DYMEC

A Subsidiary of
SILICON TRANSISTOR CORP.

MODEL

T-73-13-03

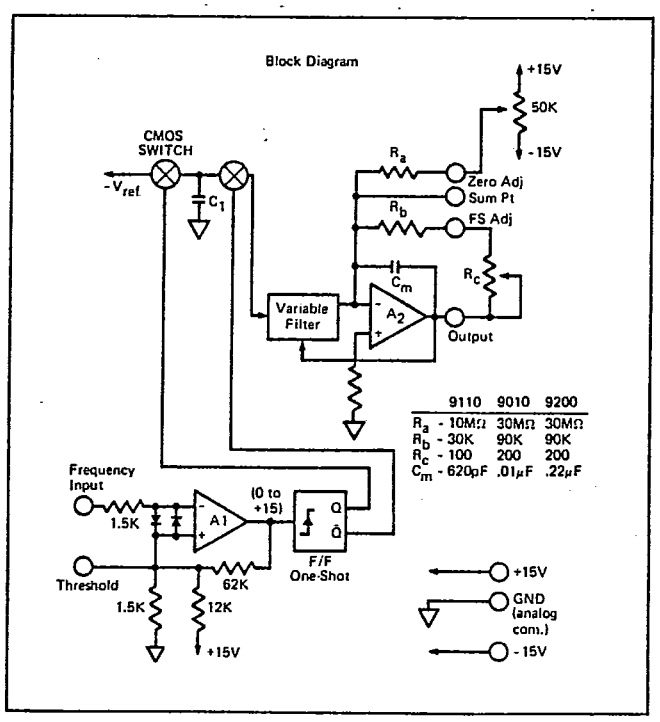
9200, 9201, 9202
9010, 9011, 9012
9110, 9111, 9112

HIGH PRECISION FREQUENCY TO VOLTAGE CONVERTERS

9110 . . . 0 to 100 KHz
9010 . . . 0 to 10 KHz
9200 . . . 0 to 1 KHz

FOR PRECISE LINEAR CONVERSION OF PERIODIC FREQUENCY INFORMATION INTO PROPORTIONALLY EQUIVALENT ANALOG OUTPUT VOLTAGE WITH:

- PEAK RIPPLE LEVELS DOWN TO 5mV TYP
- ± 50mV ADJUSTABLE OFFSET
- TEMPERATURE COEFFICIENTS DOWN TO 10 PPM/°C MAX
- LINEARITY WITHIN 0.01% MAX OVER THE ENTIRE FREQUENCY RANGE
- INPUT THRESHOLD ADJUSTABLE TO 40mV



TYPICAL FVC APPLICATIONS

Feedback Servo Control
Power Control
Microprocessor-Based Process Control
Doppler Sonar and Radar
Frequency Metering
Phase-Locked Loops
Remote Data Transmission
Tachometer Systems
Radiation Detectors
Flow Meters
Numerical Control
Broadband FM Discriminators

Specifications

All Specifications Guaranteed at 25°C Unless Otherwise Noted

T-73-13-03

Parameter		9110 Min	9110 Typ	9110 Max	9010 Min	9010 Typ	9010 Max	9200 Min	9200 Typ	9200 Max	Units
INPUT											
Frequency Range		0		110	0		11	0		1.10	KHz
Impedance, referred to ground			3			3			3		K ohms
Levels (Note 1)	1 (high)	+2		+15	+2		+15	+2		+15	Volts
	0 (low)	-15		1.2	-15		1.2	-15		1.2	Volts
Timing	low	1.0			1.0			1.0			µsec
	high	2.5			2.5			2.5			µsec
OUTPUT											
Voltage Range											
f = 0		-6		+6	-6		+6	-6		+6	mV
f = 100KHz (9110); 10KHz (9010); 1KHz (9200)		9.97	9.99	9.995	9.97	9.99	9.995	9.97	9.99	9.995	Volts
Current (Note 2)	Sink	-5			-5			-5			mA
	Source	+20			+20			+20			mA
Impedance			0.005	0.05		0.005	0.05		.005	0.05	Ohms
Voltage Ripple			5			15			20		mV pk
Voltage Spike (once/cycle) magnitude			5			5			5		mV
Voltage Spike Duration			0.5			5			50		µsec
UNIT STEP RESPONSE to ±.01% of final value											
9110 < 0 to 100 KHz			1.3								mSec
9110 < 100KHz to 1 Hz			(Note 5)								mSec
9010 < 0 to 10 KHz						15					mSec
9010 < 10KHz to 1 Hz							(note 5)				mSec
9200 < 0 to 1KHz									150		mSec
9200 < 1KHz to 1Hz									15.0		mSec
NONLINEARITY (V_o vs F_{in}) 10 Hz to 100 KHz (9110); 1 Hz to 10KHz (9010); .1 Hz to 1.0 KHz (9200)			±.002	±.01		±.002	±.01		±.002	±0.01	% F.S.
OFFSET ADJUST RANGE			±50			±50		±50			mV
FULL SCALE ADJUST RANGE			±15			±15		±15			mV
POWER SUPPLY SENSITIVITY	+ 15V			15			15			15	ppm
	- 15V			10			10			10	% V_{cc}
POWER REQUIREMENTS (Note 3)											
Rated accuracy at ± 15 volts				±5%			±5%			±5%	
Operating Range		13		18	13		18	13		18	Volts
Current	+ 15 volts		24	27		24	27		24	27	mA
	- 15 volts		15	18		15	18		15	18	mA
TEMPERATURE CHARACTERISTICS											
Rated operating range		0		+70	0		+70	0°		+70°	°C
Derated operating range		-40		+85	-40		+85	-40		+85°	°C
Gain TC	9110, 9010, 9200			±30			±30			±150	ppm of
	9111, 9011, 9201			±20			±20			±30	FS/°C
	9112, 9012, 9202			±10			±10			±10	

NOTES

1. Input hysteresis is nominally 500mV. Levels and hysteresis are externally adjustable at REFERENCE INPUT Pin.
2. Short-circuit protected to ±15V or ground indefinitely.
3. Power supplies may be turned on separately, with no latch-up.
4. Filter time constants under 20µs (9110), 200µs (9010) or 2mSec (9200) can be obtained, with some compromise of output voltage ripple performance.

OUTPUT/INPUT CONSIDERATIONS

Without external circuitry these modules accept input signals down to +2 volts peak; sine, triangular or square wave; DTL and TTL. Input signals differing from these characteristics may require external pulse shaping and/or level conversion. Input levels up to ±15 volts will not damage these units.

In most applications the factory-trimmed full scale output is adequate, and the FULL-SCALE ADJUST Pin should be shorted to the OUTPUT Pin.

If desired, full-scale output can be adjusted to exactly 10.000 with an optional 100 ohm gain trim potentiometer connected between the OUTPUT and FULL-SCALE ADJUST Pins.

If a large modification in scale factor is required, an external resistor can be added between the SUMMING POINT Pin and the OUTPUT Pin. This method will provide full scale output for bandwidths as large as 150 KHz (9110), 11 KHz (9010) or 1.1 KHz (9200) and as low as 1 KHz (9110), 100 Hz (9010) or 10 Hz (9200) with only very slight effect upon output accuracy. The resistor value is given by:

$$R\ (\text{ohms}) = \frac{\alpha}{\text{Full-scale frequency (Hz)}}$$

$\alpha = 3.3 \times 10^9$ (9110)
$\alpha = .95 \times 10^9$ (9010)
$\alpha = .095 \times 10^9$ (9200)

When using this scale factor modification a potentiometer can be connected in series with the external resistor if fine-tuning of full scale frequency is desired.

These modules will not operate if the FULL SCALE ADJUST Pin is left open, unless a feedback path is provided via an external resistor connected between the OUTPUT Pin and either the FULL SCALE ADJUST Pin or the SUMMING POINT Pin.

Output offset is guaranteed to be less than ±6mV without external compensation when the input frequency is zero. For extreme precision a trim potentiometer can be used to adjust the output to zero.

GENERAL APPLICATION NOTES

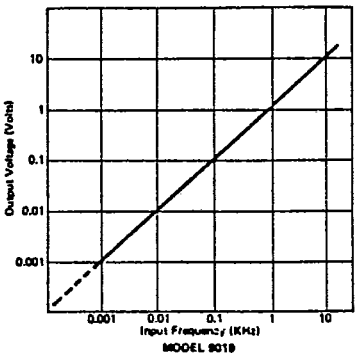
These FVCs are simple to understand and easy to use. They are the most precise frequency to voltage converters available, and the following provisions will ensure optimum performance.

As is good practice with all precise electronic conversion instruments, it is recommended that supply bypass capacitors be added in close proximity to the module. Tantalum capacitors, 15µf/35V, from both the +15V and -15V pins to analog ground serve the purpose and are especially advisable if the power supplies are some distance away and/or multiple connectors are used.

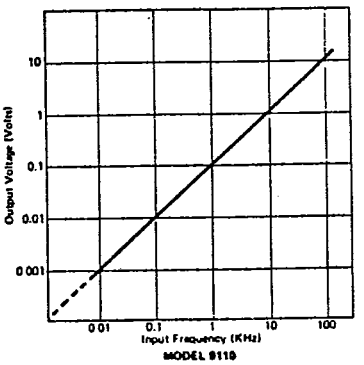
Low TC (100 ppm), 10 to 20 turn trim 100 ohm (9110) or 200 ohm (9010 & 9200) potentiometers are recommended for the gain adjustment potentiometer. A large TC potentiometer will degrade the overall effective TC.

In systems or environments where supplies may drift significantly with time and temperature variations, it might be well to zener regulate the voltages applied to each end of the E_{os} trim potentiometer. This will attenuate the effect of supply drift on output voltage offset.

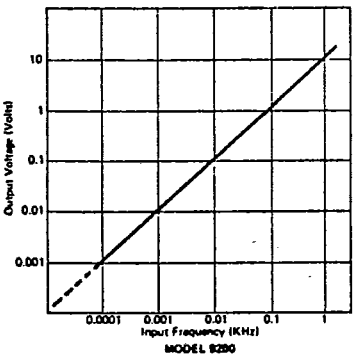
TRANSFER CHARACTERISTICS



MODEL 9010



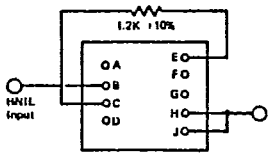
MODEL 9110



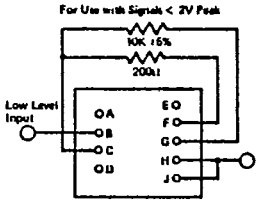
MODEL 9200

USEFUL CONFIGURATIONS

For Use with HNIL (High Noise Immunity Logic)



For Use with Signals < 2V Peak



In this configuration, pick-off level = 0 Volts and hysteresis = 40mV.

Hysteresis and Trip Point Adjustment

$R = R_1 + R_2 = \frac{\alpha}{\text{FS Frequency}}$

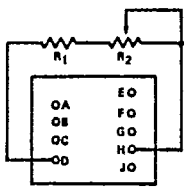
$\alpha = 3.3 \times 10^9$ (9110)
$\alpha = .95 \times 10^9$ (9010)
$\alpha = .095 \times 10^9$ (9200)

9110 Typical Values
10KHz (R_1 = 300K, R_2 = 50K)
50KHz (R_1 = 60K, R_2 = 10K)

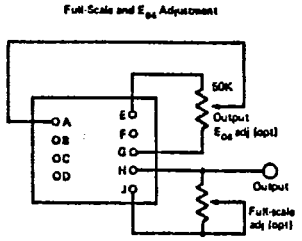
9010 Typical Values
1KHz (R_1 = 900K, R_2 = 100K)
5KHz (R_1 = 170K, R_2 = 20K)

9200 Typical Values
100HZ (R_1 = 900K, R_2 = 100K)
50HZ (R_1 = 1.7M, R_2 = 200K)

Changing Full Scale Frequency (Leave FS ADJ pin open)

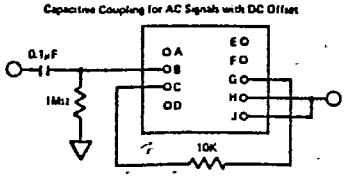


Full-Scale and E_{os} Adjustment

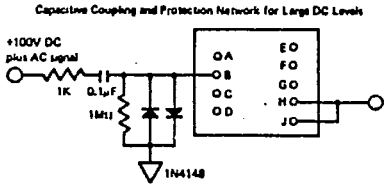


FULL SCALE ADJUST pin must be shorted to OUTPUT pin if trim pot is not used.

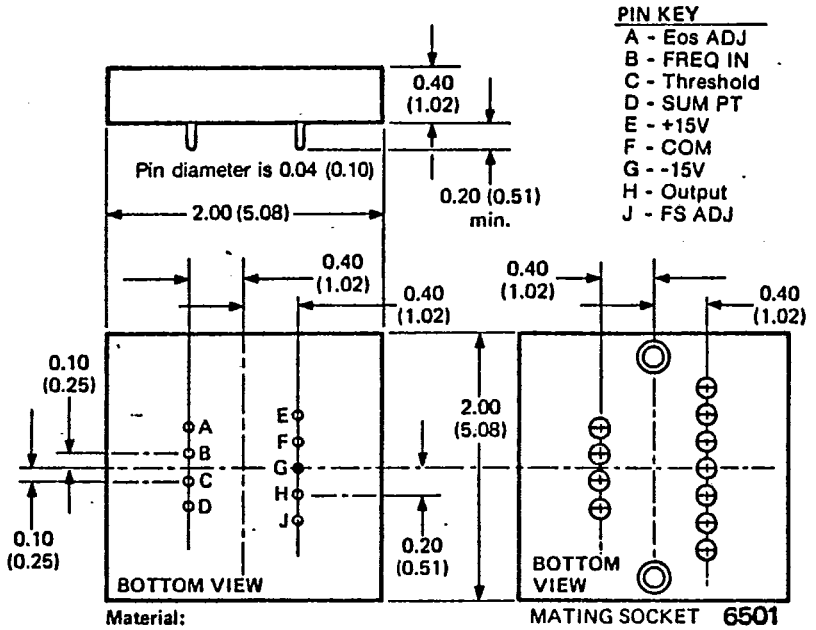
Capacitive Coupling for AC Signals with DC Offset



Capacitive Coupling and Protection Network for Large DC Levels



MECHANICAL OUTLINE/PIN KEY



Material:
NEMA grade G10 .093 (2-36) black panelyte

MATING SOCKET 6501
(Order Separately)

NOTE: All dimensions in parentheses are expressed in centimeters.

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