

API1620 and API1718

FEATURES

Five Digit Display
Accuracy 0.02° (API1620) or 2 arc-minutes (API1718)
Two Channel Input
Accepts High or Low Level Synchros, Resolvers or Magslips
47Hz to 600Hz Carrier Frequency
16-Bit BCD or Natural Binary Output
Storage Compartment for Leads/Connectors

API1620 FEATURES

Degrees and Decimal Parts of a Degree Display
Display Test Facility
Full Scale 359.99°

API1718 FEATURES

Nato Codified
Degrees and Minutes Display
Display Latch Facility
Full Scale $359^\circ 59'$

DESCRIPTION

The Angle Position Indicators API1620 and API1718 are instruments for displaying in visual digital form the angle represented by synchro, magslip or resolver signals. In addition to displaying the angle in visual form the APIs also convert the input angular signals into natural binary or BCD angular data at TTL levels for use externally. Facility is provided for the connection of two sets of input signals which may be alternately switched into the converter. The APIs have been designed to accommodate input signals from all the usually encountered angular data transmission systems i.e., Synchros, Magslips and Resolvers at both high and low voltage levels and at frequencies from 47Hz to 600Hz. The two sets of inputs to the APIs can be different e.g., a 60Hz synchro on one input together with a 400Hz resolver on the other. The facility of switching from one set of inputs to the other enables the angular position of separate devices to be directly compared. The meters have been designed to work with any reference voltage from 6V rms to 115V rms.

STORAGE COMPARTMENT

A storage compartment for storing the input leads and connectors is provided on the underside of the instrument, access to this is by an easily operated slotted screw fastener. The API is delivered with part of the Application Kit stored in this compartment.

SELF TESTING

Both Angle Position Indicators have a self checking facility. This is provided by internally simulated input angles of 45° and 225° selected by the front panel mode switch. The simulated angles have an accuracy an order of magnitude greater than the Instrument.



NATO CODE NUMBER

The API1718 BCD option has been issued with a Nato Stock Number, 6625-99-539-8389, which eases acceptance of the Angle Position Indicator in military applications.

MODELS AVAILABLE

The two Angle Position Indicators described in this data sheet differ primarily in the format of the display and the presence of a Display Check or Display Latch facility.

Model API1620 has a display format of degrees and decimal parts of a degree with a full scale range of 359.99° and an accuracy of 0.02° . It has a display check facility on the front panel and is available in two options, viz.

BINARY option has 16-bit representation at TTL levels of the input angular signal in natural binary form on the rear connector.

BCD option has a 5 decade BCD representation at TTL levels of the input angular signal on the rear connector.

Model API1718 has a display format of degrees and minutes with a full scale range of $359^\circ 59'$ minutes and an accuracy of 2 arc minutes. It has a display latch facility on the front panel and is available in two options, viz.

BINARY option has a 16-bit representation at TTL levels of the input angular signal in natural binary form on the rear connector.

BCD option has a 5 decade BCD representation at TTL levels of the input angular signal on the rear connector.

SPECIFICATIONS (typical @ +25°C unless otherwise noted)

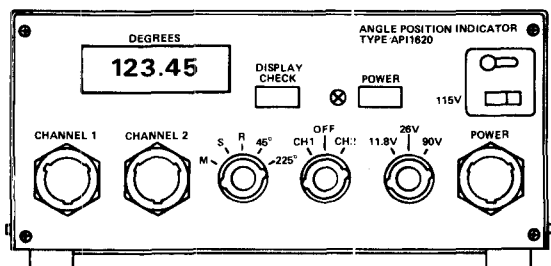
Models	API1620	API1718
ACCURACY ¹	±0.02° at 400Hz ±0.03° at 60Hz	2 arc minutes at 400Hz 3 arc minutes at 60Hz
ANGULAR RANGE	000.00° to 359.99° continuous rotation	000.00° to 359° 59 minutes continuous rotation
TEMPERATURE RANGE	Operational 0 to +50°C Storage -5°C to +55°C	*
INPUT SIGNAL VOLTAGE	11.8V rms 200Hz to 600Hz 26.0V rms 200Hz to 600Hz 90.0V rms 47Hz to 600Hz	*
REFERENCE VOLTAGE	6V rms to 115V rms with no adjustments required	*
REFERENCE FREQUENCY	47Hz to 600Hz	*
INPUT IMPEDANCE	Signal 2MΩ Reference 200kΩ	*
TOLERANCE ON SIGNAL TO REFERENCE PHASE	±20°	*
DISPLAY	5 digit, dot matrix LED	*
DATA OUTPUT (TTL) ON REAR CONNECTOR (BCD 2TTL Loads, Binary 3TTL Loads)	Either 5 decade BCD or 16-bit natural binary. Degrees and decimal parts of a degree format.	*
INHIBIT INPUT (TTL) (1TTL LOAD)	Logic "0" = Hold Logic "1" = Track	*
BUSY OUTPUT (TTL) (10TTL LOADS)	Logic "0" = Data Stable Logic "1" = Busy	*
POWER SUPPLY	23VA (typ), 28VA (max) at either 115V rms or 220V rms ±15% 47Hz to 400Hz	*
WEIGHT	10 lbs 4.53Kgm	*
SIZE (EXCLUDING HANDLE)	11.75" X 8" X 4" (300mm X 204mm X 102mm)	*
NATO STOCK NO.	—	6625-99-539-8389 (BCD version only)

NOTES

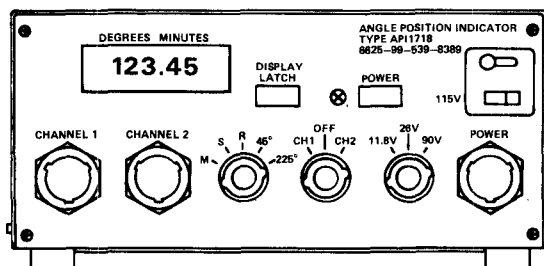
*Specifications same as API1620.

¹ Full accuracy is maintained if signal voltages within ±10% of the nominal values are applied (all lines varying together). The input amplifier limits are set at +15% of the nominal voltage levels, no damage will occur if 90 volts is applied on the 11.8 volts or 26.0 volt settings and up to 150 volts can be applied on the 90 volts setting without damage. For voltages considerably lower than the normal voltages the API will continue to function at a reduced accuracy; the inaccuracy will manifest itself mainly as an hysteresis error.

Specifications subject to change without notice.



Front Panel of the API1620



Front Panel of the API1718

DATA READOUT

The digital angle readout is displayed on a five digit display by Light Emitting Diode (LED) dot matrix indicators on the front panel.

The API1620 model displays this angle as degrees and hundredths of a degree.

The API1718 model displays this angle as degrees and minutes.

The displayed angle is also available at TTL levels in either Binary or BCD format on the rear connector. *In both APIs this angle is produced in degrees and hundredths of a degree.*

DISPLAY CHECK (API1620)

The API1620 has a display check press button on the front panel which when pressed causes all the dots in all LED matrices to be illuminated.

POWER CONNECTIONS

The Angle Position Indicators can be powered from 115V ac or 220V ac $\pm 15\%$, the changeover switch being on the front panel. The supply frequency can be 47Hz to 400Hz.

DISPLAY LATCH (API1718)

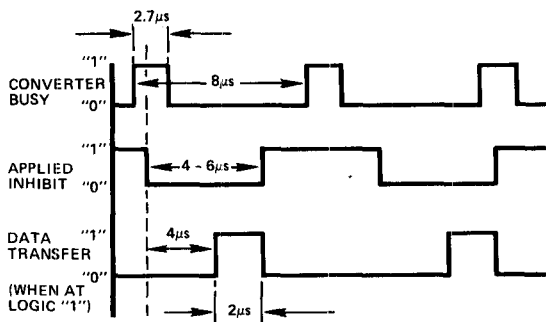
The API1718 has a Display Latch button on the front panel which when pressed will hold the display at its existing reading—but does not effect the digital output data.

Both APIs have a latch facility available on Pin 36 on the rear connector. This "INHIBIT" input will "Freeze" both the display and the digital output data if a Logic "0" is applied.

OUTPUTTING VALID DATA

A "Converter Busy" pulse is available on Pin 37 of the rear connector, which indicates the state of the converter. When this line is at Logic 1 the converter is busy and the data is changing. A Logic 0 indicates that the data is valid.

Data can be transmitted without error under the following timing sequence.



Data Transfer Waveforms

DATA OUTPUT CONNECTIONS AND BIT WEIGHTS

The APIs are available in two forms one giving the output in BCD form and the other giving the output in natural binary form. In both cases the resolution corresponds to 16-bits binary. The pin connections for the 37 way DCM 37S Souriau rear connector are given in the following table.

OPERATING NOTES

The line voltage selector switch must be set in the correct

PIN NUMBER	NATURAL BINARY VERSION		BCD VERSION
	BIT NO.	BIT WEIGHT	CODING
1	GROUND		GROUND
2	16	0.0055	0.01°
3	15	0.0110	0.02°
4	14	0.0220	0.04°
5	13	0.0439	0.08°
6	12	0.0879	0.16°
7	11	0.1758	0.32°
8	10	0.3516	0.64°
9	9	0.7031	1.28°
10	N/C		1.0°
11	N/C		2.0°
12	8	1.4063	4.0°
13	7	2.8125	8.0°
14	6	5.6250	16.0°
15	5	11.2500	32.0°
16	4	22.5000	64.0°
17	3	45.0000	128.0°
18	2	90.0000	256.0°
19	1	180.0000	512.0°
20	N/C		N/C
20↓	**		TD↓
35	N/C		N/C
36	INHIBIT		INHIBIT
37	BUSY		BUSY

Connections on Output Connector at rear of API

position before the power is applied. To the left of the voltage selector switch is the instrument "on/off" press button and to the left of that is the power indicator neon.

SIGNAL VOLTAGE SELECTOR SWITCH

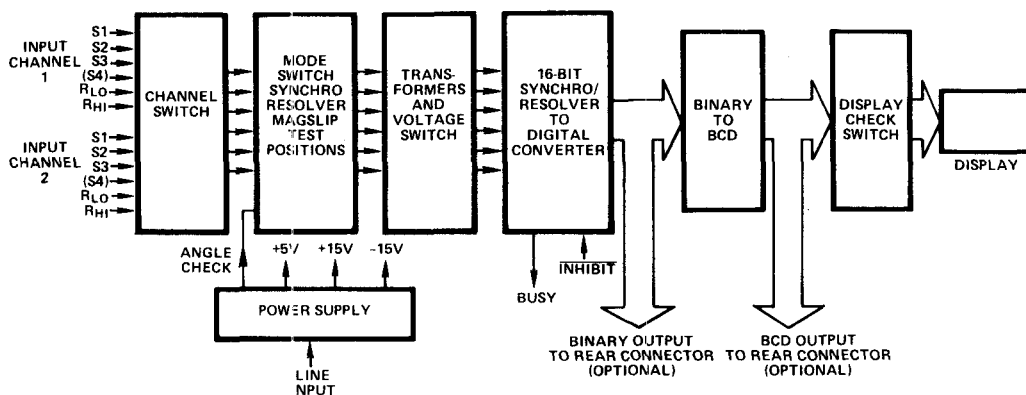
The three position selector switch alters the transformers to suit the synchro or resolver voltages being applied to the API. THIS SWITCH SHOULD BE SET IN THE 90 VOLT POSITION DURING 45° OR 225° CHECKING, no damage will be done if this or any of the switches are in wrong positions but errors in checking could occur.

MODE SELECTOR SWITCH

This mode selector switch marked M, S, R, 45°, 225° meaning Magslip, Synchro, Resolver, 45° check and 225° check is for making appropriate changes according to whether a magslip synchro or resolver is being used. If two differing systems are being applied to the inputs e.g. Channel 1 resolver at 26V and Channel 2 synchro 90V, then the mode switch will have to be changed from R to S and the voltage switch from 26V to 90V when changing from Channel 1 to Channel 2. No damage will be done to the API by any order of switching but some change of loading on the inputs may occur. To avoid this problem the channel switch marked CH1, OFF, CH2 should be set in the OFF position when changing the mode and voltage switches.

DIRECTION OF DATA ROTATION

The convention of zero angle on Magslips differs from Synchros by 150°. Correction for this has been made inside the APIs, so that zero degrees will be indicated on the API for both Synchro and Magslips set to zero. The direction of rotation convention is different for Synchros and Magslips this has not been changed so that a clockwise rotation (from zero) of the synchro will give the same reading as an anticlockwise rotation (from zero) of a Magslip.



Schematic Arrangement of the API1620 and API1718

REFERENCE INPUT

Both the Angle Position Indicators require a reference voltage to be supplied via the input connectors. This must be the same reference as supplied to the devices under test and can be any voltage from 6V rms to 115V rms.

POWER AND SIGNAL INPUT CONNECTIONS

The power and input connectors have lettered pins (see table on previous page). Connections are:

Power

Fixed Connector: Amphenol 62GB-57A-8-3.3P

Free Connector: Amphenol 62GB-16F-8-3.3S

3 Way: Pin A Ground
Pin B Live
Pin C Neutral

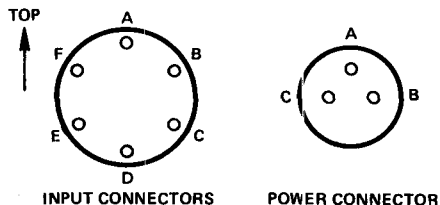
Inputs

Fixed Connector: Amphenol 62GB-57A-10-6P

Free Connector: Amphenol 62GB-16F-10-6S

6 Way: Pin A to S1 Pin D to S4
Pin B to S3 Pin E to Ref High
Pin C to S2 Pin F to Ref Low

For resolver inputs the sine voltage is applied to S1 and S3 and the cosine to S2 and S4. The phase of the resolver connections should be such that if S3 and S4 and Ref Low are regarded as common then in the first angular quadrant 0 to 90° the voltages on S2 and Ref High will be in time phase, i.e., positive together and negative together and the voltages on S1 and Ref High will be 180° out of time phase. For synchro or mag slip operation the connections should be made to S1, S2 and S3 in rotation.



Pin Connections as Viewed Looking at the Front of the API1620 and API1718

APPLICATIONS OF THE ANGLE POSITION INDICATOR

The API finds many applications in both civil and military systems where it is common place to use synchro or resolver angular data transmission.

In many areas of mechanical engineering where angular settings have to be made to high accuracies, the APIs can be used with a precision synchro to display the shaft angle—or by using both inputs to compare shaft angle settings.

Other examples of the API's applications are checking constant velocity, coupling (universal joints) and measuring nonuniformity in the gearing velocity of gear boxes. By converting the digital output data to printers, permanent records can be obtained.

FUSES

The API1620 is protected by a 300mA anti-surge fuse in the fuse holder in the rear panel. The API1718 has two 160mA anti-surge fuses located on the rear panel for 240V operation. When used at 115V the 300mA fuses supplied should be fitted.

ORDERING INFORMATION

The APIs should be ordered according to the following:

API1620/BCD	degrees and hundredths display. BCD digital data output on rear connector.
API1620/BIN	degrees and hundredths display. Binary digital data output on rear connector.
API1718/BCD	degrees and minutes display. BCD digital data output on rear connector. Nato Code: 6625-99-539-8389.
API1718/BIN	degrees and minutes display. Binary digital data output on rear connector.

The API1620 is supplied with the following applications kit: 2 input connectors Amphenol sockets type 62GB-16F10-6S, 1 mains lead with Amphenol socket type 62GB-16F8-3.3S attached, one 37 way DCM37S Souriau connector with cover and spring clip. 1 Users Handbook. Calibration Result Sheet.

The API1718 is supplied with the following applications kit: 2 input leads with Amphenol socket type 62GB-16F10-6S attached. (Nato stock number 6625-99-541-3454). 1 mains lead with Amphenol socket type 62GB-16F8-3.3S attached. (Nato stock number 6625-99-541-3453). One 37 way connector DCM37S/Souriau connector with cover and spring clip. 1 Users Handbook. 3 Spare fuses (one 160mA anti-surge, two 300mA anti-surge). Calibration result sheet.