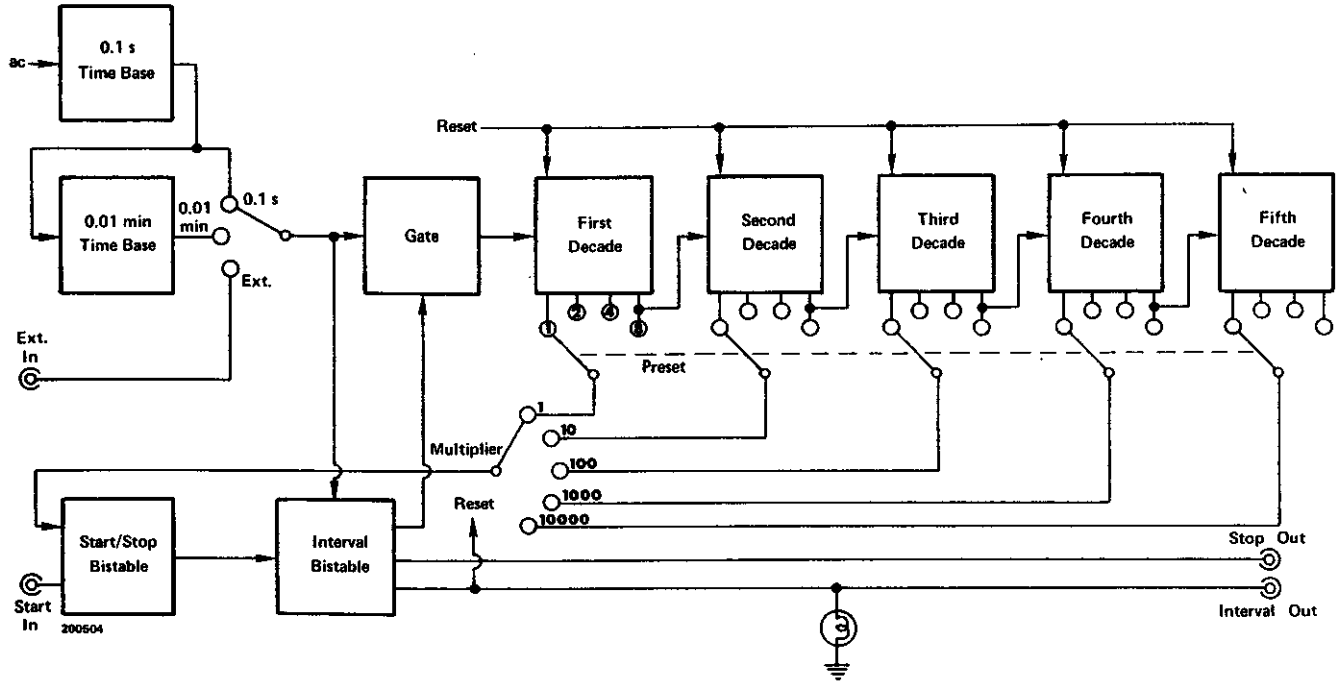


Fig. 5.1. Simplified Block Diagram of ORTEC 719 Timer.

5.4 GATE CONTROL

Any pulse that is to be counted in the 5-decade register must pass through gate IC 8-3. The gate is disabled when the Interval Bistable IC 7-3 and 7-6 is reset, with IC 7-6 high and IC 7-3 at ground. Therefore the gate will permit the counting register to count pulses only after the Interval Bistable has been set.

5.5 START/STOP BISTABLE

The Start/Stop Bistable is IC 8-8 and 8-6. At the reset state, which is obtained initially by pressing the manual Stop switch, IC 8-6 is high and IC 8-8 is low. The output from IC 8-8 must go high to enable gate IC 7-8 and permit an input time-increment pulse from IC 3-1 to be used to synchronize the Interval Bistable. The signal to set the Start/Stop Bistable can come from either the Start switch on the front panel or from a NIM slow-positive-logic pulse through CN2 and IC 8-11. The Start/Stop Bistable is reset again by reset of the Interval Bistable through the Stop switch.

5.6 INTERVAL BISTABLE

The Interval Bistable is composed of IC 7-3 and 7-6. At reset, which is obtained initially by pressing the manual Stop switch, IC 7-6 is high and IC 7-3 is low. To terminate the preset period during normal operation, the Interval Bistable is reset by a Preset signal through IC 7-11. The Interval Bistable will be set by the first time interval pulse that occurs after the Start/Stop Bistable has been set, and this is controlled by gate IC 7-8.

At set time, IC 7-3 goes high and enables Gate IC 8-3. It also drives the Interval indicator lamp through Q9. At the same time, IC 7-6 goes low and this is inverted by Q12 to form the Interval Output signal through the emitter-follower Q13.

At Preset time, or at a manual Stop signal, the Interval Bistable is reset with IC 7-6 going high and IC 7-3 going low. As IC 7-3 goes to low, the transition triggers the one-shot IC 9-6 and 9-3 to generate the Stop Output pulse which is amplified and buffered through Q10 and Q11. The front-panel indicator goes out and Gate IC 8-3 is disabled. At the same time, as IC 7-6 goes high, this resets the Start/Stop Bistable and all five decades and terminates the Interval Output signal.

5.7 COUNTING REGISTER

The five decades in the counting register are IC 2, IC 5, IC 1, IC 4, and IC 6, respectively. Each of these is a type SN7490 integrated circuit decade with 1-2-4-8 binary outputs. It counts input pulses only when the Interval Bistable is set and input counts are accepted at IC 2-14. Switch S1 selects one of the four BCD identification output lines from each decade and furnishes this identify to the Multiplier switch S2. Switch S2 selects which of the decades will furnish the identification for a Preset signal. The selected Preset level then resets the Interval Bistable in order to terminate the Interval Output and generate a Stop Output pulse.