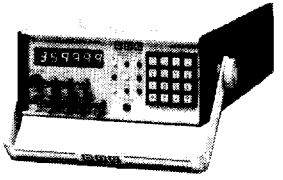
SIM-31200 SERIES

SYNCHRO AND RESOLVER ANGLE SIMULATORS



High Frequency Option (SIM-31205) Available (contact factory)

DESCRIPTION

The SIM-31200 Series are high quality synchro and resolver simulators, which incorporate microprocessor control of digital input multiplexing, front panel display, internal 20-bit digital to resolver converter and status/fault flag outputs. The internal 20-bit binary converter provides resolution of .001° BCD or .00034° binary, with accuracy up to ±.003° (10 arc seconds). The angle input may be entered locally via the keyboard, or remotely through the rear panel parallel data connector. The remote input format (BCD or binary) is selectable via a rear panel switch. An optional IEEE-488 interface is available for using the SIM-31200 with instruments connected to a General Purpose IEEE Parallel Data Bus.

The front panel keyboard is for local programming of output formats, increment/decrement, output voltage levels, angle entry and calibration/test functions.

The reference input (26 or 115V rms) is broadband (47 Hz to 11 KHz) and may be supplied to the rear panel connector or front panel terminals.

The outputs are transformer isolated synchro or resolver signals programmable to 11.8, 26, or 90V rms line-to-line.

The microprocessor provides control for analog signal output formats and levels. In addition, the microprocessor works in conjunction with a nonvolatile memory and a counting circuit to measure the reference frequency which is used to generate a digital correction and calibration scheme.

The instrument is powered by 115V or 230V rms, and has internal EMI/RFI filtering. Bench top and rack mounted configurations with or without front panel keyboard or display are available.

APPLICATIONS

Applications for SIM-31200 Series include production testing, quality control inspections and laboratory instrumentation. Due to its I/O flexibility, the SIM-31200 functions well for testing navigation equipment, antenna position and calibration systems.

FEATURES

- *5 VA DRIVE CAPABILITY*
- *HIGH ACCURACY:*
  ±.003° NO LOAD
  ±.008° FULL LOAD
- *WIDEBAND: 47 Hz TO 11 KHz*
- *IEEE INTERFACE (OPTIONAL)*
- *PROGRAMMABLE OUTPUT STANDARD SYNCHRO AND RESOLVER LEVELS*
- *OVERLOAD PROTECTED*
- *DIGITAL CALIBRATION FOR IMPROVED MAINTAINABILITY*

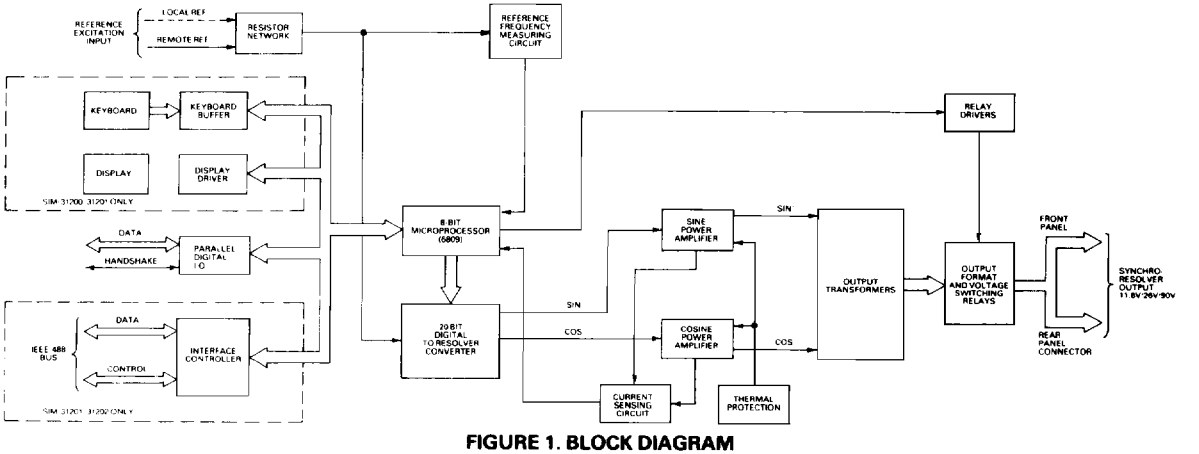


FIGURE 1. BLOCK DIAGRAM

SPECIFICATIONS

Apply over temperature range, ±10% reference voltage and frequency variation, and ±10% harmonic distortion in the reference.

PARAMETER	VALUE
RESOLUTION	.001° BCD; .00034° Binary
ACCURACY*	
47Hz-2KHz	±.003° (no load); ±.004° 1.5VA load; ±.008° 5VA load
10KHz	±.015° (no load); ±.03° 1.5VA load.
*Accuracy degrades as a linear function of frequency from 2KHz to 11KHz. For higher accuracy consult factory.	
ANGLE RANGE	000.000° To 359.999° (BCD) 000.000° To 359.99966° (Binary); continuous rotation
DISPLAY	
Output Angle	6-digit, 7-segment LED with polarized filter
Status Indications	Local, Remote, Synchro, Resolver, 11.8V, 26V., 90V., Overload, Reference Missing LEDs
DIGITAL INPUT/OUT	
Parallel I/O Type	TTL Compatible Open = Logic 1, Ground = Logic 0
Inputs	
Loading	1 LS TTL Load
BCD/Binary Angle Input	Switch selectable format; 22 data lines; 6 decades BCD, or 20-bit binary: 200°, 100°, 180/80°, 90/40°, 45/20°, 22.5/10°, 11.25/8°, 5.625/4°, 2.812/2°, 1.406/1°, .703/.8°, .351/.4°, .176/.2°, .088/.1°, .044/.08°, .022/.4°, .011/.2°, .0055/.01°, .0027/.008°, .0014/.004°, .00069/.002°, .00034/.001°
Other Inputs	Synchro/Resolver, 11.8 volt, 90 volt, Data Track/Hold, MPU Reset
Outputs	
Drive Capability	5 Standard TTL loads
Signal	Reference Missing, Overload, Parallel Input Ready, Binary/BCD, GPIB/Parallel
GPIB IEEE Interface	Optional, See Below
REFERENCE INPUT	
Input Type	Transformer Isolated
Voltage Levels	26 VRMS/115 VRMS. Others Special: Consult Factory.
Frequency	47Hz - 11KHz.
Input Impedance	26V-50K min.; 115V-230K min.
Harmonic Content	10% maximum allowable
Location	Through either front panel or rear connector for both local and remote modes.
Max. Allowable Voltage Operating	127V for 115V nominal 29V for 26V nominal
Max. Allowable Voltage No Damage	35V for 26V nominal 150V for 115V nominal
Breakdown Voltage	±500 VDC to Logic Ground
FACTORY CALIBRATION FREQUENCIES AND RANGES	
Synchro	90V: 47-150Hz (Cal at 60Hz), 151-1000Hz (Cal at 400Hz); 11.8V: 360-2000Hz (Cal at 400Hz)
Resolver	11.8V: 360-2000Hz (Cal at 400Hz); 2000Hz-11KHz (Cal at 10KHz) 90V: 151-2000Hz (Cal at 400Hz)
User calibration frequencies	Anywhere within specified ranges.

PARAMETER	VALUE
SYNCHRO/RESOLVER OUTPUT	
Type of Output	Synchro (S1, S2, S3 outputs) or resolver (S1, S2, S3, S4 outputs) with transformer isolation.
Line-to-Line Output Voltages	Programmable 11.8, 26 and 90 VRMS ±0.5% nominal due to all causes
Output Locations	Front Panel and rear connector, active in both local and remote modes.
Minimum L-L Load impedance Z_{L-L}	$90V_{L-L}$ / $26V_{L-L}$ / $11.8V_{L-L}$
Synchro (47-2000Hz)	1215 ohms / -- / 21 ohms
Resolver (47-2000Hz)	1620 ohms / 135 ohms / 28 ohms
Resolver (2-11KHz)	-- / -- / 93 ohms
Drive capability	Will drive loads with any phase angle from −90° to +90°
Time phase	• 4° max. up to 2 KHz; ±1° at 11KHz with respect to reference input
Scale factor variation	±.025% simultaneous amplitude variation in all output lines as a function of digital angle
Protection	Momentary and continuous overcurrent protection; Output overload and reference input missing indications to user. Over temperature shutdown protection
Breakdown voltage	±500 VDC to GND
RESPONSE TIME	7.5ms max. upon receipt of input from parallel I/O or IEEE bus
FACTORY CALIBRATION	Instrument not specified for 26V Synchro operation
WARM UP TIME	30 sec. max
FRONT PANEL CONTROLS	
Power	On/Off switch
Keyboard	Local/Remote, Synchro/Resolver, 11.8/26/90 volt Lamp Test, Angle "Delta" Entry, Increment/Decrement Angle, clear entry, decimal point, calibrate, angle entry
FRONT PANEL I/O	Reference Input (115R, 26R, RL); Synchro/Resolver Output (S1, S2, S3, S4), Case Ground Digital Ground
REAR PANEL	
Connectors	J1 (50-Pin Analog/Digital I/O) Standard** J2 (24-pin GPIB I/O) optional** J3 (3-pin Power)
Control Switches	GPIB/Parallel (Optional) BCD/Binary GPIB Address-5 bits (Optional) 115/230 volt Power Input
POWER INPUT	
Connector	Rear Connector including internal EMI/RFI filter, separate line cord supplied
Voltage	Switch selectable 115/230V rms ±10%
Power frequency	47 to 63Hz (For 400Hz line power operation contact factory)
Fuse (on rear panel)	Buss, GMW-2, 2 Amp
Isolation	Transformer
PHYSICAL CHARACTERISTICS	
Size	8 1/8 x 3 1/2 x 14 1/2 inches (20.6 x 8.9 x 36.8 cm.)
Weight	14 lbs (6.4 kg.)
Mounting**	Half-rack, full-rack
TEMPERATURE RANGE	
Operating	0° to 50°C
Storage	−65°C to +100°C

**See Ordering Information

TECHNICAL INFORMATION

INTRODUCTION

The SIM-31200 Series Simulator is a third generation unit featuring μP control and calibration. It is available in three configurations:

1. SIM-31200 is the standard bench top unit with front panel controls and a parallel digital output at the rear for remote operation.
2. SIM-31201 is the same as the SIM-31200 but with optional IEEE GPIB interface.
3. SIM-31202 is a unit optimized for ATE applications. It has a blank front panel to prevent inadvertent operation. The interface is solely through the rear panel IEEE GPIB port or parallel digital I/O.

All versions may be bench operated or rack mounted with appropriate mounting hardware.

KEYBOARD OPERATION

Local operation of the SIM-31200 Series is through a 16 pad keyboard, which allows for selection of operating mode, output level and format, test and calibration functions, six digit numerical angle programming, digital angle input enable and angle increment/decrement with programmable delta angle. The keyboard has 10 dual-function keys (highlighted in grey in Figure 2) which are identified by the presence of numerals in the lower case position. The remaining keys are single function keys. A description of the keyboard functions is provided in Table 1.

FRONT PANEL CONNECTIONS

Front panel signal output terminals (S1, S2, S3 and S4) permit direct access to selected signal levels in synchro or resolver format. The reference input terminals may be used for local or remote operation to provide the instrument with 115V or 26V reference excitation. Care must be taken to operate with only *one* reference source (rear connector or front panel terminals). Accidental duplication of reference input signals will not damage the instrument, but will cause errors in angular information in the display (SIM-31200 and SIM-31202) and synchro and resolver outputs on all models.

CALIBRATION

The internal microprocessor operates in conjunction with a non-volatile RAM and the reference measuring circuit (Figure 1) to implement a calibration scheme. This allows compensation for angular errors caused by the output transformers. The procedure will allow calibration to a total error that is equal to or less than ±.003°. A detailed calibration procedure is in the Instruction Manual supplied with each instrument.

DIGITAL PARALLEL I/O

Operating any of the Simulator models through the rear parallel digital I/O port requires that the instrument be connected according to the connection scheme shown in the Parallel I/O (J1) Pin Function Table. The user must also position the rear panel switch (PRL) to select the parallel interface and then select the proper angle format with the Binary or BCD (BIN/BCD) switch. The user must manually set the remote mode, since all models, except the SIM-31202, initialize to the local mode when power is turned on.

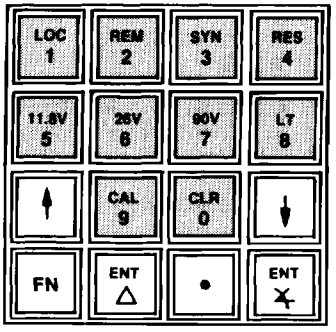
REMOTE OPERATION VIA THE IEEE GPIB

When operating via the IEEE-488 Interface, a remote mode command signal is provided by the Interface (SIM-31201 and SIM-31202). The front panel indicator lights will illuminate, even though the instrument is controlled remotely (except SIM-31202). They will function as if in the local operating mode, by indicating synchro or resolver signal output and line-to-line voltage level. In the event of a fault condition, such as current overload or reference voltage drop below 5V rms (26V reference) or 22V rms (115V reference) the front panel lights (OVLD or REF LOSS) will illuminate in either local or remote mode.

The SIM-31202 requires that all signals access the device through the J1 Interface Connector (rear panel). The user must further insure that the rear panel function switches are set for proper signal and power input (see Mechanical Outline). If operating SIM-31201 or SIM-31202 with IEEE-488 General Purpose Interface Bus (GPIB), the user must program the appropriate 5-digit device address, select the GPIB position and BCD or Binary code on the rear panel to facilitate communication via the IEEE-488 data bus. All GPIB signals are provided to the J2 Interface Connector with the exception of the Reference input, which must be supplied through the J1 Connector or the appropriate front panel binding post.

DRIVE CAPABILITY

SIM-31200 Series Simulators can drive up to 5 VA over the frequency range of 47 Hz to 2 kHz and 1.5 VA at frequencies up to 10 kHz. When driving tuned loads the tuning capacitors should not exceed .01μF on 90 V L-L synchros or resolvers, .15μF on 26V L-L resolvers, .75μF on 11.8V L-L synchros or resolvers or .4μF on 11.8V resolvers operating over 2 kHz. These are beyond the range of most tuning capacitors and so should not be a problem.



Indicates dual function key

FIGURE 2. SIM-31200 SERIES KEYBOARD (LOCAL OPERATION)

KEYBOARD FUNCTIONS

KEYBOARD PAD	FN ENABLED FUNCTION*	FUNCTION**
FN	When depressed, enables user to select upper functions of the dual function keys.	N/A
LOC 1	Selects local mode.	Enters numerical value of "1".
REM 2	Selects remote mode.	Enters numerical value of "2".
SYN 3	Selects synchro output.	Enters numerical value of "3".
RES 4	Selects resolver output.	Enters numerical value of "4".
11.8V 5	Selects 11.8V output level.	Enters numerical value of "5".
26V 6	Selects 26V output level.	Enters numerical value of "6".
90V 7	Selects 90V output level.	Enters numerical value of "7".
LT 8	Initiates lamp test for approximately 1 second displaying 888.888 and causing all front panel indicators to light.	Enters numerical value of "8".
▲	N/A	Increments input angle by the delta value.
CAL 9	Used for instrument calibration.	Enters numerical value of "9".
CLR 0	Clears angular display.	Enters numerical value of "0".
ENT △	N/A	Enters selected delta angle into instrument
▼	N/A	Decrements input angle by delta value.
ENT ✕	N/A	Enters displayed angle into instrument
•	N/A	Enters numerical value representing a fractional part of an angle entry.

*FN enabled functions are called out in red alphanumerics and are collocated with angle entry digits, which are blue.

**Functions are activated after FN configuration has been selected.

PARALLEL I/O J1 PIN FUNCTIONS

PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
1	Spare Pin	17	.0027/.008°	38	DATA T/H Handshake Input "1" = Track Parallel Angle Input Data "0" = Hold Parallel Angle Input Data
2	Spare Pin	18	115R } Remote Ref Input		
3	Case GND	19	RL		
4	J1 Return	20	26R		
5	SYN/RES Input(1) "1" = Synchro "0" = Resolver	21	GPIB/PARALLEL Input/Output(4)	39	BIN/BCD "0" = Binary I/O "1" = BCD I/O
		22	Signal Output Programming(2)		
		23	NU/100°		
6	Output Level Programming(2)	24	180/80°		
7	90/40° (3)	25	1.406/1°	40	NU/200°
8	22.5/10°	26	11.25/8°	41	45/20°
9	5.625/4°	27	.088/.1°	42	2.812/2°
10	.703/.8°	28	Spare	43	.352/.4"
11	.176/.2°	29	REF MISSING Output	44	Spare
12	MPU RESET Input "1" = Normal Operation "0" = Resets Microprocessor	30	PARALLEL INPUT RDY Output(1)	45	Converter SIN/COS Common (6)
		31	Spare	46	Converter SIN
		32	.0055/.01°	47	Converter COS
13	OVERLOAD Output "1" = Overcurrent Sensed "0" = No Overcurrent	33	.0014/.004°	48	.044/.08°
		34	S2	49	Spare
		35	S3 } Synchro/Resolver Output	50	.0003/.001"
14	.022/.04°	36	S4(5)		
15	.011/.002°	37	S1		
16	.0007/.002°				

Notes: (1) Pins used in all parallel I/O modes only.
(2) Signal output programming is as follows:

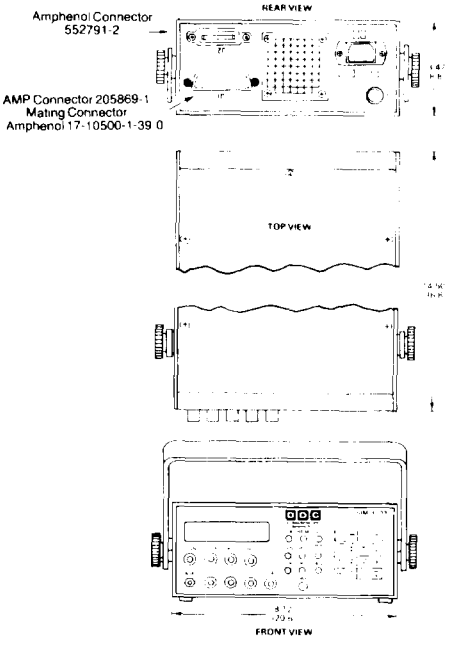
J1-6 Logic	J1-22 Logic	L-L Voltage Level
"0"	"0"	90 Volts
"0"	"1"	26 Volts
"1"	"0"	Illegal
"1"	"1"	11.8 Volts

(3) J1 Connector pins 7, 11, 14, 17, 23, 27, 32, 33, 40, 43, 48, and 50 are Binary BCD (NU = not used Binary).
(4) Switch Selectable (rear panel)
"1" = IEEE 488 Bus controlled "0" = Parallel I/O controlled
(5) S4 used for resolver operation only.
(6) Converter SIN/COS Common is to be used only for the analog calibration of the internal Digital to Resolver Converter Module. Refer to the SIM-31200 Manual for calibration procedures. It should not be connected to J1 Return or other system grounds.

IEEE-488 PIN FUNCTIONS

Pin	Function
1	D101 Data I/O Line
2	D102 Data I/O Line
3	D103 Data I/O Line
4	D104 Data I/O Line
5	EOI
6	DAV
7	RFD
8	DAC
9	IFC
10	SRQ
11	ATN
12	Case GND
13	D105 Data I/O Line
14	D106 Data I/O Line
15	D107 Data I/O Line
16	D108 Data I/O Line
17	REN
18-24	GND

MECHANICAL OUTLINE Dimensions in inches (centimeters).



ORDERING INFORMATION

All instruments are supplied with detachable line cord, mating connector (J1) and instruction manual.

SIM-31200
└— Options:
0 = Bench top with keyboard
1 = Bench top with keyboard and IEEE-488
2 = Blank front panel with IEEE-488

High Frequency Option (SIM-31205) Available (contact factory)

Notes: 1. SIM-31201 and SIM-31202 are supplied with carry/support handle. For ½ rack mounting brackets order P/N 33395. For full rack mounting brackets order P/N 33396.

2. SIM-31202 is supplied with ½ rack mounting brackets. For full rack mounting brackets order P/N 33396.

SIM-31203 ADDENDUM

The SIM-31203 is identical to the SIM-31200 series with the addition of "rate" mode.

The implementation of the new Rate feature takes advantage of the fact that the main Firmware loop in the SIM-31200 is interrupt driven by a 20 millisecond timer (ie. 50 times a second). What we have done is to utilize this consistent 20 millisecond clock as a time base for stepping the Synchro/Resolver output of the Simulator. The amount that the output steps each interval is controlled by the Delta Angle function already incorporated in the SIM-31200. This implementation does however require that the user calculate the Delta Angle (ie. step size) required for the desired rotational rate. The formula for calculating the Delta Angle knowing the desired output rate in degrees/second is the following:

Delta Angle = Desired rate * 0.02

The limitation on the slowest possible programmable rate is based on the fact that the smallest programmable Delta Angle is 0.001 Degrees. Therefore the slowest programmable Rate (and also the resolution of the Rate feature) is 50 * 0.001 deg/sec or 0.05 deg/sec. The upper limit for the Rate feature is basically meaningless as it can theoretically be programmed for a rate of 360 * 50 = 18000 degrees/second.

Because of the implementation technique utilized only linear rates (constant velocity) are available, however the output can be programmed for either the Positive of Negative rotation. The Rate feature is only available via the IEEE bus as no modifications have been made to the Keyboard of associated circuitry. It should also be noted that because of time restraints the display is not updated while in the Rate mode. Finally, in order to provide as much flexibility as possible the Delta Angle, the Angle, and the Direction can be changed while in the Rate mode should someone find it advantageous to do this.

The four new IEEE commands added to the SIM-31200 to facilitate the Rate feature are as follows:

G	Starts the rotation
H	Halts the rotation
I	Positive (Increasing angle) Rotation
J	Negative (Decreasing angle) Rotation

Typical operation of the Rate feature would involve calculating and programming the Delta Angle, programming the desired direction, and then issuing the start command.

ORDERING INFORMATION: SIM-31203