Model 3620

24-channel Counter

INSTRUCTION MANUAL

March, 1987

***** SPECIAL OPTION *****

Model 3620-S001

24-channel Counter

October, 1989

*** SPECIAL OPTION ***

The model 3620-S001 is the same as the 3620-A1D except it is modified to accept TTL signals. The input circuitry is isolated from the module. The power for the TTL level input signal must be provided by signal drive.

MLH:rem(WP)

October 27, 1989

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KineticSystems Corporation

Standardized Data Acquisition and Control Systems **3620**

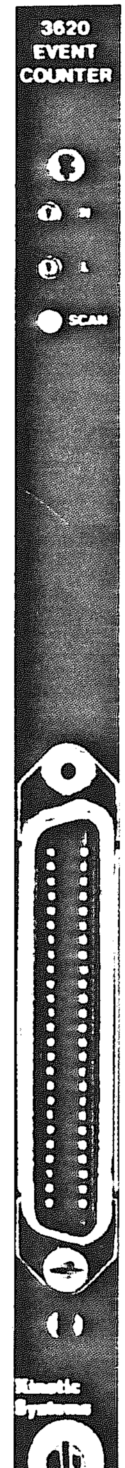
24-channel Counter

FEATURES

- **24 independent counters**
- **Maximum count, each counter, 16,777,215 (24 bits)**
- **LAM on overflow**
- **Many input options available: 12, 24, 48 VDC, unbalanced contact monitor, optically isolated; or TTL nonisolated**
- **Contact bounce filter on each input**
- **Count rate, DC to 200 hertz**
- **On-board microprocessor**

APPLICATIONS

- **General-purpose event counting**
- **Process monitoring**



GENERAL DESCRIPTION

The Model 3620 is a single-width CAMAC module containing 24 independent 24-bit counters and associated input circuits. This module is specifically designed for low-speed counting applications (up to 200 hertz). Since high-speed counters such as our 3610, 3615, and 3640 have a very high maximum counting rate (100 megahertz for the 3615), they are not suitable for counting events where the counting source is a relay contact (with associated contact bounce) or has a slow rise time.

An on-board microprocessor scans the input channels and increments the count in RAM memory when an input has changed from its Zero to One state. Input counting rates to 200 hertz can be accommodated. A 24-bit word of data stored for each input channel provides for an accumulated count from 0 to 16,777,215. The LAM is set when an overflow is detected in any counter.

All I/O connections are made via the 50-contact ribbon connector on the front panel.

INPUT OPTIONS

The 3620 is available with the following input options:

1. **Isolated.** Each circuit is a floating pair that is isolated from ground with a voltage breakdown of greater than 500 volts. LED/phototransistor optical isolators are used. Four isolated input options are available: 12 VDC, 24 VDC, and 48 VDC (with switching thresholds approximately one-half of the nominal voltage), or an unbalanced contact monitor.
2. **Nonisolated.** Each circuit is single-ended with a ground return. This signal level option operates at TTL level.

READING DATA COUNT

The count for any channel is read by setting the channel address to that input channel [F(16)·A(1)] and then reading the register [F(0)·A(0)]. Data is available several microseconds after the address is changed. A Q = 0 response will be given if data is not yet fetched. For most program transfer sequences, the data will be available before the Read command is executed. To read a block of channels, the address of the first channel is written, followed by Read commands. The address increments after each valid command.

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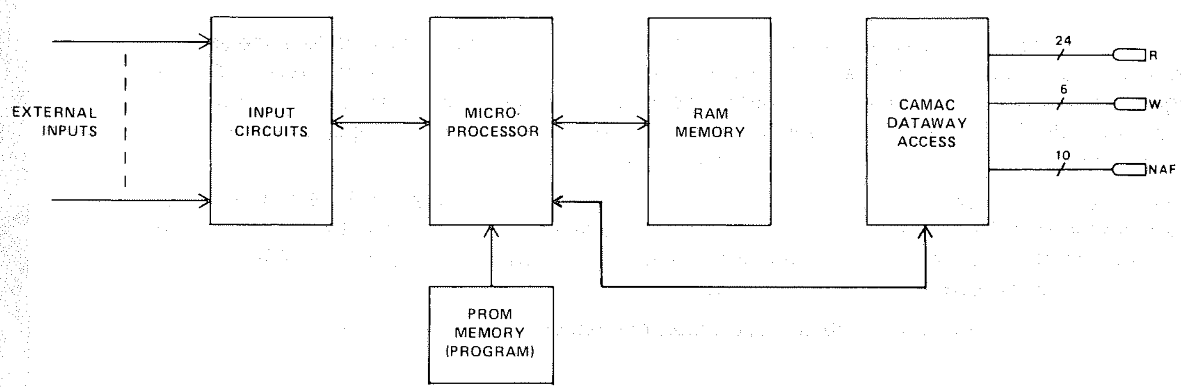
FUNCTION CODES

Command		Q	Action
F(0)·A(0)	RD1	DAV	Reads the 24-bit data register containing the count for the current channel address, then increments the channel address. (See Note 1.)
F(0)·A(1)	RD1	1	Reads the current channel address.
F(8)·A(15)	TLM	LR	Tests whether the LAM request is present (See Note 1.)
F(9)·A(0)	CL1	1	Clears Read Data registers for all channels.
F(9)·A(1)	CL1	1	Clears Read Data registers for current channel address.
F(10)·A(0)	CLM	1	Clears the LAM Status register.
F(16)·A(1)	WT2	1	Writes the channel address, then causes the Read Data register to be loaded with the current count for that channel.
F(24)·A(0)	DIS	1	Disables the LAM request.
F(26)·A(0)	ENB	1	Enables the LAM request.
F(27)·A(0)	TST	DAV	Tests whether Read data is available.
Z	CZ	0	Clears all data registers and the Address register, resets the CPU.

Notes: 1. Overflowed channel can be determined by setting address Zero and reading the data register. This is the LAM Status register.
2. X = 1 for all valid addressed commands.

SIMPLIFIED BLOCK DIAGRAM



POWER REQUIREMENTS

Model 3620-A1A — +6 volts — 1700 mA
−6 volts — 25 mA
+24 volts — 50 mA

Model 3620-A1B, A1C, A1D, A1E — +6 volts — 1700 mA
−6 volts — 25 mA
+24 volts — 45 mA

ORDERING INFORMATION

Weight: .70 kg. (1 lb. 8 oz.)

Model 3620-A1A — 24 Channel Counter — Unbalanced Contact Input
Model 3620-A1B — 24 Channel Counter — 48 VDC
Model 3620-A1C — 24 Channel Counter — 24 VDC
Model 3620-A1D — 24 Channel Counter — 12 VDC
Model 3620-A1E — 24 Channel Counter — TTL

Accessories — Model 5950-Z1A Mating Connector
Model 1850-A1D Rack Termination Panel

INPUT LEVEL CONSIDERATIONS

1. Isolated Options

For modules with these options, each input is connected through a series resistor to the LED input of an optional isolator. External voltage is required for a "1" input. See the schematic drawing for details. The operating characteristics for each such option is as follows:

Option	Nominal Voltage	Current at Nominal Voltage	Typical Just-Operate Voltage	Absolute Maximum Continuous Voltage
3620-A1B	48 VDC	4.5 mA	24 VDC	70 VDC
3620-A1C	24 VDC	5.0 mA	12 VDC	40 VDC
3620-A1D	12 VDC	9.0 mA	6 VDC	22 VDC

These inputs are fully protected in the reverse direction, and the same maximum voltage limits apply. The input will be indicated as a "0" with no voltage or reverse voltage.

2. Unbalanced Contact Option

This option uses the same basic circuit as the 3620-A1C except that one side of the optical isolator input is internally connected to the +24 volt source, and the other side is connected to the POSITIVE input contact. The NEGATIVE contact is connected to module ground. Therefore, the open circuit voltage is 24 volts, the closed current is 5 mA and a contact closure (0 ohm to approximately 3K ohm) will indicate a "1".

This option is often preferred over the TTL option for contacts because of the higher voltage to break down "contact film" and the higher "contact wetting" current. Open contacts can become intermittant if used "dry" (very low voltage and current).

3. TTL Option

This option operates at normal TTL levels. A "1" is indicated when an input (POSITIVE contact) goes LOW. Internal pull-up resistors on the module hold the inputs normally HIGH. The input current (when at 0 volt) is 2.25 mA. The inputs are fully zener diode-protected. Absolute maximum continuous positive voltage is +15 volts; negative continuous maximum is -10 volts.

CONTACT BOUNCE FILTERING

Since this module may often be used with contacts and that the input signal (extra transitions) will "bounce" when opening or closing, it is very important that this input signal must be filtered to prevent "multiple" counts.

If a long time constant is used to cover contacts with long bounce periods (100 milliseconds, for example), the counting rate is severely limited. If the input circuit requires that a contact be closed for at least 100 milliseconds and open for at least that period, the counting rate is limited (for a 50% duty cycle signal) to 1/(200 milliseconds)=5 Hz. For other than 50% duty cycle, the rate is even slower.

For additional versatility, we have included digital bounce-eliminator IC's (one Motorola MC14490 hex eliminator per six channels). Each input incorporates the CMOS contact bounce eliminator, which is basically a digital integrator. The bounce eliminator is composed of a 4.5-bit register (the integrator) and logic to compare the input with the contents of the shift register. The shift register requires a clock signal in order to shift the input signal into each shift register location.

The only requirement on the clock frequency in order to obtain a bounce-free output signal is that four clock periods do not occur while the input is in a false state. Referring to Figure 1, a false state is seen to occur three times at the beginning of the input signal. The input signal goes low three times before it finally settles down to a valid low state. The first three low pulses are referred to as false states.

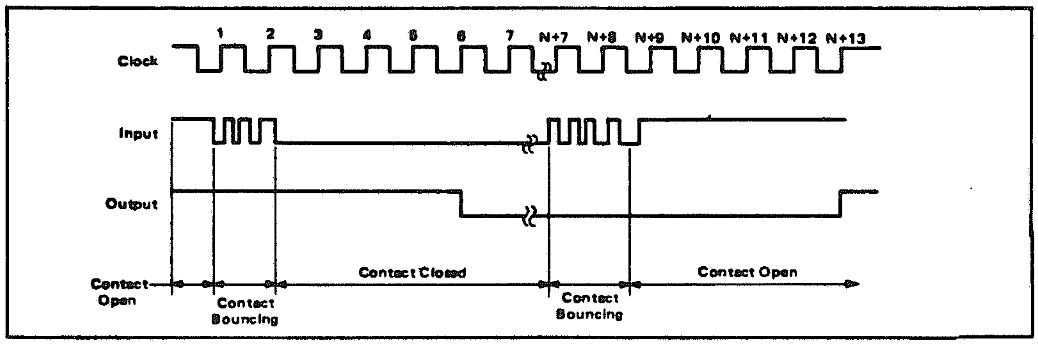


Figure 1 -- Timing Diagram

The bounce eliminators are strapped at the factory for operation from a common on-board oscillator. This oscillator has range from approximately 0.3 KHz to 4.5 KHz. Since the input must be in one state for four clock periods to be counted as a change, the maximum "false open or close" time to be integrated and ignored is:

$BFT_{max} = \frac{4}{F}$ with bounce filter time in milliseconds and frequency in kilohertz

This makes the range of maximum bounce filter time as 0.9 milliseconds to 13.3 milliseconds (4.5 to .3 KHz). The potentiometer is factory-set to 1 KHz. (Four milliseconds, maximum bounce time.) If very long "bounce time" is required, the master oscillator capacitor can be changed. See Figure 2.

MAXIMUM INPUT RATE

The maximum count speed (50% duty cycle) is 200 Hertz. This is due to software latency on the board. This means that the contact must be closed for at least 2½ milliseconds and open for at least 2½ milliseconds to be sure that it will be counted. This is a worst-case limit with all channels counting. As the other channels are "less busy", the software latency is less, and a higher counting rate would be accepted. The maximum count speed can also be limited by the "bounce eliminator" time. The open and close periods of the input must each be longer than the bounce time set in the module, otherwise counts will be missed.

INPUT FILTERING--SELECTION FOR A GROUP OF CHANNELS

The master oscillator for the contact bounce circuits can normally be set to cover the longest bounce period of any input. However, if the module is receiving signals of various types (some reasonably fast signals with little bounce and some very slow signals with long bounce times) it is possible to independently select bounce filter time in groups of six inputs. This uses the internal clock on the bounce eliminator IC's. Strapping is as shown in Figure 2. An external capacitor is required for each group of six inputs. The typical clock frequency is:

$f = \frac{1875}{C_{ext}}$ when f is in kilohertz and C_{ext} is in picofarads

Also, as before, the bounce filter time is $BFT = \frac{4}{f}$, where BFT is in milliseconds and f is in kilohertz. This makes the typical filter time:

$$BFT = \frac{4C_{ext}}{1875}$$

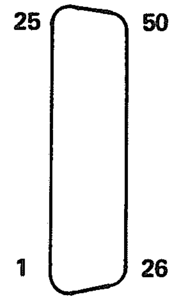
We have found that the initial frequency, when using the on-chip oscillator, can vary widely from chip to chip (5 to 1). Therefore, frequency should be measured at pin 9 of the MC14490 IC to determine if the desired frequency is present.

FRONT PANEL LEDS

N indicates that the module is currently being addressed.

L indicates that the L-signal is true (LAM status bit set and LAM request enabled).

SCAN indicates that the on-board microprocessor is properly scanning channels. The scan is started when the module is initialized.



FACE VIEW

Pin/Wire List

I/O Connector - Amphenol 57-20500
Mating Connector - Amphenol 57-10500

50 PIN RIBBON CONN.

PIN NO.	CHANNEL	POLARITY
25	N/C	
24	24	Positive
23	23	↓
22	22	
21	21	
20	20	
19	19	
18	18	
17	17	
16	16	
15	15	
14	14	
13	13	
12	12	
11	11	
10	10	
9	9	
8	8	
7	7	
6	6	
5	5	
4	4	
3	3	
2	2	
1	1	

PIN NO.	CHANNEL	POLARITY
50	N/C	
49	24	Negative
48	23	↓
47	22	
46	21	
45	20	
44	19	
43	18	
42	17	
41	16	
40	15	
39	14	
38	13	
37	12	
36	11	
35	10	
34	9	
33	8	
32	7	
31	6	
30	5	
29	4	
28	3	
27	2	
26	1	

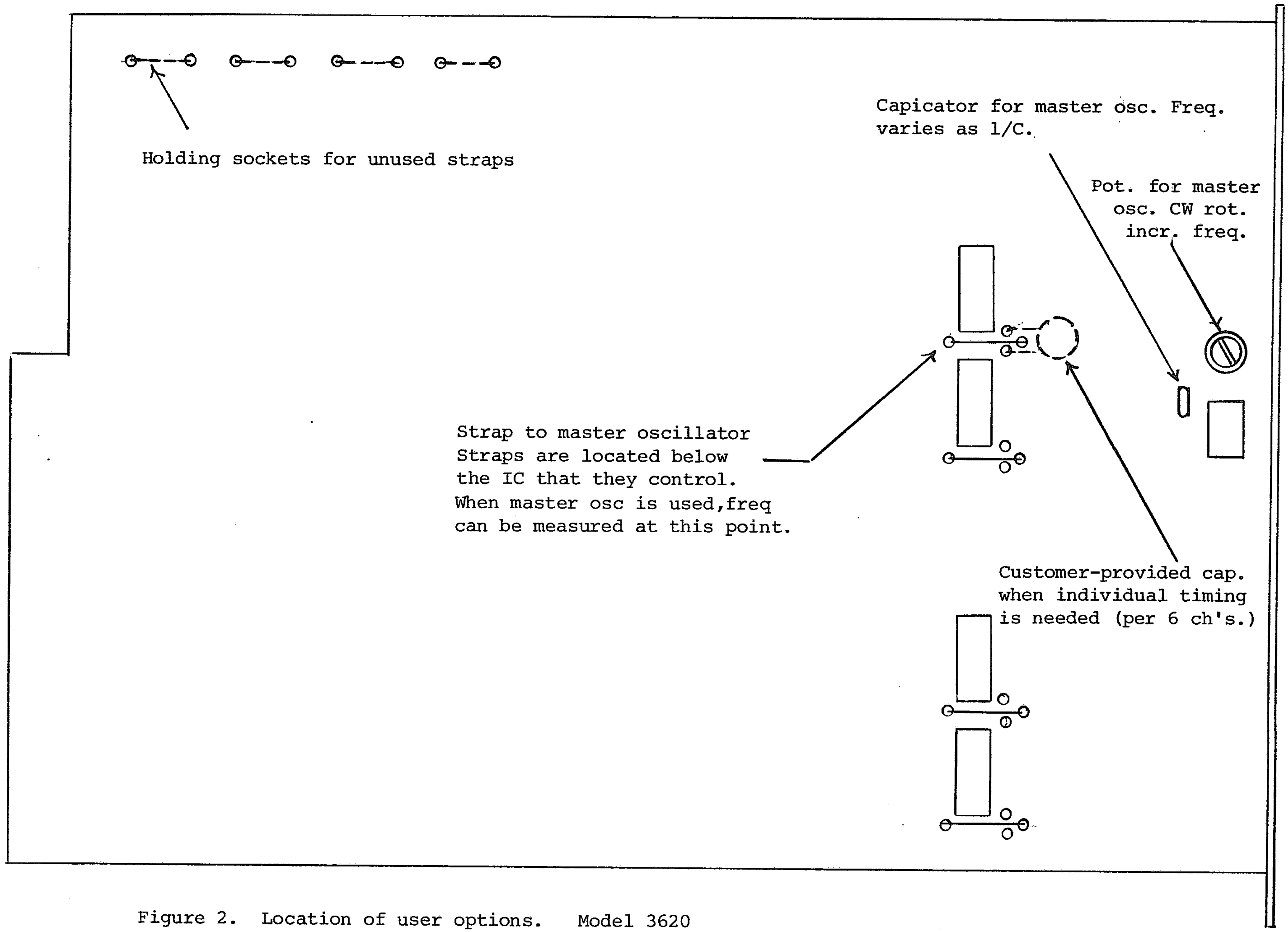


Figure 2. Location of user options. Model 3620

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2. Obtain a Return Authorization (RA) Number.
3. Initiate a purchase order for the estimated repair charge if the product is out of warranty.
4. Include a description of the problem and your technical contact person with the product.
5. Ship the product prepaid with the RA Number marked on the outside of the package to:

KineticSystems Company, LLC
Repair Service Center
900 North State Street
Lockport, IL 60441

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Facsimile: (815) 838-4424
Email: tech-serv@kscorp.com