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Operations Manual for Model 8810A

ANGLE POSITION INDICATOR

TWO SYNCHRO/RESOLVER MEASUREMENT CHANNELS AND ONE (OPTIONAL) REFERENCE SUPPLY

GENERAL

This Operations Manual contains general description, installation, operating instructions, maintenance and calibration verification information for the Model 8810A Angle Position Indicator (API). This Operation Manual is supplemented by "8810A Programmer's Reference" which can be found at www.naii.com.

FEATURES

- High-Resolution Touch Screen
- Programmable display options
- Self-Calibrating
- 0.0001° Resolution
- Accuracy: Up to ±0.0015°
- Two isolated Input Channels
- Single or Two-Speed Measurements: Programmable Ratio from 2 to 255
- Three display modes: 0-360°, ±180° or degrees, minutes & seconds
- Auto-ranging Signal and Reference
- 47Hz to 20KHZ Frequency Range
- Auto Phase Correction
- Measures and displays Reference Voltage, frequency, and VL-L
- Ethernet, USB, IEEE-488 & parallel ports
- Optional 6 VA internal Reference
- CE compliant



DESCRIPTION

The 8810A is a rack mount or bench top API featuring front panel controls (including touch screen display) and input terminals. This self-calibrating unit is furnished with factory installed rubber feet and foldaway tilt stand and can also be installed in a 3.5" half rack slot. Using optional rack mounting brackets, the 8810A may be installed as a single unit in a full rack slot or as a tandem mount of two units in a full rack slot.

This second-generation API truly represents a major step forward in Synchro-to-digital conversion technology. The use of an intelligent DSP design eliminates push buttons and allows all programming to be done either via an integrated touch-screen, front panel USB optical mouse interface or with the multi-purpose increment/setup knob. In addition, IEEE-488, Ethernet, and USB 2.0 interfaces have been added to extend remote operation capabilities. The display can be set for one of three display modes; 0-360º, ±180°, or Degrees, Minutes, Seconds. A wide frequency range (47 Hz to 20 KHz) is standard.

Improved flexibility is provided by two fully independent inputs that can be used to simultaneously read two separate input signals or can be combined to measure multi-speed Synchro's or Resolvers. The gear ratio, for the two-speed mode, is programmable from 2:1 to 255:1. Built-in phase correction eliminates errors caused by quadrature and harmonics when reference and signal are out of phase by as much as 60°.

The 8810A automatically accepts and displays input voltages from $1.0V_{L-L}$ to $90V_{L-L}$ and reference voltages from 2Vrms to 15Vrms over a broad frequency range of 47 Hz to 20 KHz. Therefore, one Instrument can handle most known Synchro and Resolver measurement requirements.

The 8810A is a replacement for all variations of the previously supplied standard and special versions of the Model 8810. Contact factory to determine compatibility.

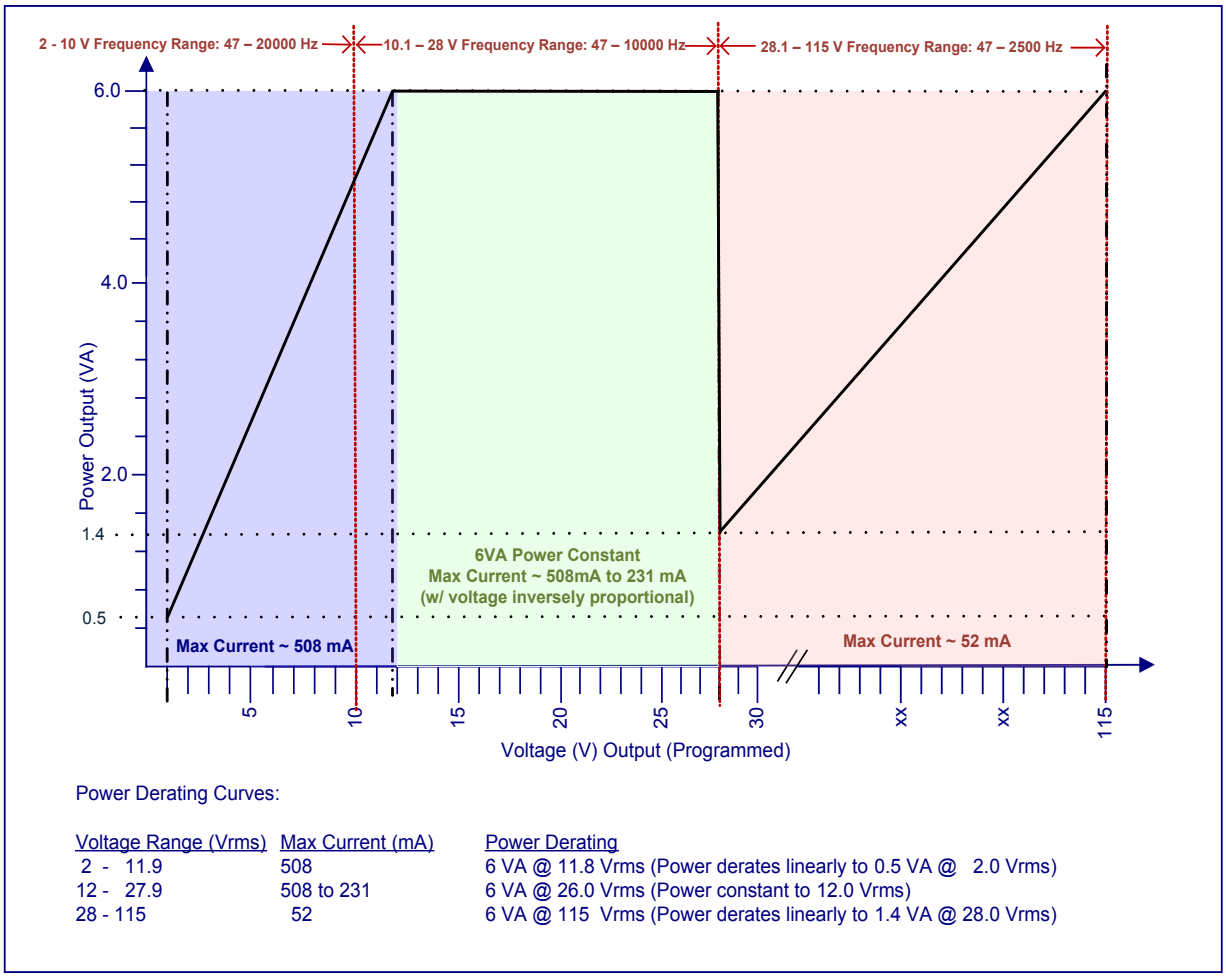
Optional Reference: This design can also incorporate a 6 VA programmable reference generator that is used for standalone applications (See P/N).

SPECIFICATIONS

Resolution:	0.0001°
Input Channels:	2 separate isolated Inputs
Signal Inputs:	Ch.1: Synchro/Resolver programmable; 1 - 90VL-L auto-ranging Ch.2: Synchro/Resolver programmable; 1 - 90VL-L auto-ranging Each channel measures the Input VL-L, Reference voltage and frequency. Data is displayed on the front panel and also available via various digital outputs.
Accuracy:	See detailed Accuracy Specifications below.
Frequency Range:	47 Hz – 20 kHz. See detailed Accuracy Specifications below.
Angular Range:	0.0000°-359.9999° or ±179.9999° programmable, or output angle can be viewed in degrees, minutes and seconds
Two-speed mode:	Both inputs can be combined with a ratio from 2 to 255
Reference Voltage:	2V to 115 V auto-ranging
Reference Frequency:	47 Hz – 20 kHz
Input Impedance:	**Input Signal (V L-L)** — **Input Impedance (kΩ)** 1 to 3 V — 47 3 to 6 V — 55 6 to 11.8 V — 58 11.8 to 26 V — 60 26 to 90 V — 200
Tracking Speed:	±10,000°/sec. (±27.7rps)
Settling Time:	1.5 s max. for 180° step change (Based on Bandwidth selected) 3.0 s max. at 47-66 Hz (Based on Bandwidth selected)
Phase Correction:	Automatically corrects for up to a 60° phase shift between stator and rotor
Velocity or DC angle for Ch.1 & Ch.2:	±1000 °/sec = ±10 VDC ±100 °/sec = ±10 VDC 0 to 359.99°= 0 -10 VDC ±179.99° = ±10 VDC
Bandwidth:	Automatically set based on frequency of input, up to a max of 100 Hz BW. User can change this parameter as desired, over a range of 6 to 1200 Hz BW. (See details under *Setup Menus).*
Data averaging:	Selectable from 10ms to 10 Seconds
Converter Busy:	TTL compatible pulses, 1µs wide nom. Pulses present when tracking.
Digital Output:	6-Decade BCD (1-2-4-8) 10 TTL loads
Serial Interfaces:	Ethernet, USB, and IEEE-488, and legacy 50 pin connector
Temperature Range:	0-50°C operating; 0-70°C storage
Input Power:	85Vrms to 265Vrms, 47Hz to 440 Hz, < 20 Watts
Weight:	4 lbs.
Dimensions:	13.0” L (33.02 cm) x 9.5” W (24.13 cm) x 3.5” H (8.89 cm)

REFERENCE GENERATOR SPECIFICATIONS (Optional, see part number)

Voltage Output:	2 Vrms to 115 Vrms, Programmable with a resolution of 0.1 V • 2.0 to 10.0 Vrms / 47 Hz to 20 KHz frequency range • 10.1 to 28.0 Vrms / 47 Hz to 10 KHz frequency range • 28.1 to 115.0 Vrms / 47 Hz to 2.5 KHz frequency range
Accuracy (No Load):	±5% of setting < 15 KHz ±10% of setting ≥ 15 KHz
Regulation	±5% (No Load to Full Load)
Output Drive:	6 VA maximum (See detailed description of Output Drive)
Output Protection:	Over-current (10x automatic retry; @ 1.3 sec int.; afterwards, shutdown w/ manual reset)
Frequency:	47 Hz to 20 KHz Programmable with 0.1 Hz steps
Frequency accuracy:	The greater of ±0.1% of frequency programmed or ±1 Hz.
THD:	±3% (maximum)
Reference Output Drive:	Isolated, single output (See detailed characterization)



Power Derating Curves:

Voltage Range (Vrms)	Max Current (mA)	Power Derating
2 - 11.9	508	6 VA @ 11.8 Vrms (Power derates linearly to 0.5 VA @ 2.0 Vrms)
12 - 27.9	508 to 231	6 VA @ 26.0 Vrms (Power constant to 12.0 Vrms)
28 - 115	52	6 VA @ 115 Vrms (Power derates linearly to 1.4 VA @ 28.0 Vrms)

Above figure: Reference output drive detailed characterization

DETAILED ACCURACY SPECIFICATIONS

NOTE: SPECIFICATIONS APPLY AFTER A 15 MINUTE WARMUP AND CALIBRATION

Accuracy: 8810A		
Resolver mode: 2.0 to 28 VL-L	±0.004°	from 47 Hz to 5 KHz
Resolver mode: 28 to 90 VL-L	±0.004°	from 47 Hz to 1 KHz
Resolver mode: 2.0 to 12 VL-L	±0.004° to ±0.008°	from 5 KHz to 10 KHz derated linearly
Resolver mode: 2.0 to 12 VL-L	±0.008° to ±0.015°	from 10 KHz to 15 KHz derated linearly
Resolver mode: 2.0 to 12 VL-L	±0.015° to ±0.02°	from 15 KHz to 20 KHz derated linearly
Resolver mode: 1.0 to 2.0 VL-L	±0.006°	from 47 Hz to 5 KHz
Resolver mode: 1.0 to 2.0 VL-L	±0.006° to ±0.015°	from 5 KHz to 10 KHz derated linearly
Resolver mode: 1.0 to 2.0 VL-L	±0.015° to ±0.025°	from 10 KHz to 15 KHz derated linearly
Resolver mode: 1.0 to 2.0 VL-L	±0.025° to ±0.035°	from 15 KHz to 20 KHz derated linearly
Synchro mode: 2.0 to 90 VL-L	±0.004°	from 47 Hz to 1 KHz

Accuracy: 8810AH		
Resolver mode: 2.0 to 28 VL-L	±0.0015°	from 47 Hz to 5 KHz
Resolver mode: 28 to 90 VL-L	±0.002°	from 47 Hz to 1 KHz
Resolver mode: 2.0 to 12 VL-L	±0.0015° to ±0.005°	from 5 KHz to 10 KHz derated linearly
Resolver mode: 2.0 to 12 VL-L	±0.005° to ±0.01°	from 10 KHz to 15 KHz derated linearly
Resolver mode: 2.0 to 12 VL-L	±0.010° to ±0.015°	from 15 KHz to 20 KHz derated linearly
Resolver mode: 1.0 to 2.0 VL-L	±0.0025°	from 47Hz to 5 KHz
Resolver mode: 1.0 to 2.0 VL-L	±0.0025° to ±0.01°	from 5KHz to 10 KHz derated linearly
Resolver mode: 1.0 to 2.0 VL-L	±0.010° to ±0.02°	from 10 KHz to 15 KHz derated linearly
Resolver mode: 1.0 to 2.0 VL-L	±0.02° to ±0.03°	from 15 KHz to 20 KHz derated linearly
Synchro mode: 2.0 to 28 VL-L	±0.0015°	from 47 Hz to 1 KHz
Synchro mode: 28 to 90 VL-L	±0.0025°	from 47 Hz to 1 KHz

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SAFETY SUMMARY

WARNINGS



This symbol is intended to alert the presence of un-insulated dangerous voltage and shock hazard if misuse or improper handling.



This symbol is intended to alert the presence of important information in the literature accompanying this device. All information should be read carefully to avoid misuse and potential harm to the user and/or device.

GENERAL SAFETY NOTICES

The following general safety notices supplement the specific warnings and cautions appearing elsewhere in the manual. They are recommended precautions that must be understood and applied during operation and maintenance of the instrument covered herein.

REPAIR 

DO NOT ATTEMPT REPAIR. Under no circumstances should repair of energized instrument be attempted. All repairs to this instrument must be accomplished at the Factory.

HIGH VOLTAGE 

HIGH VOLTAGE is used in the operation of this equipment.
DEATH ON CONTACT may result if personnel fail to observe safety precautions. Learn the areas containing high voltage on this equipment. Be careful not to contact high-voltage connections when installing, operating or maintaining this instrument.

INPUT POWER ALWAYS ON 

The design of the model 8810A is such that AC input power is continuously supplied to the power supply independent of the front panel ON/OFF Switch. The primary means of disconnect is pulling the line cord from the instrument

INTERFACES

The 8810A is available with several different interfaces for ATE applications. Interfaces include Ethernet, USB, IEEE-488, and a legacy 50 pin connector for API parallel BCD outputs. Below is information, for each interface. Detail programming commands / information are included in **"8810A Programmer's Reference Guide".** The Ethernet connector and the USB connector, J3, are industry standard connections.

J1 CONNECTOR, API PARALLEL PIN DESIGNATIONS

DD50P, Mate DD50S or equivalent

Pin	Designation	Pin	Designation
1	**Do Not Use(1)**	26	R2 CH.2 REF LO Input
2	**Do Not Use(1)**	27	Not Data Freeze
3	Chassis ground	28	0.02° (BCD Output)
4	Digital ground	29	0.08° (BCD Output)
5	S1 CH.1 Resolver (Sin LO); Synchro (X)	30	0.1° (BCD Output)
6	S2 CH.1 Resolver (Cos HI); Synchro (Z)	31	0.4° (BCD Output)
7	S3 CH.1 Resolver (Sin HI); Synchro (Y)	32	2° (BCD Output)
8	S4 CH.1 Resolver (Cos LO)	33	8° (BCD Output)
9	R1 CH.1 REF HI Input	34	**Not Used**
10	R2 CH.1 REF LO Input	35	**Not Used**
11	Converter busy	36	Reference Output HI(3)
12	0.04° (BCD Output)	37	Reference Output LO(3)
13	0.01° (BCD Output)	38	0.008° (BCD Output)
14	0.8° (BCD Output)	39	0.002° (BCD Output)
15	0.2° (BCD Output)	40	0.001° or 0.005° for 179.99°
16	4° (BCD Output)	41	DC out Ch.1(2)
17	1° (BCD Output)	42	Data Freeze
18	**Not Used**	43	Remote Ch. select
19	DC out Ch.2(2)	44	0.004° or 0.005° for
20	Local/Rem select	45	20 deg. (BCD Output)
21	S1 CH.2 Resolver (Sin LO); Synchro (X)	46	40 deg. (BCD Output)
22	S2 CH.2 Resolver (Cos HI); Synchro (Z)	47	80 deg. (BCD Output)
23	S3 CH.2 Resolver (Sin HI); Synchro (Y)	48	10 deg. (BCD Output)
24	S4 CH.2 Resolver (Cos LO)	49	100 deg. (BCD Output)
25	R1 CH.2 REF Hi Input	50	200° or + bit for 179.9°

Notes:

1- Previous models allowed power input at pins 1 & 2. To meet new safety requirements, power input is ONLY via the Power Entry module.
2- DC outputs on pins 19 & 41 are referenced to pin 4, digital ground.
3- Only Available with selected Internal Reference Generator option.

J2 CONNECTOR, IEEE - 488 PIN DESIGNATIONS

Standard IEEE Interface Connector

Pin	Designation	Pin	Designation	Pin	Designation	Pin	Designation
1	DIO1	7	NRFD	13	DIO5	19	Gnd., NRFD
2	DIO2	8	NDAC	14	DIO6	20	Gnd., NDAC
3	DIO3	9	IFC	15	DIO7	21	Gnd., IFC
4	DIO4	10	SRQ	16	DIO8	22	Gnd., SRQ
5	EOI	11	ATN	17	REN	23	Gnd., ATN
6	DAV	12	Shield	18	Gnd., DAV	24	Gnd., Logic

J3 CONNECTOR:

- USB-B (USB 2.0) Rear Connector, for communications only
- Ethernet (10/100/1000 Base-T copper)

CONTROLS & INDICATORS GENERAL DESCRIPTION

Below is a general description of the **Controls and Connections** on the front panel main display of the 8810A.

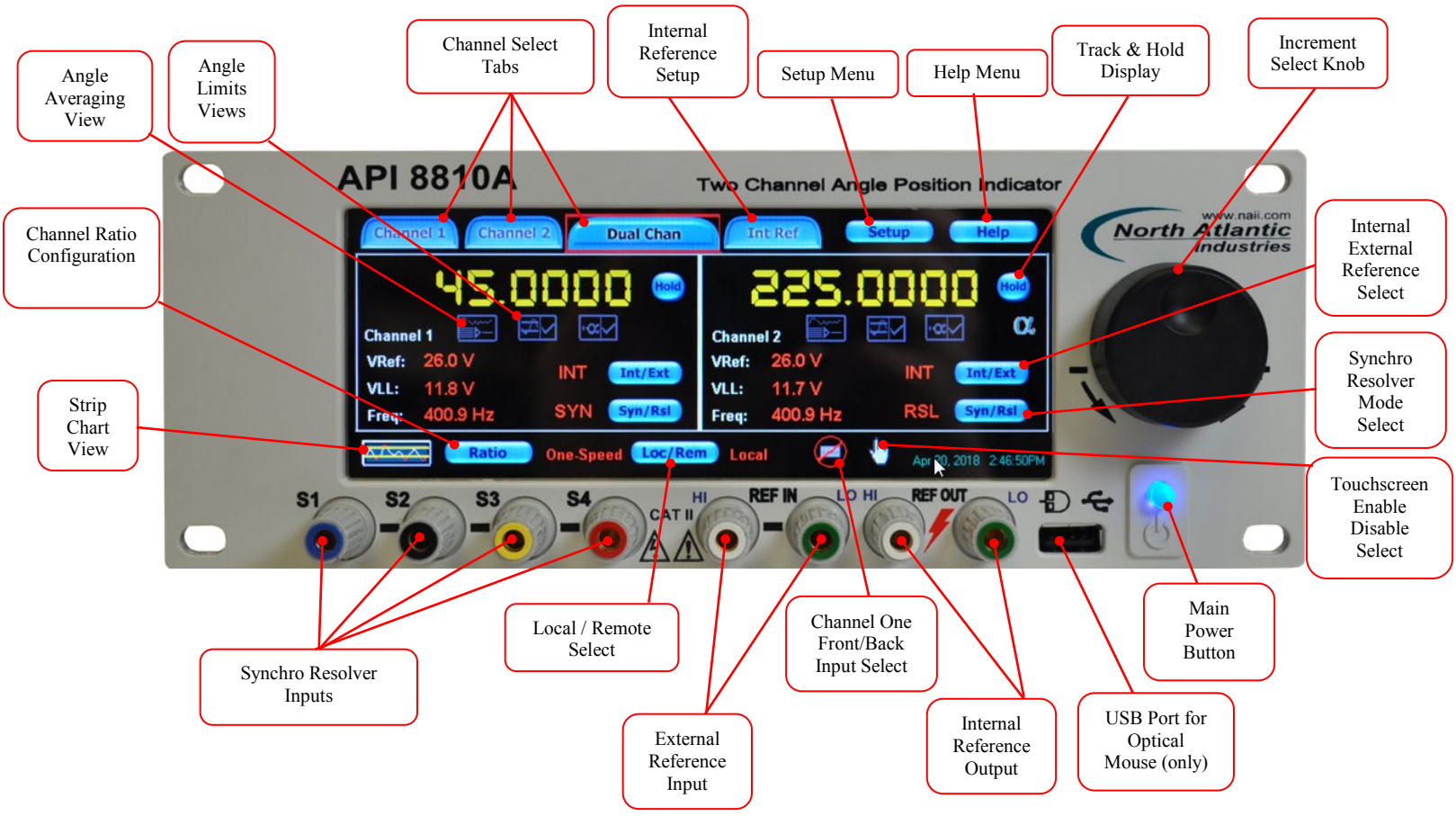


Figure 1 – Front Panel Controls & Connections

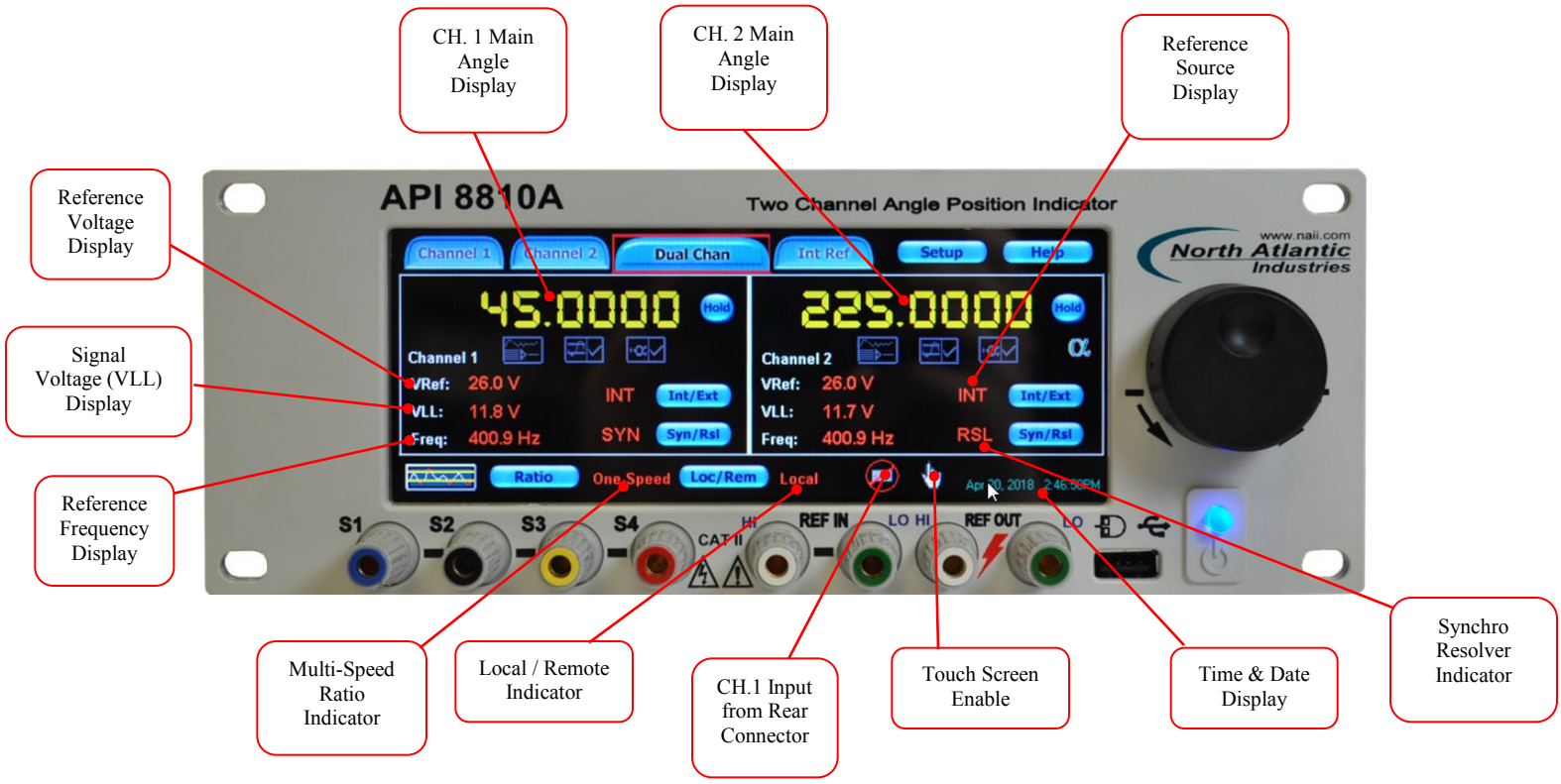


Figure 2 – Front Panel Indicators

Channel Selection

To select channel 1, channel 2 or dual channel mode, select corresponding tab by using either the touch screen, mouse or increment/setup knob. Below shows each channel select button along with the corresponding channel display.

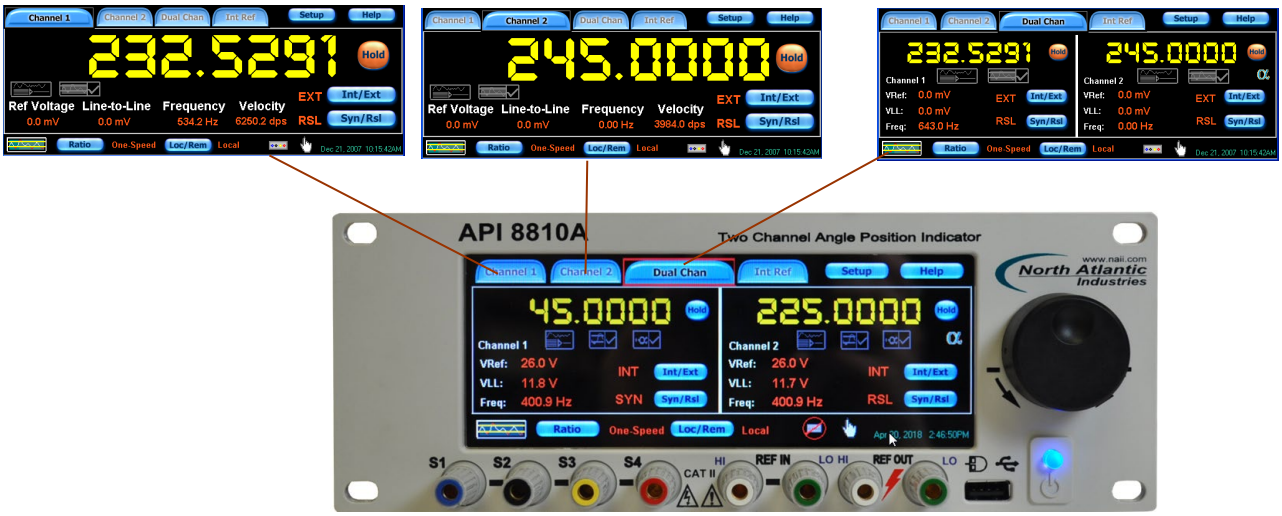


Figure 3 – Channel Selection

Internal Reference Setup

If internal reference option is installed in the 8810A; on the main screen, select the *Int Ref* button 

and the setup screen for the internal reference will be displayed as shown below:

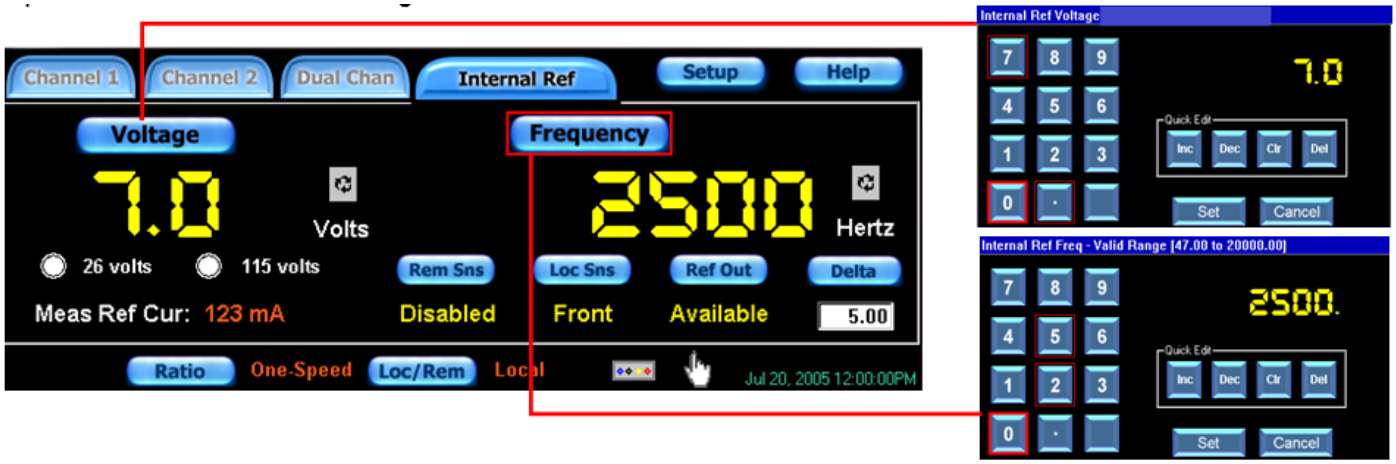


Figure 4 – Internal Reference Setup

Set the internal reference generator voltage and frequency parameters, using the setup screens shown above. When done, press any of the channel buttons or any other function to exit this setup menu.

To enable output of the optional on-board reference source, insure the “Ref Out Signal:” displays “Available”.

Note: To turn on internal reference, ensure that the *Int/Ext* button 

located on any of the channel displays is toggled on. Reference source indicator will display Int.

Synchro / Resolver Mode Select

On any channel screen, toggle the *Syn/Rsl* button 

to select either the Synchro or the Resolver mode. The mode which is selected, will be displayed next to the button as shown below

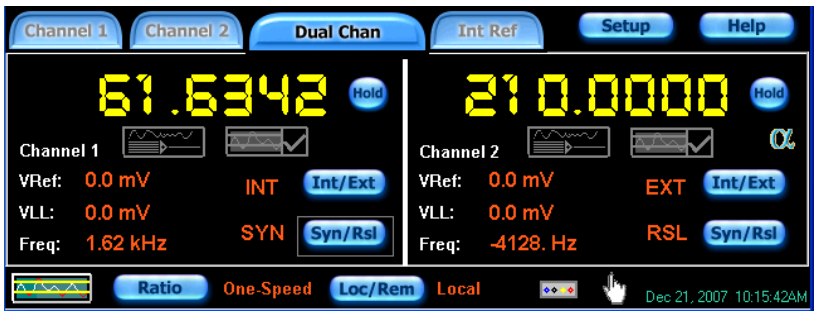


Figure 5 – Synchro / Resolver Mode Select

Ratio Select

The two inputs on the 8810A can be combined with a ratio of 2 to 255.

To enter the ratio menu and select the combined ratio, select the Ratio button 

and the menu shown below will be displayed

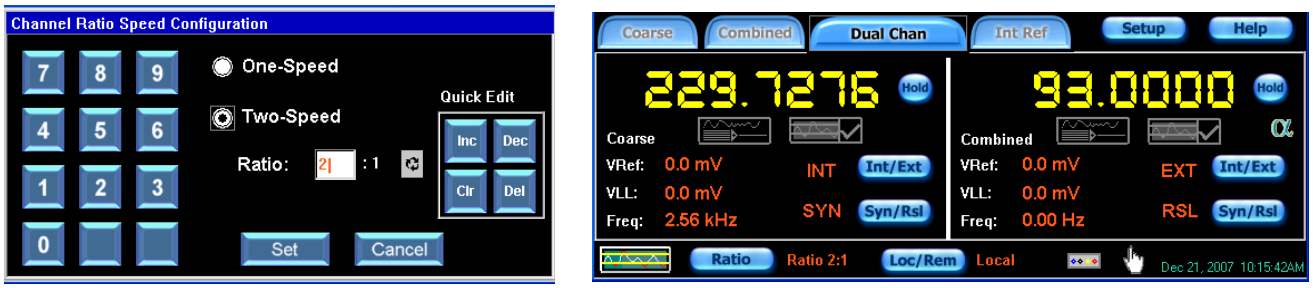


Figure 6 – Ratio Select

Refer to the menu displayed above left. Select Two-Speed and enter the desired ratio from 2 to 255. Value may be entered via keypad or with the Increment / Decrement buttons. Values may also be cleared or deleted using the quick edit keypad. Once value is selected, hit Set button and unit will return to the channel display. Refer to the display to the right and note that the ratio which has been set is now displayed next to the Ratio button. Also note that the channel select tabs at the top have now changed from Channel 1 to Course and Channel 2 to Combined.

Angle Difference



The Channel 2 input signal is shown on the 8810A when the angle difference mode is disabled. The angle data value is displayed in yellow.



The difference between two inputs on the 8810A can be displayed when the angle difference mode is enabled. The angle difference is displayed in red.

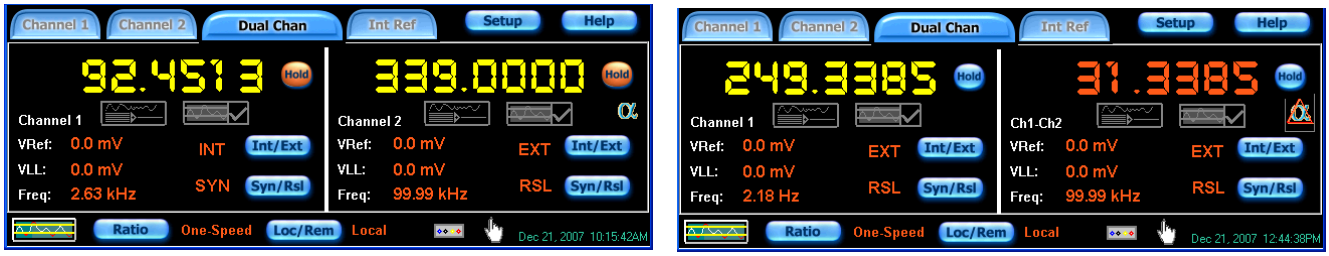


Figure 7 – Angle Difference Select

Remote programming / Legacy 8810 support (refer to 8810A Programmer's Reference Guide)

IEEE-488

Language support is provided for the following legacy 8810 instrument features: (No language support for MATE/CIIL)

API-8810 Native
API-8810 SR103
API-8810 HSR202
API-8810HSR203

API-8810A Native Language provides remote programmability for features available in the 8810A.

USB

API-8810A Native Language provides remote programmability for features available in the 8810A.

Ethernet

API-8810A Native Language provides remote programmability for features available in the 8810A.

Remote Operation Setup

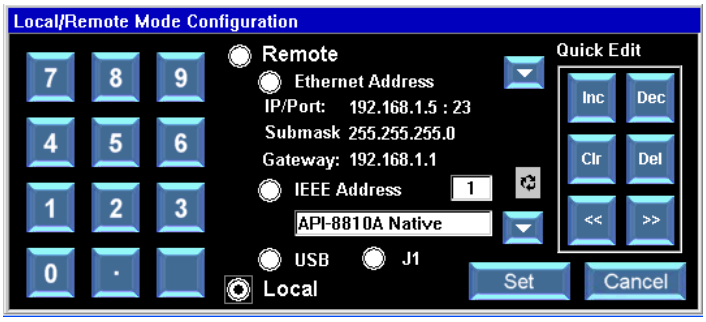


Figure 8 – Remote Operation

General Programming / Options selecting

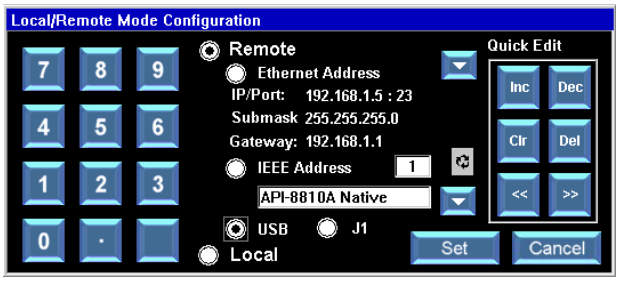
The 8810A may be remote programmed through a USB port, an Ethernet port, an IEEE-488 port or the J1 connector. The main setup screen for remote programming is shown above. The sections below show the setup for each mode.

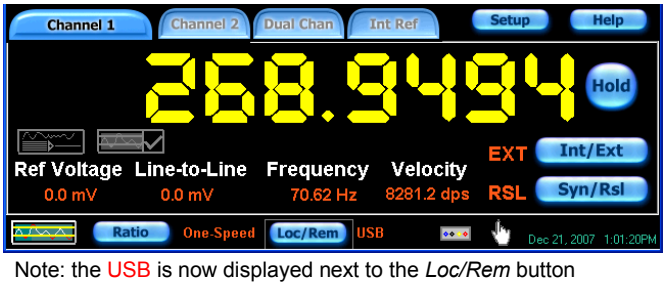
From any of the Channel Displays, select the *Loc/Rem* button to enter the remote configuration menu as shown below. Select *remote* button, then select desired port.



USB Port Selection

Selection of the USB port is accomplished by simply selecting the USB button as shown below. Once entered, hit set and unit returns to main display.



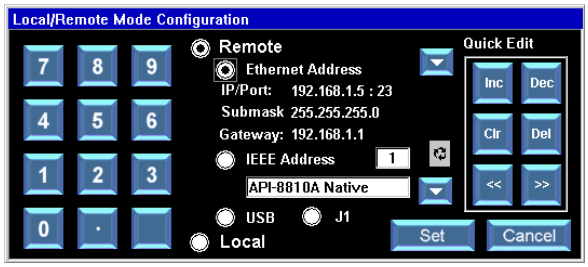


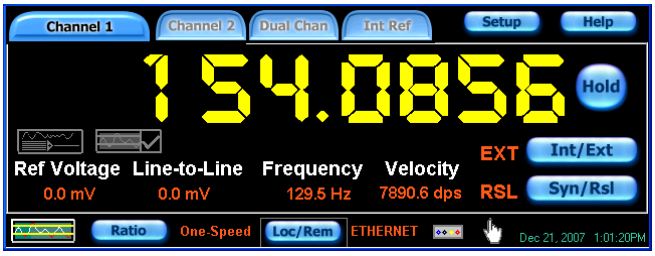
Note: the USB is now displayed next to the *Loc/Rem* button

Figure 9 – USB Port Selection

Ethernet Port Selection

Selection of the Ethernet port is accomplished by selecting the Ethernet address button as shown below, entering the Ethernet configuration for your network. Once entered, hit *set* and unit returns to main display. Modification of the Ethernet port is accomplished by selecting the Ethernet address button and entering a valid IP address, the Submask and Gateway address for your Ethernet network. The Ethernet Port used by the 8810A is always Port 23.





Note: ETHERNET is now displayed next to the Loc/Rem button

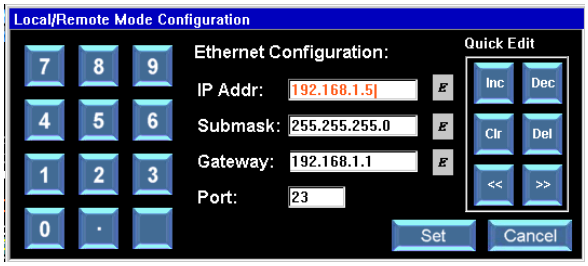
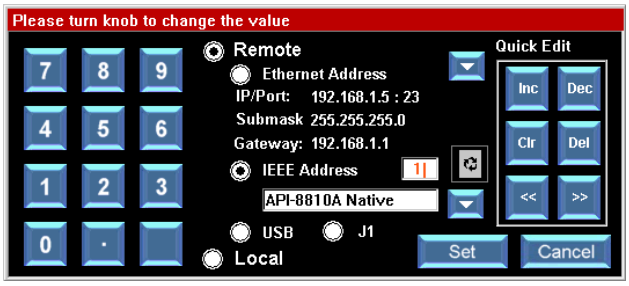
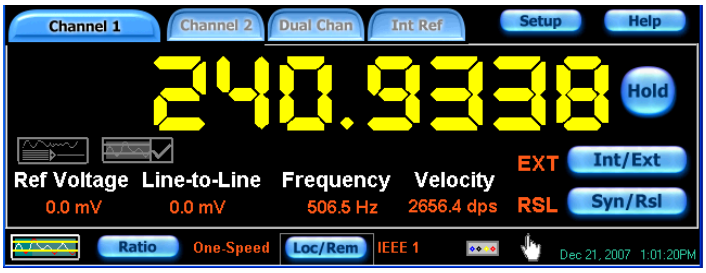


Figure 10 – Ethernet Port Selection

IEEE-488 Port Selection

This section describes the operation and programming of the Model 8810A using the IEEE-STD 488-1978, Standard Digital Interface for Programmable Instrumentation. Selection of the IEEE port is accomplished by selecting the IEEE Address button as shown above and entering an address. Once entered hit set and unit goes back to main display





Note: IEEE Address is now displayed next to the *Loc/Rem* button

Figure 11 – IEEE-488 Port Selection

Setup Menus

The 8810A setup menu accesses many of the features of the API and allows the user to easily configure it through the front panel. The setup menu is accessed by pressing the *Setup* button at the top of the main display screen. As shown by the screen below, there are ten choices in the setup menu. The section below describes each setup menu option.



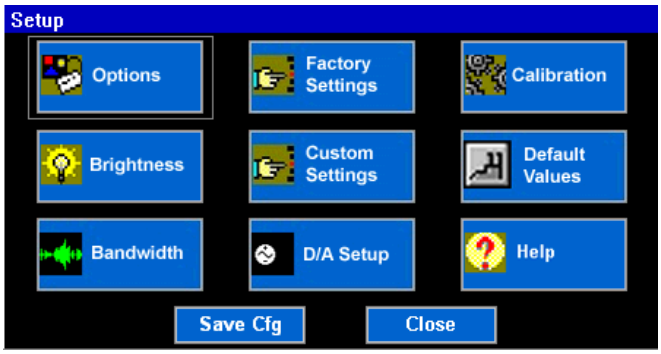


Figure 12 – Setup Menus

A sample of the **Options Menu** is shown below. This menu allows configuration of the following:

- Angle Display may be configured for the following parameters
  - 0 to 359.9999 degrees
  - -179.9999 to 179.9999 degrees
  - Degrees, Minutes and Seconds
- Channel 1 Input may be configured for the following parameters
  - Front Panel Input
  - Back Connector Input (J1)
- Touch screen
  - Enabled
  - Disabled (re-enable using the Increment /Setup knob or mouse to select Options menu)
- Auto Save (feature available on non-revision B units)
  - Enabled – 8810A will automatic save the 8810A configuration when the user changes the configuration from the front panel or remotely.
  - Disabled
- Date/Time Settings may be configured for the following parameters
  - Time Display Format either AM/PM or Military
  - Date Display Format either Text Date or Numeric only Date
  - Setting of Time and Date

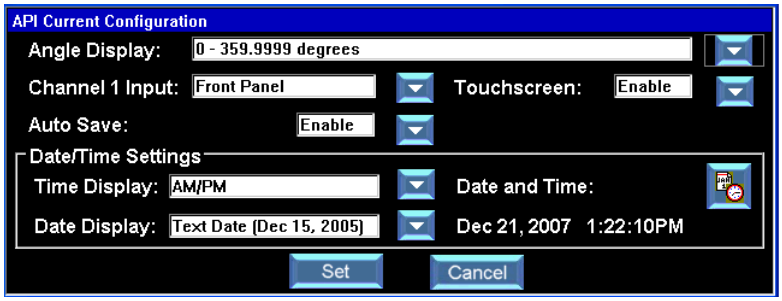


Figure 13 – Options Menu

A sample of the **Factory Setting** screen is shown below. Factory settings contain 10 sets of parameters that are permanently configured at the factory. These parameters include the settings for reference source, reference voltage, reference frequency and Synchro / Resolver configuration. The pre-set parameter is chosen by simply selecting the button on the left, followed by the Load button. Once completed, the API will return to the main display screen and the values are stored until changed. Settings 1 through 5 are shown below. Select "*More*>>" to see 6 through 10.

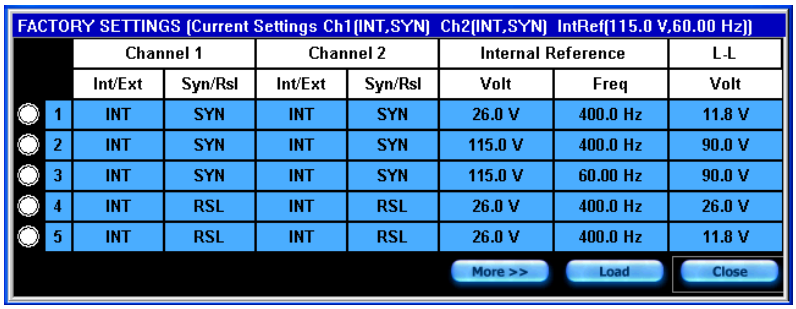


Figure 14 – Factory Setting

A sample of the **Custom Settings** Screen is shown below. The 8810A also contains the ability for the user to assign up to 10 custom configurations. These parameters include the settings for reference source, reference voltage, reference frequency and Synchro / Resolver configuration. Custom parameters are set by saving current parameters which have been previously set up on the main screens and then saving them to the 10 custom settings. This is accomplished by selecting the button to the left to choose the number 1 – 10 line and then selecting the Save Current button. The previously saved parameter is then chosen by selecting the button on the left, followed by the Load button. Settings 1 through 5 are shown above. Select "*More*>>" to see 6 through 10.

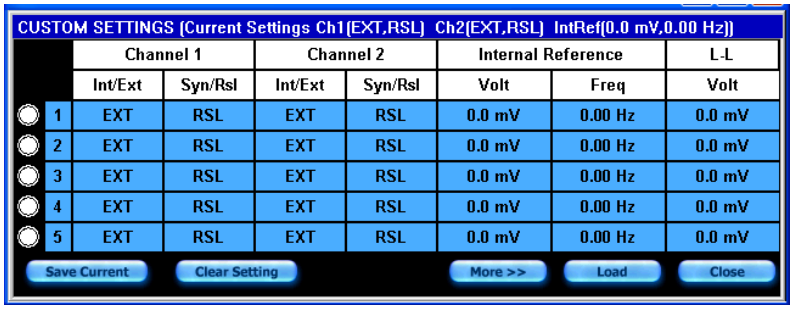


Figure 15 – Custom Settings

A sample of the **Brightness Control** screen is shown below. Brightness of the display is adjusted from 0 to 100% by touching the scale bar until the desired brightness percentage is obtained. Note that the brightness value is displayed above the bar.

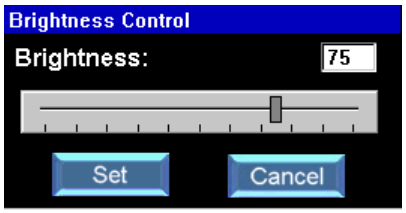


Figure 16 – Brightness Control

Shown below is the main **Calibration Menu** screen which contains a calibration routine for the Touchscreen display and a calibration routine for the measurement circuitry of the 8810A.

The Touchscreen Calibration will give prompts for the user to touch the screen in two places. The Touchscreen calibration calibrates the "user's touch" calibrating the touchscreen input position with the displayed content. When completed and successful, it will display "Calibration Complete".

The Unit Calibration will start an internal circuit calibration which requires no user intervention or external equipment. The unit will commence a full (off-line) calibration of all ranges (as opposed to background calibration which is continually running and calibrates the unit seamlessly while the unit is on-line at the particular voltage/frequency the unit is currently operating). Unit Calibration takes approximately 4 minutes to complete and will display "Calibration Completed" after successful completion.

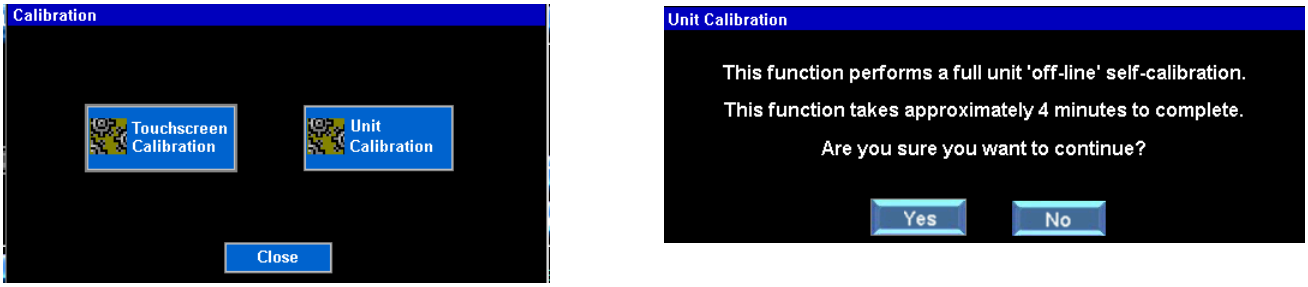


Figure 17 – Calibration Menu

Shown above are examples of the **Help Menu** screens. The help menu gives things such as specification summaries, descriptions of available buttons and descriptions of available functions included with the 8810A. The Help Menu screen shows the unit's serial number, date code, MAC address, model information and firmware revision.

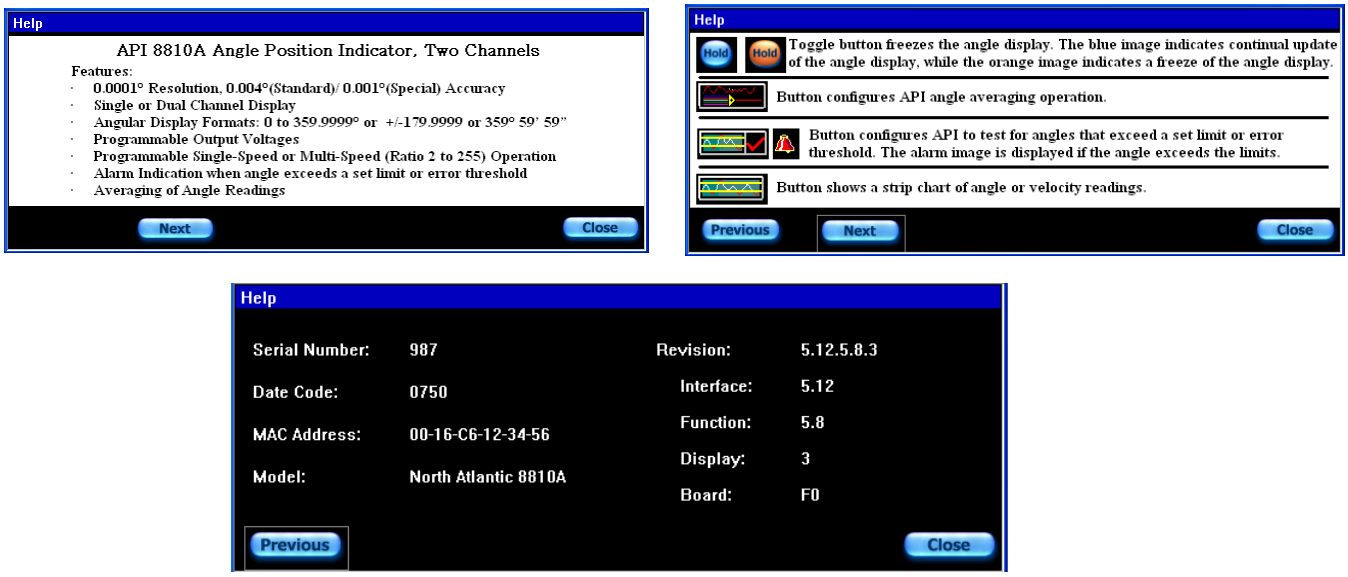


Figure 18 – Help Menus

Default Values screen allow for restoring the 8810A to factory settings.

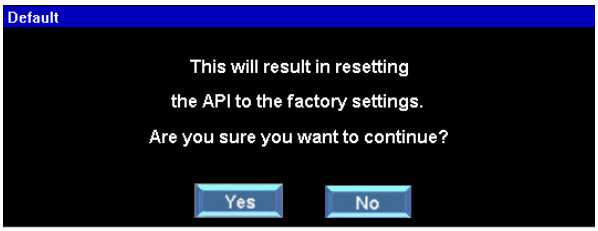


Figure 19 – Default Values

Each channel (0-360° or ±180° display mode only) can be independently set to provide a DC voltage representation of either angular position (Vdc/degree) or angular velocity (Deg./Sec.). The D/A output range can be set to +/- 10 Vdc max. See example below in Figure 20.

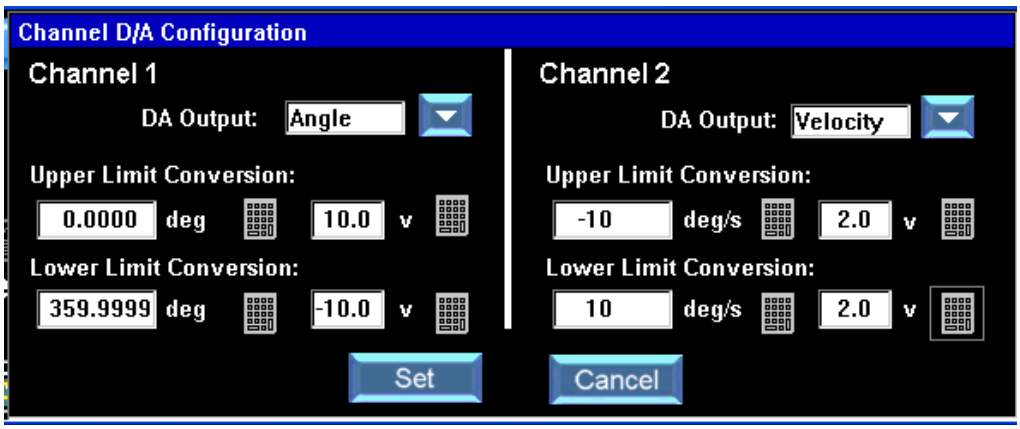


Figure 20 – D/A Setup

Two options are provided for setting the **Bandwidth (BW**) characteristics for each channel. As shown below, "Auto-Bandwidth" or user preferred BW selection is possible as follows:

Auto-Bandwidth – The 8810A measures the reference frequency and then sets the BW to 12.5% of the ref. frequency. The calculated BW will not exceed 100 Hz or be set below 6 Hz. This setting is the optimum for best compromise between response / settling time and stability (Jitter of the lower LSB's.) When this mode is selected the display indicates the calculated BW setting in the BW Value window.

User Selected – The Auto-Bandwidth box unchecked allows the user to select the BW over the range of 6 to 1200 Hz. It is recommended that BW not exceed 12.5% of the carrier frequency.

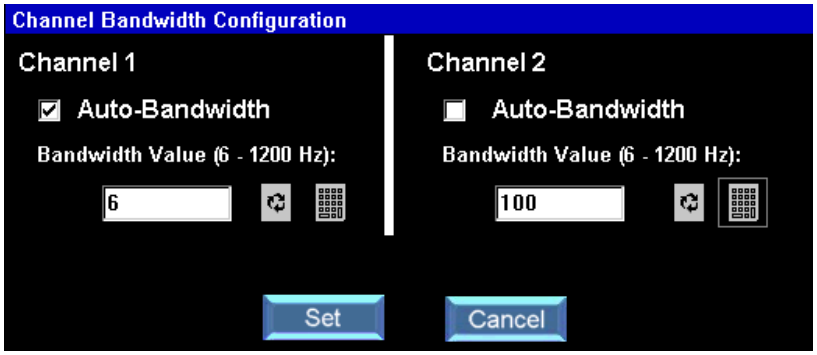
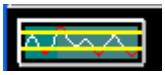


Figure 21 – Bandwidth

The 8810A includes a built-in **strip chart feature** which displays the angle readings in the form of a strip chart. Below is a sample of the screen displayed



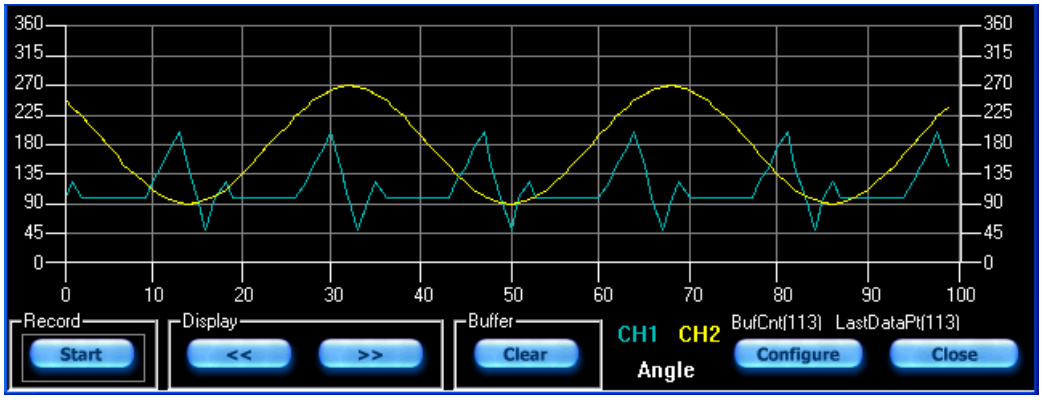


Figure 22 – Strip Chart Feature

The **configure menu** is shown in Figure 23. This menu allows the strip chart to be configured for the following parameters:

- Data plotted as either angle, angle error or velocity
- Display of either channel 1, channel 2 or both channels
- Sampling rate (minimum 100 milliseconds, maximum 30 minutes)
- Upper and lower range

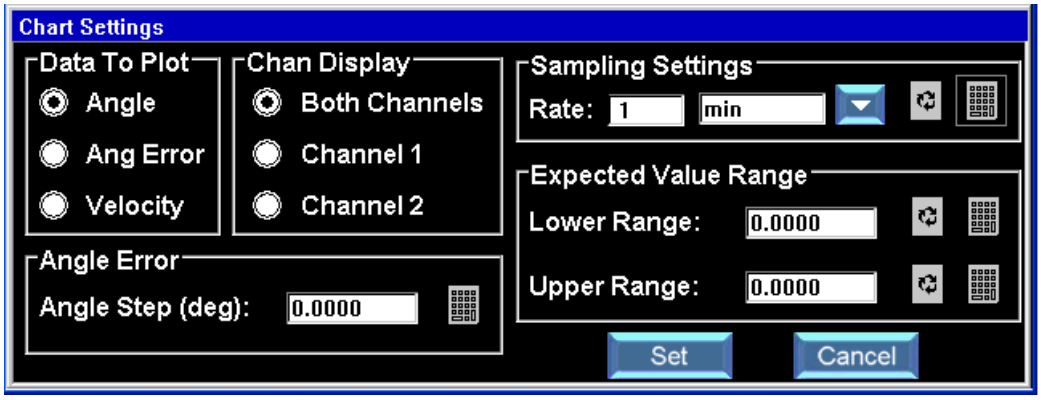


Figure 23 – Strip Chart Configuration Menu

The 8810A has a feature which allows **Averaging of the Angle Readings**. To access this feature select the *angle averaging* button on the main display (shown below left). The averaging period may be set from 10 msec to 10 sec. The number of angle readings which will be averaged is dependent on the rate of change of the angular data being monitored. These values may be set by using the keypad or the knob shown above.



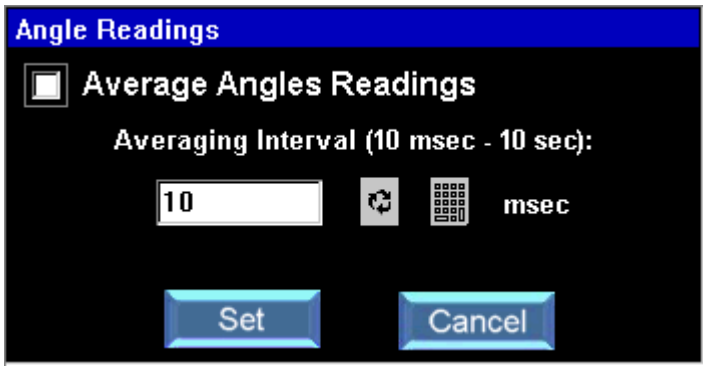


Figure 24 – Angle Averaging

The 8810A has a feature which configures the API to test for angles that exceed a set **Limit or Error Threshold**. To access this feature select the *limit/threshold button* (shown below left). The alarm image is displayed if the angle exceeds the preset limit or threshold. Settings include both an average count and an upper angle limit.



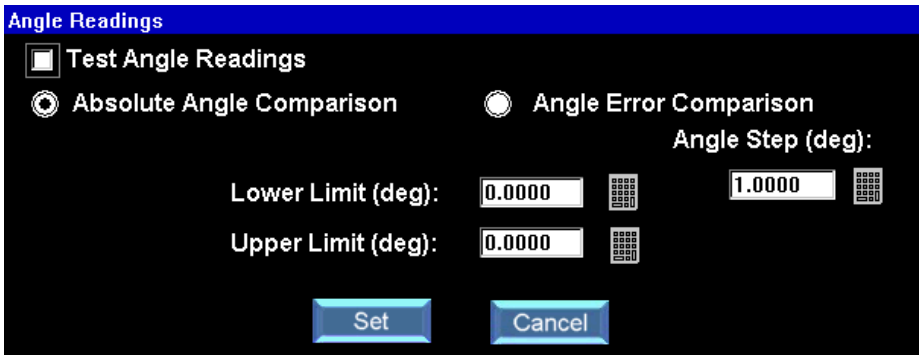


Figure 25 – Angle Limits & Thresholds

ORDERING INFORMATION

PART NUMBERS

8810A- * Standard accuracy ±0.004° (*See Detail Accuracy Specifications*)

Add "R" for an internal programmable 6 VA Reference Generator

8810AH- * Optional "High Accuracy" unit ±0.0015° (*See Detail Accuracy Specifications*)

Add "R" for an internal programmable 6 VA Reference Generator

NOTE: The Model 8810A is CE Compliant

ACCESSORIES

Included with the 8810A is an accessory kit NAI part number 8810A-ACCESSORY-KIT.

Kit includes the following items:

Description	NAI P/N
50 Pin Mating connector for J1	05-0053
Conn, Strain, Relief	05-0060
Fuse, 5 x 20mm, 2A, Slow Blow (2)	99-0146
Line Cord	202-0002
Cable, USB 2.0	07-0038
Mouse, Dell	07-0039

Optional Mounting Accessories

This instrument can be ordered with mounting adapters for mounting either one or two units in a standard 19-inch equipment rack.

The table below describes full rack and tandem full rack mounting accessories.

Type of Mount	Description	NAI P/N
Full Rack	Mounts one unit in 19-inch rack	783893
Tandem Full Rack	Mounts two units' side by side in 19-inch rack (3-1/2" rack height)	Tandem Rack Kit

INSTALLATION AND MAINTENANCE

UNPACKING AND INSPECTION

This instrument has been thoroughly tested, inspected, and evaluated at the factory before shipment. Care has been taken in the design of the wrapping and packaging material to ensure that no damage results from mishandling.

Inspect the instrument externally. Check the front panel for signs of damage to the switches, knobs, terminal jacks and display. Check the power switch and thumbwheel for smooth operation. Switch buttons should be secure. Check the condition of the connectors and fuse on the back panel. Check covers for damage and loose screws. If the instrument passes this inspection, install it and place it in operation. If damage is found, please contact NAI customer service through the NAI web-site, www.naii.com or call (631)-567-1100.

SHIPPING 

The original shipping containers, along with their appropriate blocking and isolating material are the preferred method of packing. Any other suitably strong container may be used provided the product is wrapped in a sealed plastic bag and surrounded with an appropriate amount of shock absorbing material to cushion firmly, preventing movement inside the container. Special attention should be paid to protection of the front panel touch screen display and terminal jacks.

INSTALLATION 

Rack Mounting Instructions:

The Model 8810A may be mounted in a standard 19-inch equipment with either a full rack mounting adapter, NAI PN: 783893, or Tandem Full Rack mount adapters (1/2 height), NAI PN: Tandem Rack Mount. It requires no special cooling equipment. Mount the unit so that air flows freely around it, particularly the rear panel used to transmit the power supply heat to the ambient air. Connect cables, turn on power switch and wait for unit to initialize.

Bench Installation:

For bench top use, the 8810A has Tilt stand and (4) rubber feet. Select an appropriate area that permits access to front and rear panels of API. Place API on bench, connect cables, turn on power switch and wait for unit to initialize

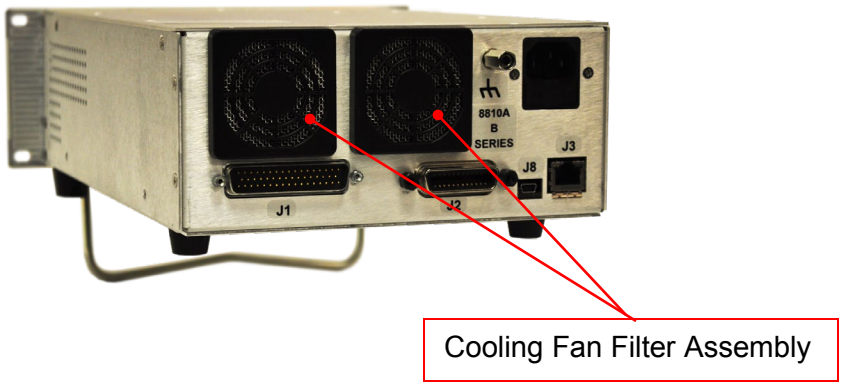
MAINTENANCE 

Input AC Power Fuse(s):

Fuses are contained within the AC Input Connector. Insure AC Power cord is disconnected. Replacement of the fuses is accomplished by removing the fuse holder located within the AC Input Connector (external, rear panel of unit). Replace with fuses equivalent to factory installed specifications. Reference the Mechanical Outline.

Rear Panel Cooling Fan Filter:

The unit is equipped with a cooling fans installed on the rear panel of the unit. The Fan Filter Assembly is user accessible and the Fan Filters have been mounted for easy removal for cleaning and/or replacement. Periodic inspection (duration varies upon unit environmental use) of the condition of the filter is recommended to insure proper air flow circulation and reduction of contaminants. If filter is clogged or deteriorated, cleaning and/or replacement is recommended. The Fan Filter is held in place by a filter shroud insert. Before any maintenance is performed, insure that the input power has been disconnected from the unit. The insert can be removed (no special tools required) by gentling pulling and disconnecting from the shroud assembly (insert is held in place by molded retainers in the shroud). The filter can be accessed at this point for maintenance. Contact factory for availability of replacement filters if required.



NOTE: All other maintenance constitutes repair and can only be performed by the Factory.

CALIBRATION

The unit is self-calibrating.

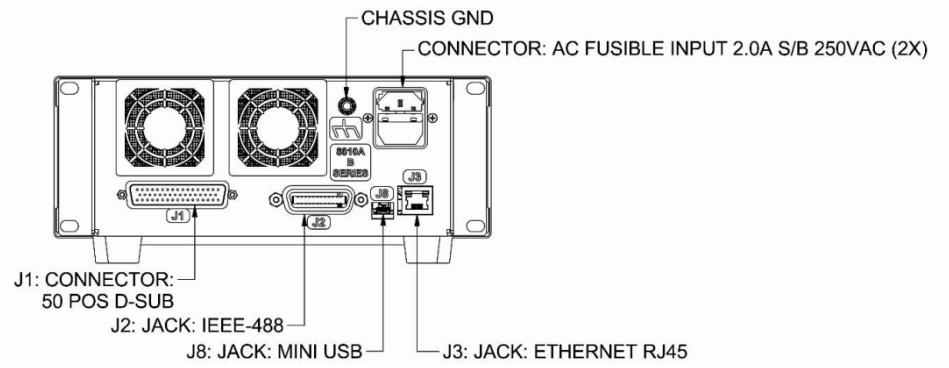
When unit is turned on it will automatically initiate self-calibration. After warm-up of 15 minutes, unit will again automatically calibrate the channel or channels being used. Once calibrated, unit will monitor usage. Should frequency or voltage of measured signal change by more than 12.5%, unit will automatically recalibrate the channel in use. Calibration takes about 2 seconds.

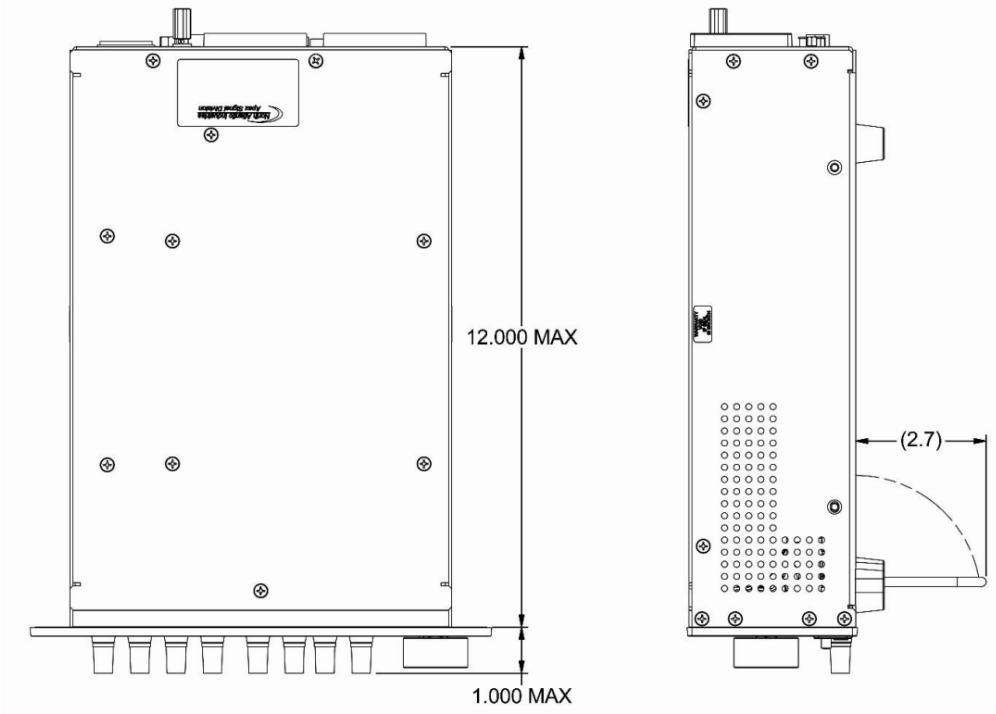
Note: For units with Manufactured Date Code 0821 and higher, see Internal Calibration Operation Addendum (Appendix D).

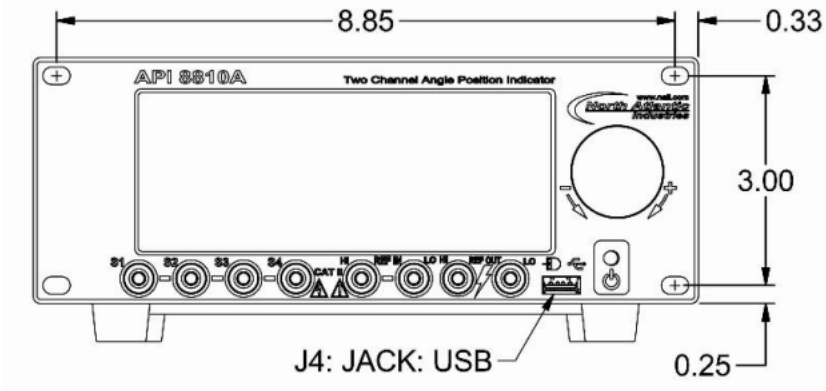
Calibration Verification

The model 8810A should have its calibration verified on an annual basis. Factory Calibration service is available on request. If the instrument fails to meet its accuracy, it must be repaired. All repair actions can only be performed by the Factory.

APPENDIX A - MECHANICAL OUTLINE, MODEL 8810A







Note: J3 USB-B Rear Connector for communications only.
J4 USB-A Front Panel Connector for optical mouse only.

APPENDIX B – SUPPLEMENTAL INFORMATION FOR UNITS SOLD WITHIN THE EUROPEAN UNION

GENERAL

Information contained within the following paragraphs supplements and in some cases supersedes information contained throughout this Manual. Where there is a conflict between information contained in these paragraphs and information contained elsewhere in the manual, these paragraphs take precedence for units sold within the European Union.

SPECIFICATIONS

Add to the list of specifications the following information:

Environmental

Temperature, Operating	0° to 70° C, standard
Temperature, Non-operating	-55° to 75° C
Relative Humidity	95% non-condensing
Altitude	3050 Meters Operating, 12,000 Meters non-operating
Over voltage/Installation Category	Category II
Pollution Degree	Degree 1

Fuses

Qty: (2)	Type: 2 A Slow Blow

LINE CORD 

The model 8810A is normally shipped with a UL approved detachable line cord. This line cord does not meet safety requirements of the European Union and should be discarded and replace with a properly approved type for applications within the European Union.

INSTALLATION AND MAINS INPUT 

The model 8810A is designed for bench top or permanent rack-mount installation. An IEC-320 appliance coupler is provided for mains power input. Safety (earth) ground is provided through this power input and the detachable line cord provides the required means of disconnection.

The design of the model 8810A is such that AC power is continuously supplied to the power supply independent of the front panel ON/OFF Switch. The primary means of disconnect is pulling the line cord from the instrument. This requires that the line cord must be kept accessible for disconnect. For rack mount installations, an external power disconnect switch must be provided to insure safety compliance.

LINE VOLTAGE 

The model 8810A is equipped with a universal AC power supply which accepts 85 to 265 VAC, 47 to 440 Hz.

SAFETY GROUNDING 

For safety from electrical shock and fire the unit must be connected to Safety (Earth) ground through the power line cord.

IMPROPER USAGE 

If the model 8810A is installed or used in a manner not specified, safety may be impaired.

TECHNICAL ASSISTANCE

Contact your local Sales Representative for any technical assistance. Alternatively, contact the Factory at:

North Atlantic Industries
110 Wilbur Place
Bohemia, NY 11716 USA

Telephone: **(631) 567-1100**
Fax: **(631) 567-1823**
Email: **sales@naii.com**
Web site: **www.naii.com**

APPENDIX C – 8810A SERIES CERTIFICATE OF CONFORMANCE

Certificate of Conformance
European Community
Council Directive 89/336/EEC
(To The EMC Aspects of Directive Only)

Date of Issue: December, 2006

Issued By: Retlif Testing Laboratories
795 Marconi Avenue
Ronkonkoma, NY 11779

Issued To: North Atlantic Industries, Inc.
170 Wilbur Place
Bohemia, NY 11716

Reference: Retlif Report Number R-11553-1, Rev. A

Retlif Testing Laboratories hereby acknowledges that compliance testing in accordance with the below listed standards was performed on a representative sample of the equipment listed below. Retlif Testing Laboratories further acknowledges that the test sample listed below was found to be in compliance with these standards.
This certificate is hereby issued to the above named grantee and is valid only for the equipment identified below.

Manufacturer: North Atlantic Industries, Inc.
170 Wilbur Place
Bohemia, NY 11716

Equipment Tested: Angle Position Indicator

Part Number: 8810A-R

Serial Number: 0003

Brand Name: North Atlantic Industries, Inc.

Product Type: Measurement, Control and Laboratory Equipment

Note(s): 1) See attached report R-11553-1 for details and/or conditions pertaining to this certificate.
2) Conforms to the emissions requirements of EN 61326:1997:

CISPR 16:2003	Class A, Conducted Emissions, 150 kHz to 30 MHz
CISPR 16:2003	Class A, Radiated Emissions, 30 MHz to 1 GHz
IEC 61000-3-2:2000	Harmonics
IEC 61000-3-3:1994	Flicker

3) Conforms to the minimum immunity requirements of Table 1 of EN 61326:1997:

IEC 61000-4-2:1995	Electrostatic Discharge
IEC 61000-4-3:1995	Radiated Immunity
IEC 61000-4-4:1995	EFT/Burst, Power Leads
IEC 61000-4-5:1995	Surge Immunity, Power Leads
IEC 61000-4-6:1996	Conducted Immunity, Power Leads
IEC 61000-4-11:1994	Voltage Dips and Interrupts

APPENDIX D – INTERNAL CALIBRATION OPERATION ADDENDUM
(DATE CODE 0821 AND HIGHER)

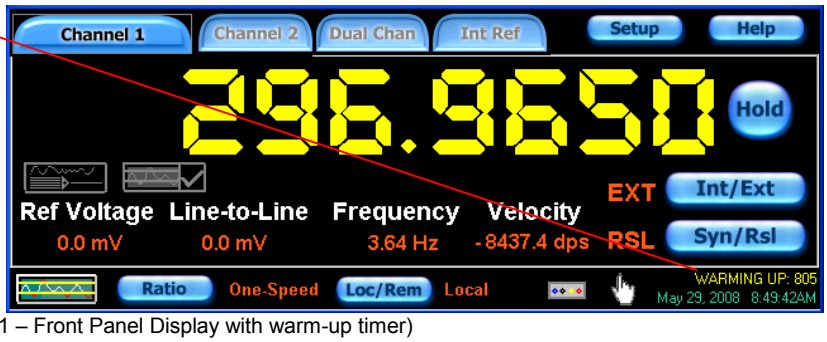
Reference#: **8810A-OMA-001** **Date: 05/29/08**

Description: Internal Calibration Operation
Model: 8810A
Effective: Manufactured Date Code (DC) 0821 and higher
Purpose: This addendum documents a product improvement. The internal calibration routine has changed to incorporate improvements in unit calibration/operation. The product improvements/additions to the calibration routine are as follows:

1. Addition of 15 minute warm-up period.
2. Addition of automatic calibration at end of 15 minute warm-up and subsequent eight hours of operation.
3. Manual disable of automatic periodic calibration (front panel or command).
4. Definition of range change calibration (normal operation).

1. Warm-Up Period

On Power-Up, the unit requires 15 minutes of "warm-up" and thermal stabilization. During initial 15 minutes of operation, communications and all functions will be available. However, accuracy of measurements to the published specifications is not guaranteed. Addition of a countdown timer has been provided to indicate the unit is in the 15 minute warm-up period.

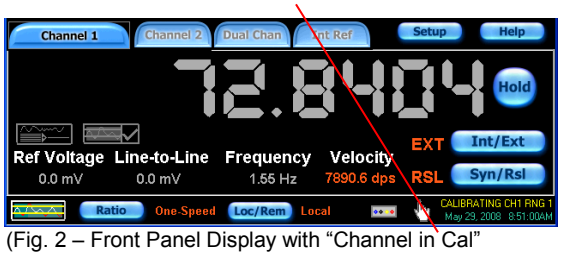


(Fig. 1 – Front Panel Display with warm-up timer)

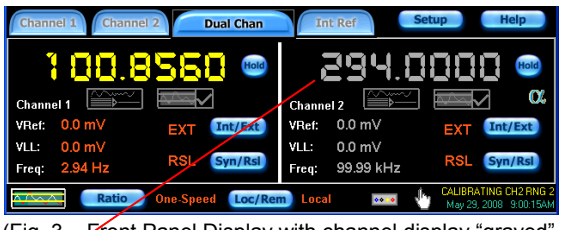
2. Automatic Calibration

After completion of the 15 minute warm-up period, the unit will commence an automatic periodic calibration at the sensed signal input voltage (Line-to-Line) and Frequency (calibration duration less than 10 seconds). Subsequent automatic periodic calibrations will be initiated after every eight hours of continuous "run time".

During the calibration period, a statement indication will be displayed that the particular channel(s) are being calibrated.



(Fig. 2 – Front Panel Display with "Channel in Cal"

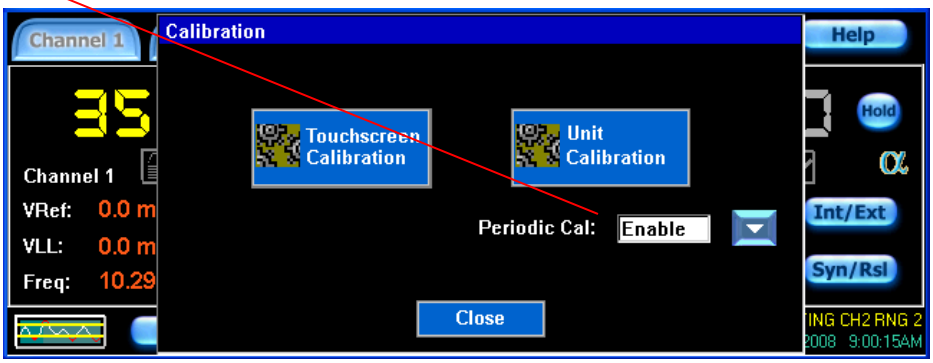


(Fig. 3 – Front Panel Display with channel display "grayed"

Also, the particular channel displays will be "grayed" indicating the channel is currently "IN CALIBRATION".

3. Disabling Automatic Calibration

If the user wishes to disable the automatic (timed) calibration, addition of the function “Periodic Cal” has been added under the <SETUP> - <CALIBRATION> front panel window. A drop down menu is provided for the user to “Enable” or “Disable” the automatic timed calibration. Power-On default is “Enable”.



(Fig. 4 – Front Panel Display with “Periodic Cal” function)

This can also be software commanded by utilizing the function call:
APICMD PERIODIC_CAL <OFF | ON>

4. Normal Self-Calibration Operation

The unit, in normal operation, continuously monitors the signal input voltage and frequency and will initiate an internal calibration (at the new voltage/frequency) if certain voltage or frequency-range thresholds are sensed as having been crossed (calibration duration < 10 seconds):

Voltage Calibration Ranges (V_{L-L}):

Thresholds

	Range 1	Range 2	Range 3	Range 4	Range 5
Increasing Voltage	0 – 3.2	3.2 – 6.2	6.2 – 13.2	13.2 – 28.2	28.2 - 90
Decreasing Voltage	0 – 2.8	2.8 – 5.8	5.8 – 12.8	12.8 – 27.8	27.8 - 90

Frequency Change Sensed: 12.5% (from last measured value)

This normal operation of range change calibration is always “enabled” and cannot be manually “disabled”.

During this range change calibration, the unit will display the “calibrating channel” process and deliver an “invalid” output angle measurement. When the API is programmed for 8810A native language, the unit will respond to remote commands with “999.9999”, indicating the unit is calibrating. When the API is programmed for 8810 Legacy languages, the unit will respond to remote commands with “ERROR”, indicating the unit is calibrating.

During this calibration period, the unit will display @45 or @60 degrees and this will be grayed out.

APPENDIX E – 8810A NEW FEATURES OPERATION ADDENDUM
(DATE CODE 0914 AND HIGHER)

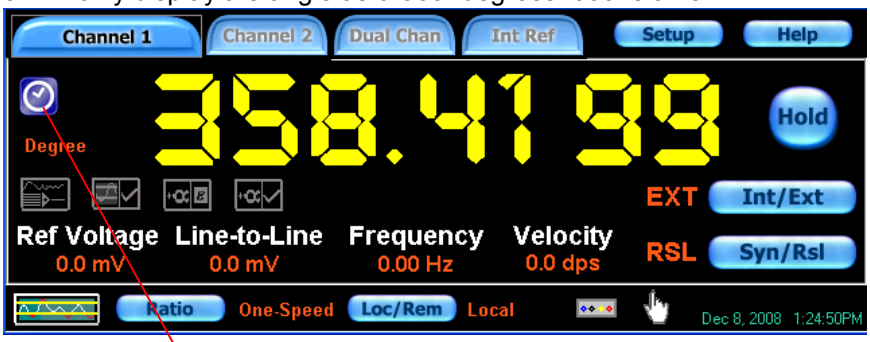
Reference#: **8810A-OMA-002** **Date: 06/30/09**

Description: Operational Control Product Improvements
Model: 8810A
Effective: Manufactured Date Code (DC) 0914 and higher
Purpose: This addendum documents a product improvement. Several additions to the operational control of the 8810A have been added to incorporate customer suggestions. The product improvements/additions to the operational control panels are as follows:

1. Addition of analog display mode.
2. Additional ability to define the resolution of the digital display from **xxx.xxxx** to **xxx.xxx**, **xxx.xx**, **xxx.x** or **xxx** (front panel command only).
3. Addition of output angle display/output in radians / milliradians (customizable format).
4. Angle offset option – Displayed angle can be offset (static or dynamic control) from actual signal input (front panel command only).
5. Power off display recall (unit will recall last display setting; CH1, CH2 or Dual Channel).

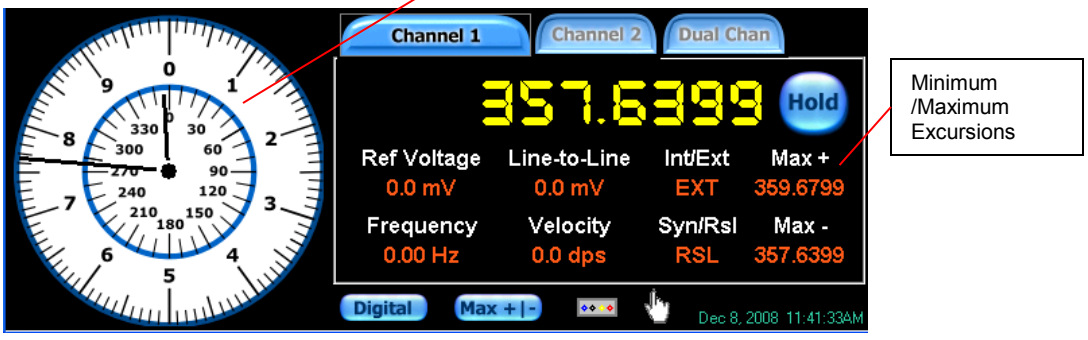
1. Addition of analog display mode

The analog display mode allows for viewing the measured angle through the use of a fixed dual numbered dial and moving hands. In its most basic form the inside dial is graduated 0-360 (for coarse measurement indication) and the outside dial is graduated 0-10 (for fine measurement indication) indicating the 360 degrees in one full rotation. The analog display will be supplemented with the digital display and the minimum/maximum excursions are tracked. The analog display dial will only display the angle as 0-360 “degrees” at this time.



(Fig. 1 – Front Panel Display digital display only)

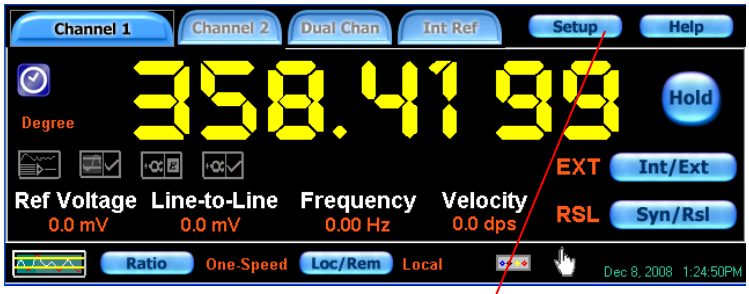
Depress the analog display button  to display the analog view.



(Fig. 2 – Front Panel Display with analog display)

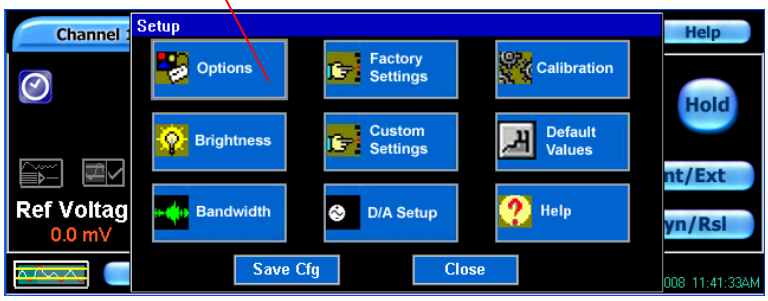
2. Resolution definition

Digital display resolution (number of digits to the right of the decimal) may now be user defined. The digital angle output resolution can be displayed from four digits to **x.xxxx** to **x.xxx**, **x.xx**, **x.x** or **x** (front panel command only).



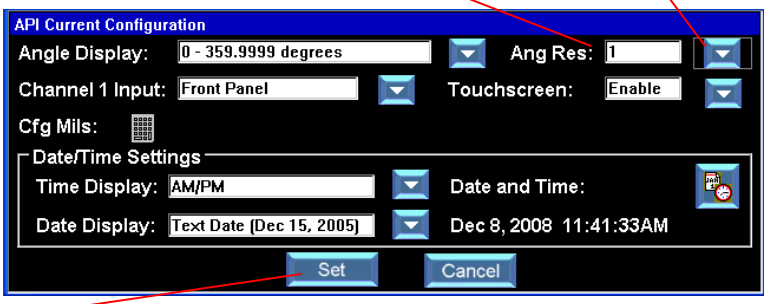
(Fig. 3 – Front Panel Display – "4 digit" resolution)

To program the digital display resolution, depress the <SETUP> button to enter the configuration set-up window. In the setup window, depress the <OPTIONS> button.



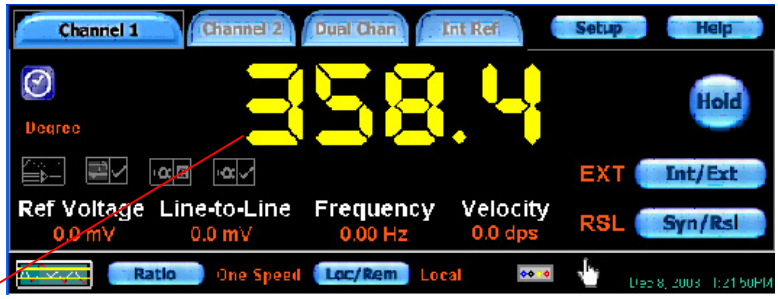
(Fig. 4 – Setup display)

Choose the display resolution desired from the ***Ang Res*** drop down selection (default is 4).



(Fig. 5 – Setup/Options display)

Depress the <SET> button after selection.

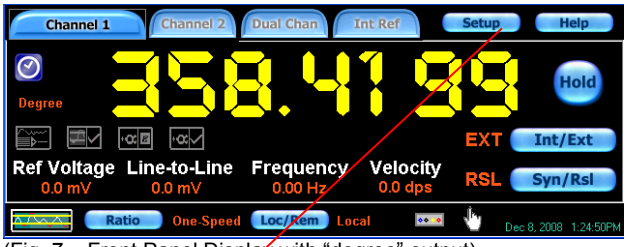


(Fig. 6 – Front Panel Display with "1 digit" resolution)

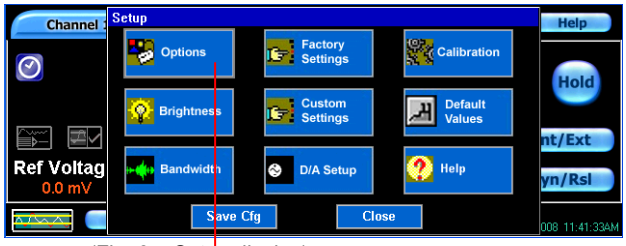
The digital angle output resolution is now displayed at the resolution chosen **x.xxxx** to **x.xxx**, **x.xx**, **x.x** or **x** (front panel command only).

3. Output Angle Display – Radians/Milliradians

The digital output angle can now be programmed to display/output in radians / milliradians (customizable format).

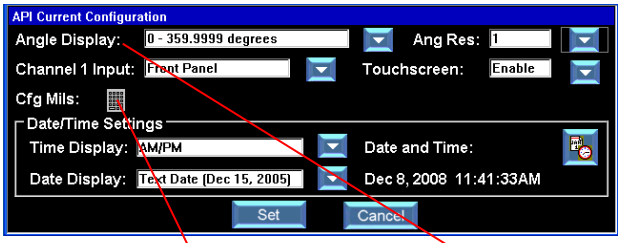


(Fig. 7 – Front Panel Display with "degree" output)

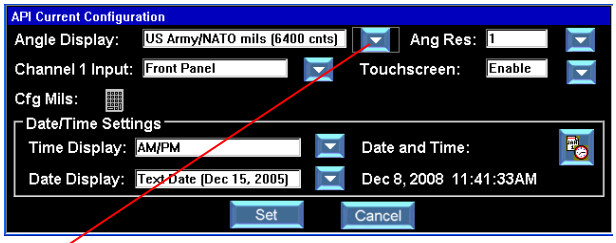


(Fig. 8 – Setup display)

Depress the <SETUP> button to program the digital output angle in radians / milliradians (customizable format) to enter the configuration set-up window. In the setup window, depress the <OPTIONS> button.



(Fig. 9 – Angle display configuration 1)



(Fig. 10 – Angle display configuration 2)

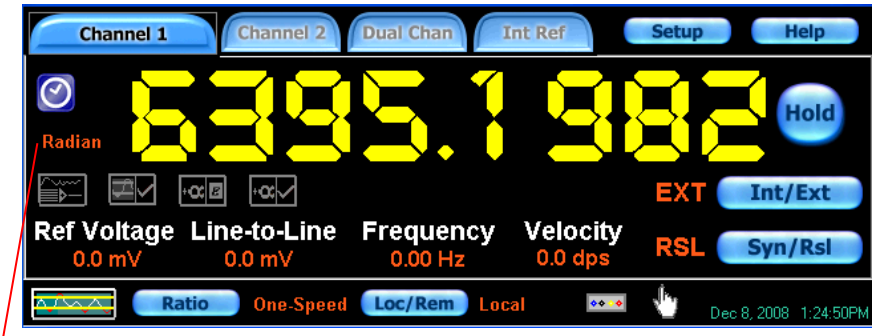
Choose the desired display type from the ***Angle Display*** drop down selection (default is 0 – 359.9999 degrees).

Current choices are:

1. 0 to 359.9999 degrees (default)
2. -179.9999 to 179.9999 degrees
3. Degrees, Minutes and Seconds
4. Radians
5. Milliradians (6283 counts)
6. US Army / NATO mils (6400 counts)
7. Russian mils (6000 counts)
8. Swedish mils (6300 counts)
9. French mils (6280 counts)
10. Other mils (user defined counts)

When the drop down option "Other mils" is selected, the user can enter the full scale travel counts by depressing the Cfg Mils "keypad"  button and entering the desired number of full scale counts.

Once completed, depress the <SET> button.

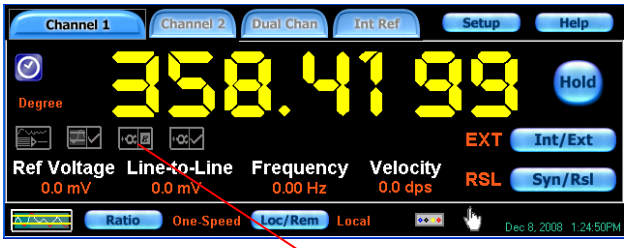


(Fig. 11 – Front Panel Display with "Radians" output)

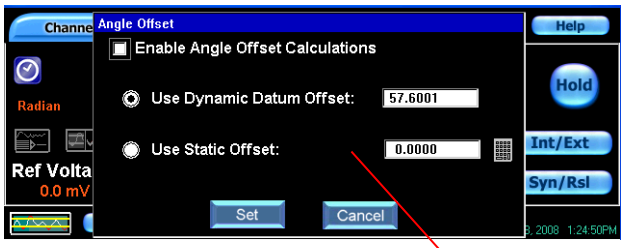
The digital display will output the angle measurement by the chosen radian method. The display will also indicate Radian.

4. Angle Offset

The displayed angle can be offset (static or dynamic control) from the actual measured signal input (front panel command only).



(Fig. 12 – Front Panel Display with Offset Control)

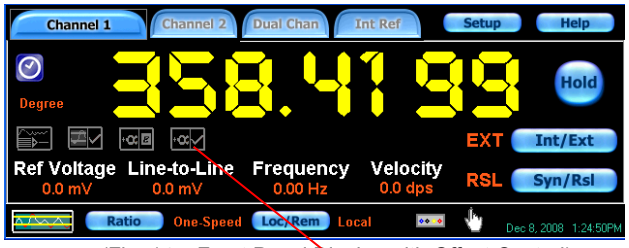


(Fig. 13 – Angle Offset Control panel)

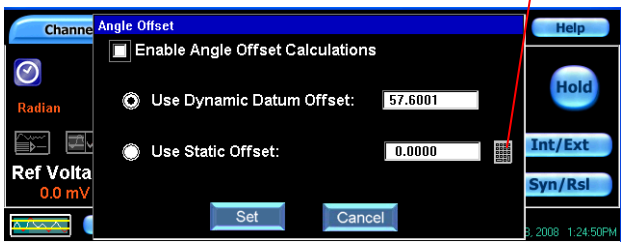
Depress the Angle Offset Control  button to enter the Angle Offset Control panel window.

There are two choices of Angle Offset corrections which can be made:

- The first is the "Use Static Offset". When enabled, the user can input a static angle offset via the keypad.
- The second is the "Use Dynamic Datum Offset" choice. When selected, the second angle offset control button



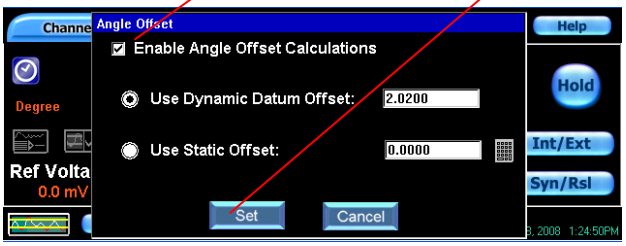
(Fig. 14 – Front Panel Display with Offset Control)



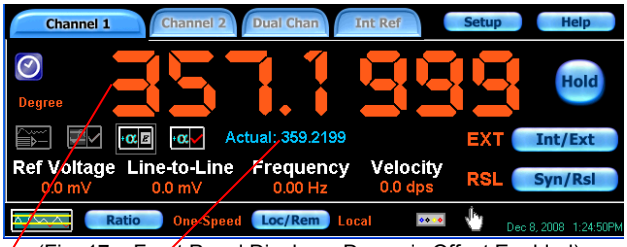
(Fig. 15 – Angle Offset Control panel)

(trigger) is enabled  on the front panel. When this trigger button is depressed, whatever angle is currently being measured/displayed, will be adjusted for a null and the difference stored as the "static angle offset". This is a dynamic "trigger" button and will update the static angle if depressed again.

Once set for either dynamic or static offset (and static offset entered if applicable), depress the "Enable Angle Offset Calculations box and depress the <SET> button. The unit will now respond and display the measured angle with the programmed offset.



(Fig. 16 – Angle Offset Control panel - Enabled)



(Fig. 17 – Front Panel Display – Dynamic Offset Enabled)

Note that the angle display will change color to RED indicating the displayed angle has been offset from the actual measurement which is displayed in minor format BLUE as well.

5. Power-On display recall

As part of the standard (default) unit operation, the unit has a Power off panel display recall. The unit will recall the last display setting; CH1, CH2 or Dual Channel and display this window panel on power up.

REVISION HISTORY

Revision	Description of Change	Engineer	Date
A1.1	Updated Pg 4 specifications , added Pg 24 - Revision History	FR	07/14/06
A1.2	Restated pg 1 & pg 4 specifications. Changed operating temp. to 50 deg C max. added high accuracy P/N 8810AH, updated /corrected Table of Contents.	FR	07/18/06
B	Extensive edit to bring manual into compliance with actual production units	FR	08/04/06
C	Corrected Tilt stand information (standard, not optional)	FR	08/11/06
C1	Clarified remote programmability / legacy 8810 compatibility, deleted mouse as a purchase option, changed Ref. Generator output to 1.2VA, updated table of contents.	FR	08/22/06
D	Added CE Requirements / Re-format	SL/PR/as	07/13/07
D1	47 to 440 Hz Input Power requirement remains	AS	In-Proc
D2	Updated Appendix C	SB	09/07/07
D3	Added maintenance procedure for rear fan filter replacement.	AS	09/07/07
E	Specifications updated for 8810AH (pgs 1, 3 ; Tables 1B, 1C added (pg. 4)); BW specification updated (pg. 3); Cal statement added (pg. 4); Output rating for optional on-board REF from 1.2 VA to 2.2 VA. (Changes coincide with specification update F3).	AS	10/09/07
F	Added CE compliance features bullet (pg. 1); Angular range to 4 decimals (pg. 3); Detailed accuracy VLL from 26 to 28 (pg. 4); Added Reference Power Output derating curve (fig. 3.1) (pg. 4); Minor typographical error corrections.	AS	10/12/07
G	Added REF frequency characterization for voltage output, changed max REF harmonic content from 1% to 2% (table 3, pg.4).	AS	11/07/07
H	Updated screen shots to display channel 1 input connection and touch screen buttons, angle difference mode, quick configuration for Internal Reference Module, and Auto Save feature. (FR)- Replaced Appendix A – Mechanical Outline drawing with new up to date version.	GC/FR	12/21/07
H1	Added Internal Calibration Operation Addendum (Appendix D); added Input Impedance table	FR	06/09/08
H2	Reformatted Document, revised Bandwidth spec, added note to J1 connector table	FR	06/26/08
H3	Added note in Appendix D	GC/AS	09/02/08
I	(Purposely skipped)		
J	Added Appendix E; Product improvement/additional features	AS	06/30/09
J1	Added storage temperature spec	FH	03/02/10
K	Updated with improved optional reference generator specifications (applies to units manufactured with D/C 1001 or higher)	AS	10/06/10
L	Clarified Reference Generator frequency accuracy specification (pg.3) (From: 0.1% FS To: The greater of 0.1% of frequency programmed or 1 Hz.)	AS	03/24/11
M	Changed Reference Generator voltage accuracy specifications	RS	01/16/13
N	ECO C05682, Updated Certificate of Conformance with version dated October 2017 from Retlif	LG	06/12/18
O	(Purposely skipped)		
P	ECO C06378, Reformatted Document to show latest hardware outline and display	RS	02/22/19

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