

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

- Direct replacement for all Standard 8810's
- High resolution Touch-Screen, Front Panel "jog wheel" or Front Panel USB mouse input for control / setup
- Two isolated Input Channels
- 0.0001° Resolution
- ±0.004° Accuracy (optional 0.0015°)
- LXI compatible
- Programmable display options
- Auto-ranging Signal and Reference
- 47 Hz to 20 KHZ Frequency Range
- DC rate or angle output
- Auto Phase Correction
- Measures and displays Reference Voltage, frequency, and VL-L
- Ethernet, USB, IEEE-488 & parallel ports
- Optional 2.2 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; 0-360°, ±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 Synchros 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 1.0 to 90 V_{L-L} and reference voltages from 2 to 115 V_{rms} 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 drop-in replacement for all variations of the previously supplied standard North Atlantic Industries Model 8810. For special versions (P/N = 8810 -Sxxxx), contact factory to determine compatibility.

Optional Reference: This design can also incorporate a 2.2 VA programmable reference generator that is used for stand alone 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:	<table border="0"> <thead> <tr> <th><u>Input Signal (V L-L)</u></th> <th><u>Input Impedance (kΩ)</u></th> </tr> </thead> <tbody> <tr> <td>1 to 3 V</td> <td>47</td> </tr> <tr> <td>3 to 6 V</td> <td>55</td> </tr> <tr> <td>6 to 11.8 V</td> <td>58</td> </tr> <tr> <td>11.8 to 26 V</td> <td>60</td> </tr> <tr> <td>26 to 90 V</td> <td>200</td> </tr> </tbody> </table>	<u>Input Signal (V L-L)</u>	<u>Input Impedance (kΩ)</u>	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
<u>Input Signal (V L-L)</u>	<u>Input Impedance (kΩ)</u>												
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:	2.76 rps. At 60 Hz 4.68 rps. At 360 Hz or higher												
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												
Band width:	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 <i>Setup Menus</i>).												
Data averaging:	Selectable from 10 ms 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												
Input Power:	85 Vrms to 265 Vrms, 47 to 440 Hz, < 20 Watts												
Weight:	4 lbs.												
Dimensions:	12.5" L x 9.5" W x 3.5" H												

REFERENCE GENERATOR SPECIFICATIONS (Optional, see part number)

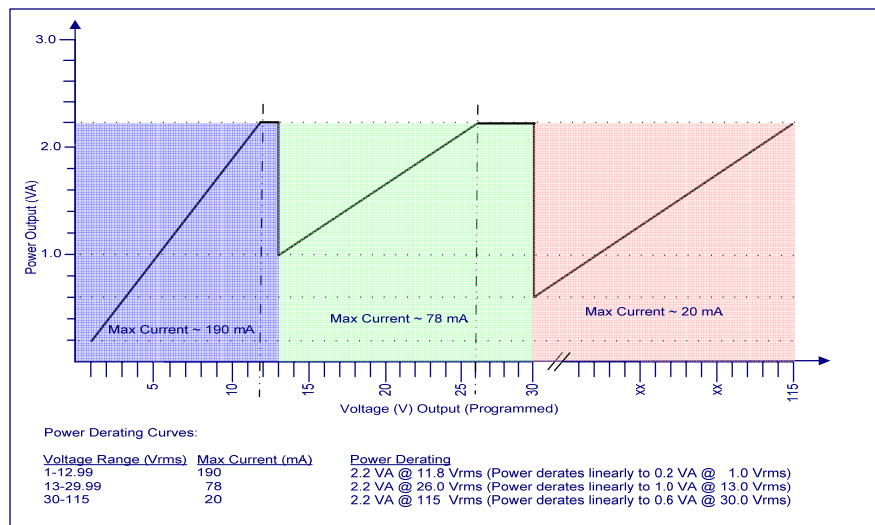
Voltage Output:	2 Vrms to 115 Vrms, Programmable with a resolution of 0.1 V <ul style="list-style-type: none"> • 2.0 to 9.9 Vrms / 47 Hz to 20 KHz frequency range • 10.0 to 27.9 Vrms / 47 Hz to 4 KHz frequency range • 28.0 to 115.0 Vrms / 47 Hz to 800 Hz frequency range
Accuracy:	±3% of setting
Harmonic Content:	2.0% maximum
Output Drive:	2.2 VA (See Operation manual for detail description of Output Drive)
Output Protection:	Over-current and over-temperature
Frequency:	47 Hz to 20 kHz Programmable with 0.1 Hz steps
Frequency accuracy:	0.1% FS

DETAILED ACCURACY SPECIFICATIONS

NOTE: SPECIFICATIONS APPLY AFTER A 15 MINUTE WARMUP AND CALIBRATION

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

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



Reference Output Drive Characterization

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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. The legacy 50 pin connector and the IEEE-488 are both 100% backwards compatible with the model 8810. 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	Pin	Designation	Pin	Designation	Pin	Designation
1	Do Not Use ¹	11	Converter busy	21	S1 Ch. 2	31	0.4°	41	DC out Ch.1 ²
2	Do Not Use ¹	12	0.04°	22	S2 Ch. 2	32	2 deg. (BCD)	42	Data Freeze
3	Chassis ground	13	0.01°	23	S3 Ch. 2	33	8 deg. (BCD)	43	Remote Ch. select
4	Digital ground	14	0.8°	24	S4 Ch. 2	34	Do Not Use	44	0.004° or 0.005° for
5	S1 Ch. 1	15	0.2°	25	R1 Ch.2 Ref Hi	35	Do Not Use	45	20 deg. (BCD)
6	S2 Ch. 1	16	4°	26	R2 Ch. 2 Ref LO	36	Reference Out Hi	46	40 deg. (BCD)
7	S3 Ch. 1	17	1°	27	Not Data Freeze	37	Reference Out Lo	47	80 deg. (BCD)
8	S4 Ch. 1	18	Do Not Use	28	0.02°	38	0.008°	48	10 deg. (BCD)
9	R1 Ch. 1 Ref HI	19	DC out Ch.2 ²	29	0.08°	39	0.002 °	49	100 deg. (BCD)
10	R2 Ch. 1 Ref LO	20	Local/Rem select	30	0.1°	40	0.001° or 0.005° for 179.99°	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.

J2 CONNECTOR, IEEE - 488 PIN DESIGNATIONS

Standard IEEE Interface Connector

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

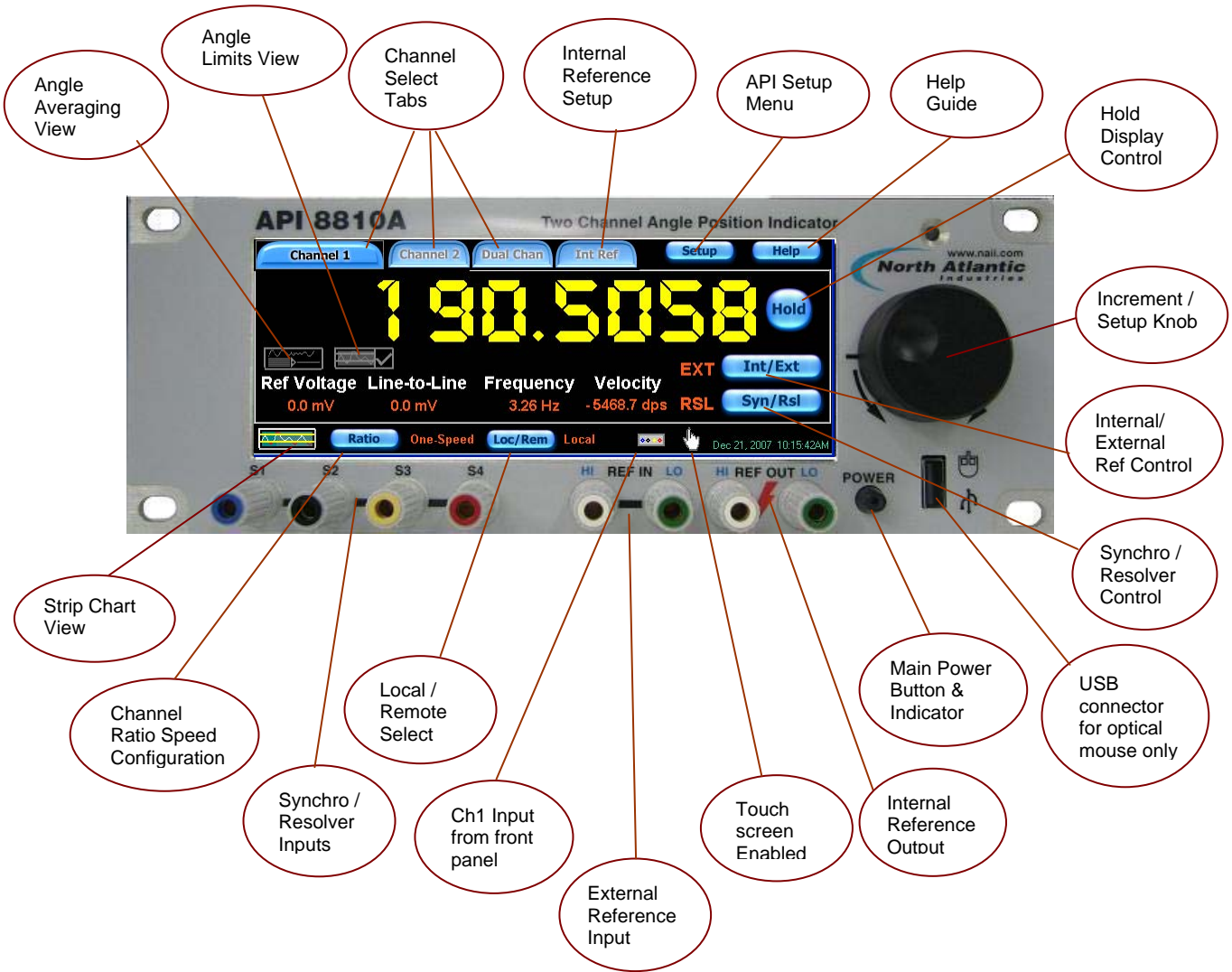


Figure 1 – Front Panel Controls & Connections



Figure 2 – Indicators on the front panel main display of the 8810A

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.

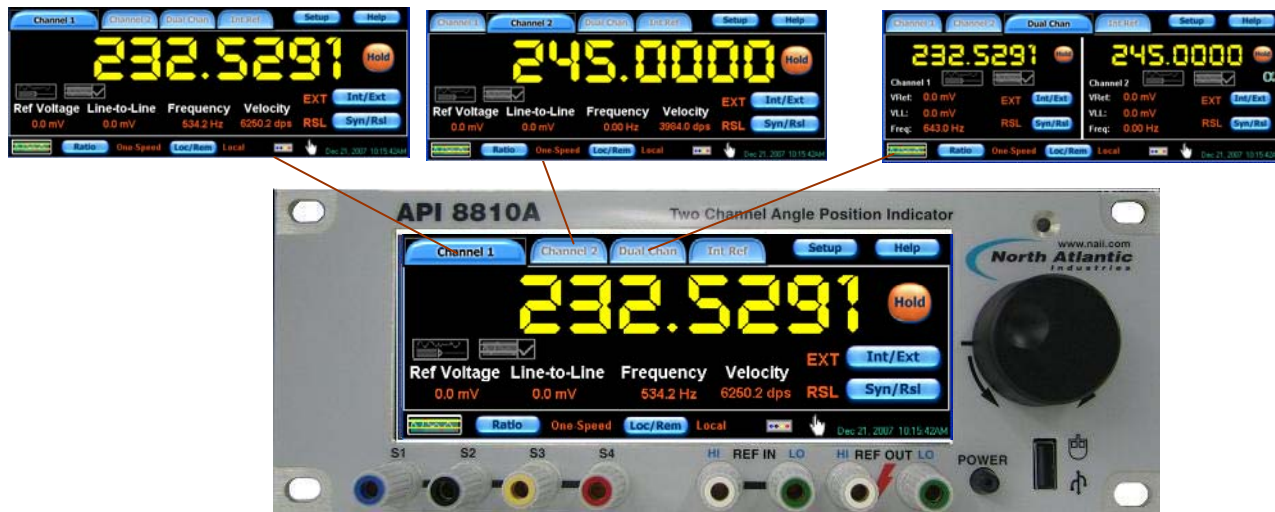


Figure 3 – Channel Selection

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:

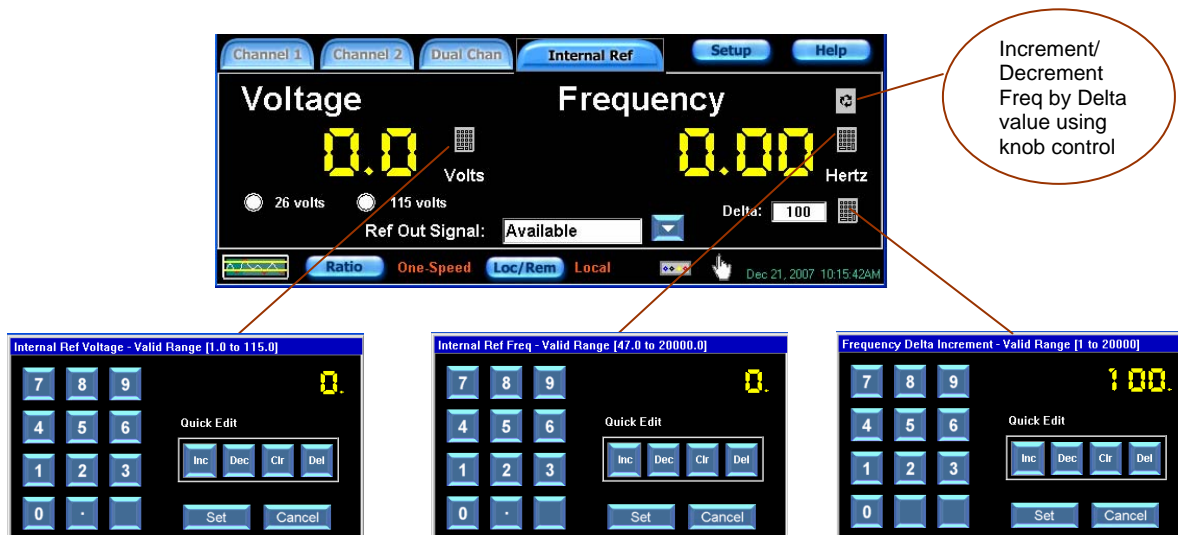


Figure 4 – Internal Reference Setup

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

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

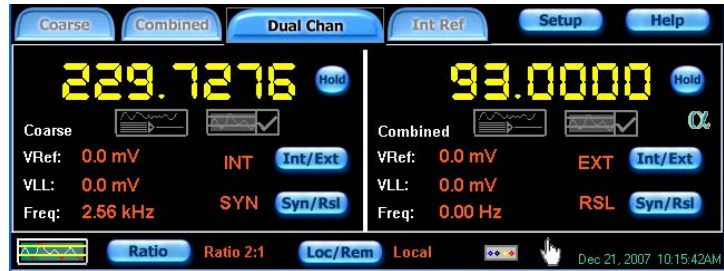
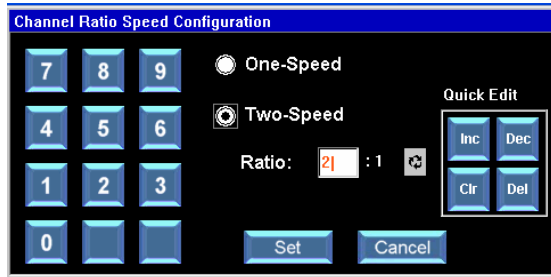


Figure 6 – Ratio Select

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.

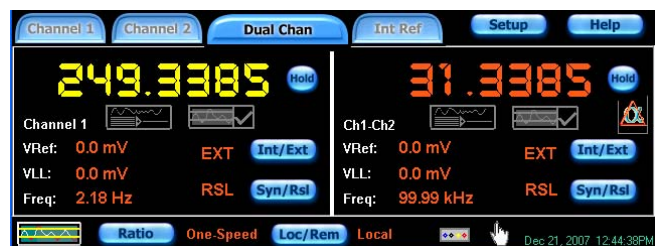
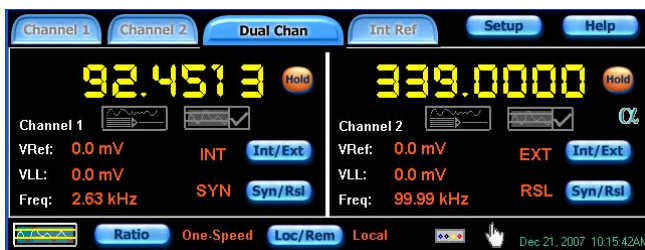


Figure 7 – Angle Difference Select

PROGRAMMING

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

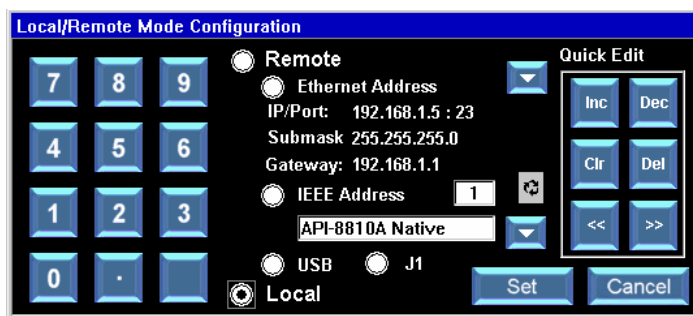


Figure 8 – Remote Operation

General Programming / Options selecting

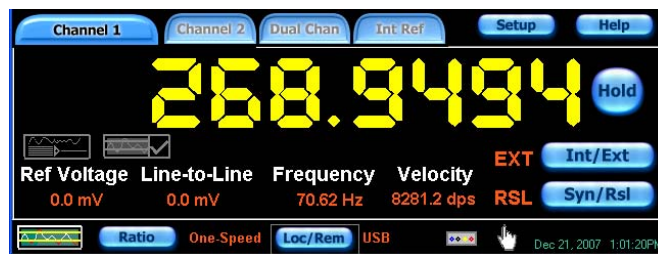
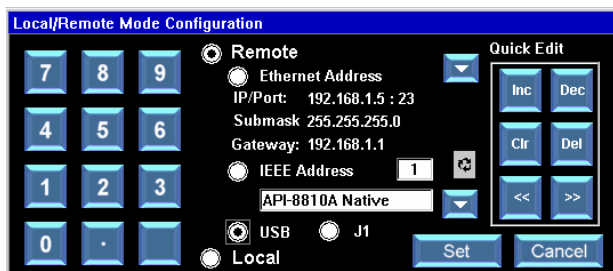
The 8810A may be remote programmed through a USB port, an Ethernet port, an IEEE-488 port or the J1 connector. The main setup screen for remote programming is shown above. The sections below show the setup for each mode.

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.

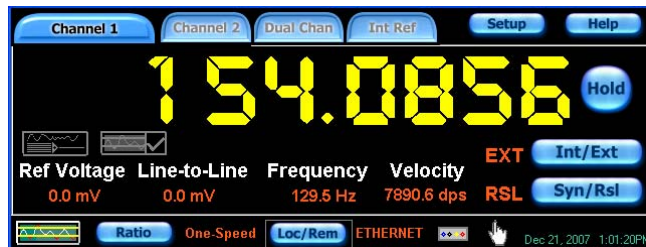
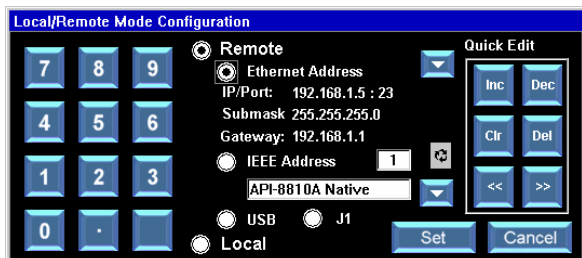


Note: the **USB** is now displayed next to the *Loc/Rem* button

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

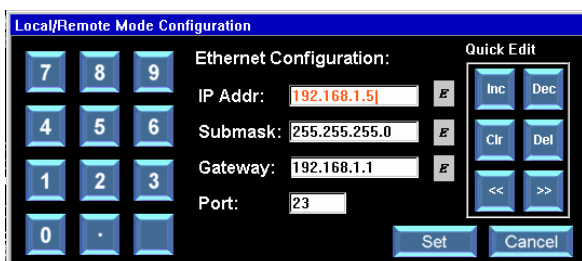


Figure 10 – Ethernet Port Selection

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

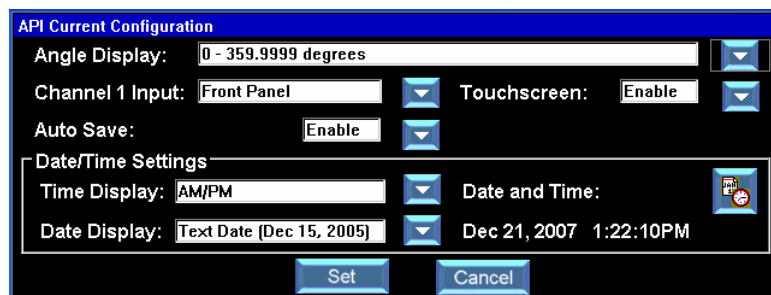


Figure 13 – Options Menu

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.

FACTORY SETTINGS [Current Settings Ch1[INT,SYN] Ch2[INT,SYN] IntRef[115.0 V,60.00 Hz]]							
	Channel 1		Channel 2		Internal Reference		L-L
	Int/Ext	Syn/Rsl	Int/Ext	Syn/Rsl	Volt	Freq	Volt
<input type="radio"/> 1	INT	SYN	INT	SYN	26.0 V	400.0 Hz	11.8 V
<input type="radio"/> 2	INT	SYN	INT	SYN	115.0 V	400.0 Hz	90.0 V
<input type="radio"/> 3	INT	SYN	INT	SYN	115.0 V	60.00 Hz	90.0 V
<input type="radio"/> 4	INT	RSL	INT	RSL	26.0 V	400.0 Hz	26.0 V
<input type="radio"/> 5	INT	RSL	INT	RSL	26.0 V	400.0 Hz	11.8 V

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.

CUSTOM SETTINGS [Current Settings Ch1[EXT,RSL] Ch2[EXT,RSL] IntRef[0.0 mV,0.00 Hz]]							
	Channel 1		Channel 2		Internal Reference		L-L
	Int/Ext	Syn/Rsl	Int/Ext	Syn/Rsl	Volt	Freq	Volt
<input type="radio"/> 1	EXT	RSL	EXT	RSL	0.0 mV	0.00 Hz	0.0 mV
<input type="radio"/> 2	EXT	RSL	EXT	RSL	0.0 mV	0.00 Hz	0.0 mV
<input type="radio"/> 3	EXT	RSL	EXT	RSL	0.0 mV	0.00 Hz	0.0 mV
<input type="radio"/> 4	EXT	RSL	EXT	RSL	0.0 mV	0.00 Hz	0.0 mV
<input type="radio"/> 5	EXT	RSL	EXT	RSL	0.0 mV	0.00 Hz	0.0 mV

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.

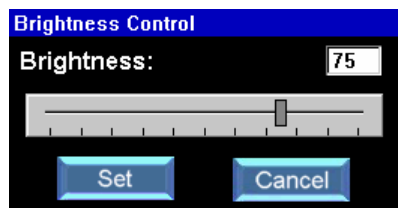


Figure 16 – Brightness Control

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.

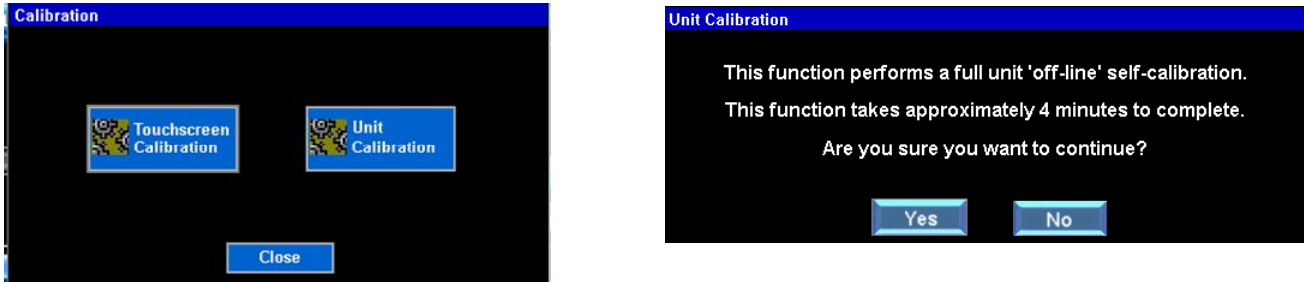


Figure 17 – Calibration Menu

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.

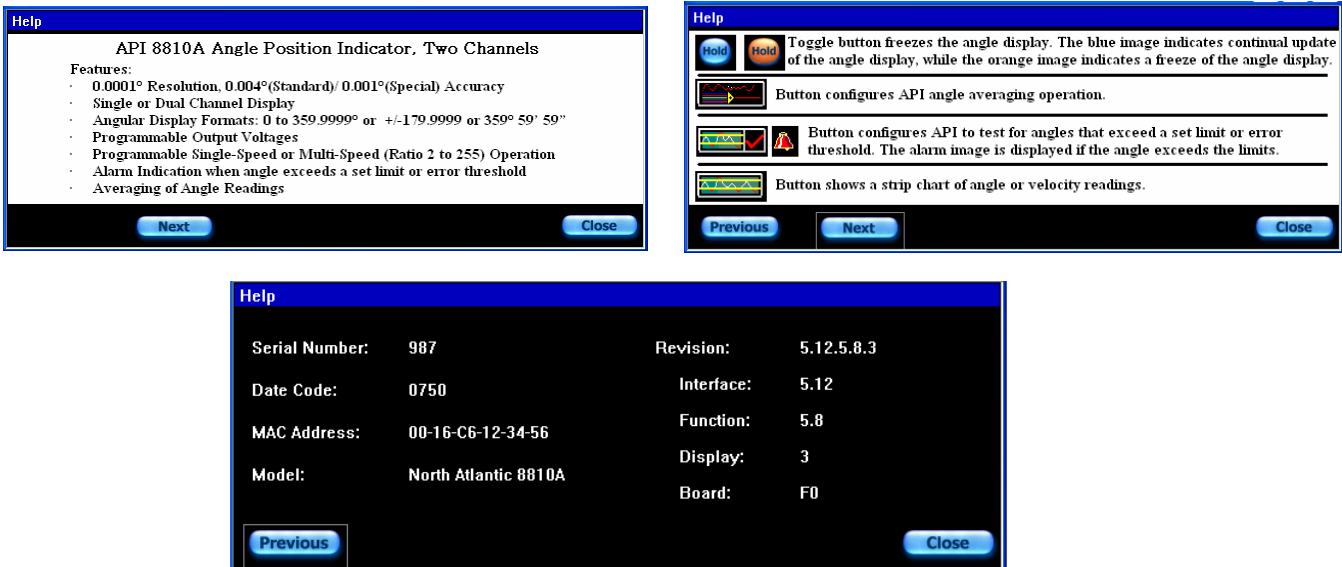


Figure 18 – Help Menus

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

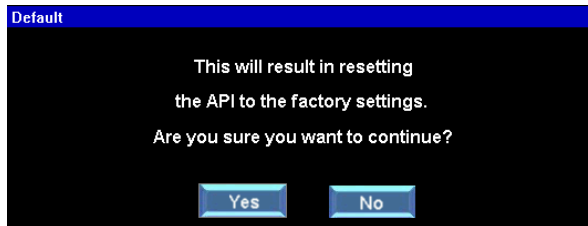


Figure 19 – Default Values

Each channel 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.

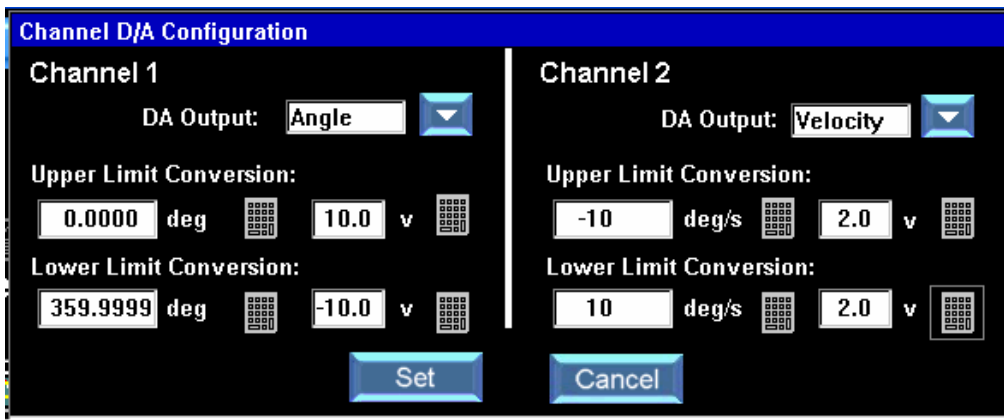


Figure 20 – D/A Setup

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.

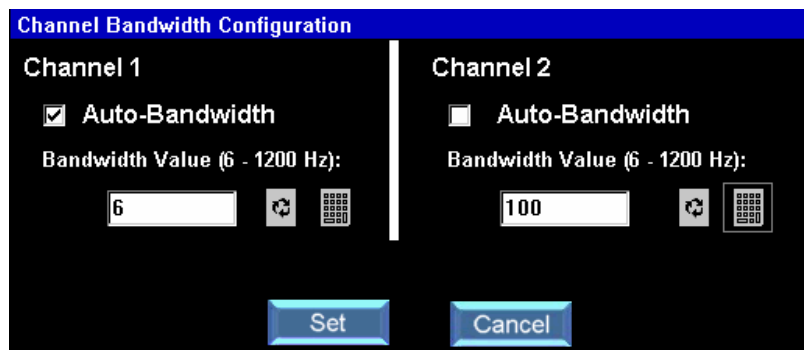


Figure 21 – Bandwidth

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

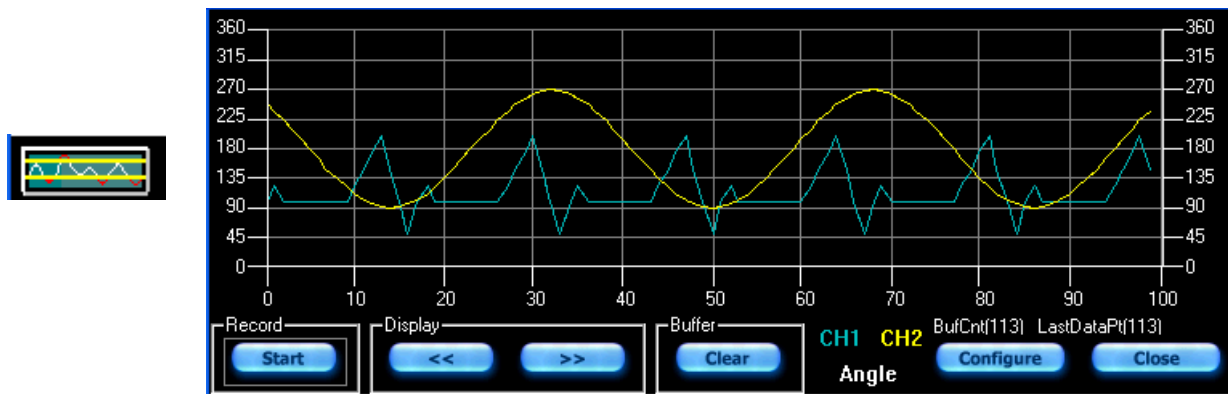


Figure 22 – Strip Chart Feature

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

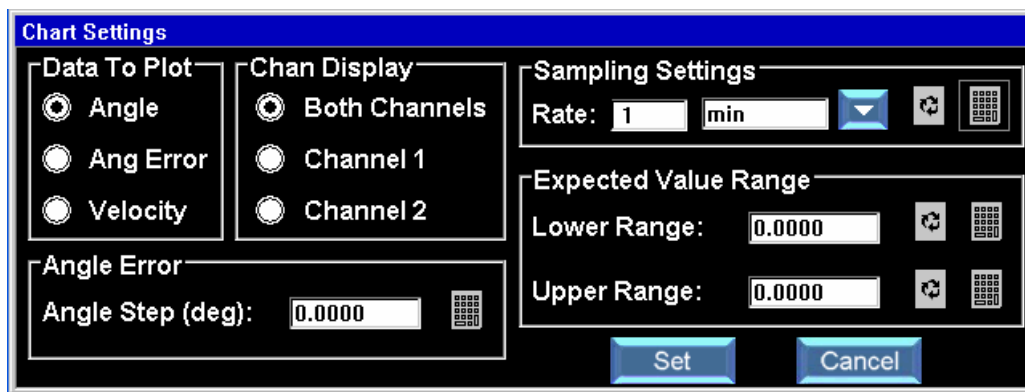


Figure 23 – Strip Chart Configuration Menu

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.

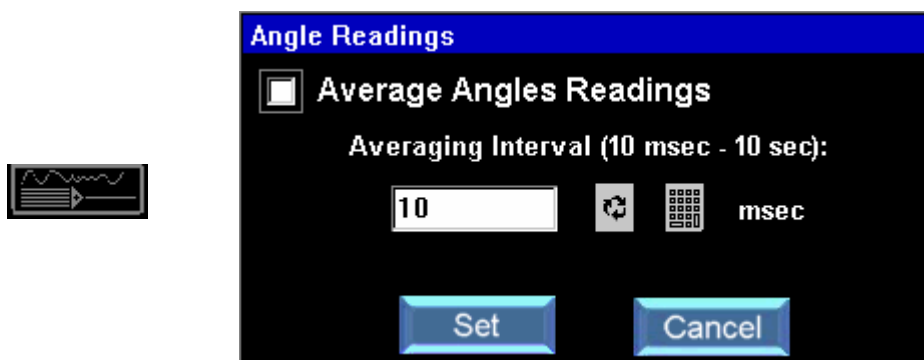


Figure 24 – Angle Averaging

UNDER DEVELOPMENT - 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 pre set limit or threshold. Settings include both an average count and an upper angle limit.



Angle Readings

Test Angle Readings
 Absolute Angle Comparison **Angle Error Comparison**

Angle Step (deg):

Lower Limit (deg):

Upper Limit (deg):

Figure 25 – Angle Limits & Thresholds

ORDERING INFORMATION

Part number:

8810A- * Standard accuracy $\pm 0.004^\circ$ (See table 1B for characterized accuracy)

└─ Add "R" for an internal programmable 2.2 VA Reference Generator

8810AH- * Optional high accuracy unit $\pm 0.0015^\circ$ (See table 1C for characterized accuracy)

└─ Add "R" for an internal programmable 2.2 VA Reference Generator

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
Fuse, 5 x 20mm, 2A, slo-blo (2)	99-0146
Line Cord	202-0002

Optional Mounting Accessories

The 8810A 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 Mounting	Mounts one unit in 19-inch rack	783893
Tandem Full Rack Mounting ½ height	Mounts two units side by side in 19-inch rack (3-1/2" rack height)	548557

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 insure 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 p/n 783893, or Tandem Full Rack mount adapters (1/2 height), NAI p/n 548557. 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

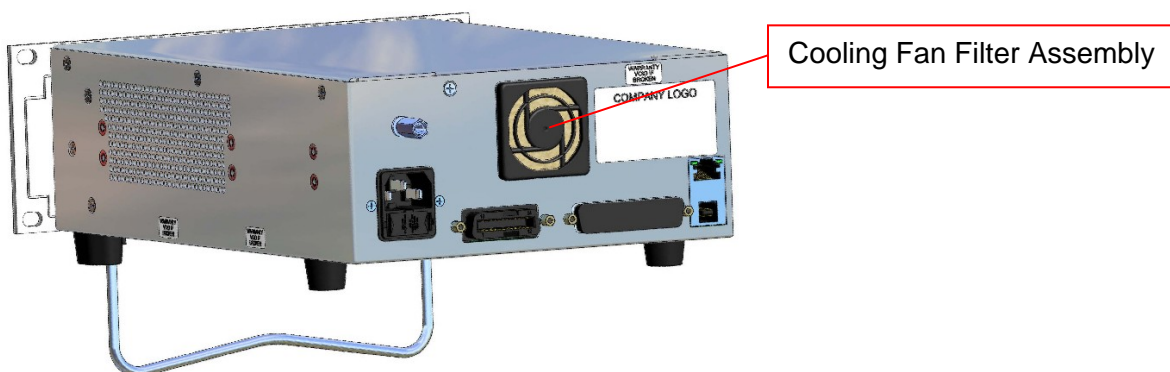
MAINTENANCE

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 fan installed on the rear panel of the unit. The Fan Filter Assembly is user accessible and the Fan Filter has 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 gently 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.

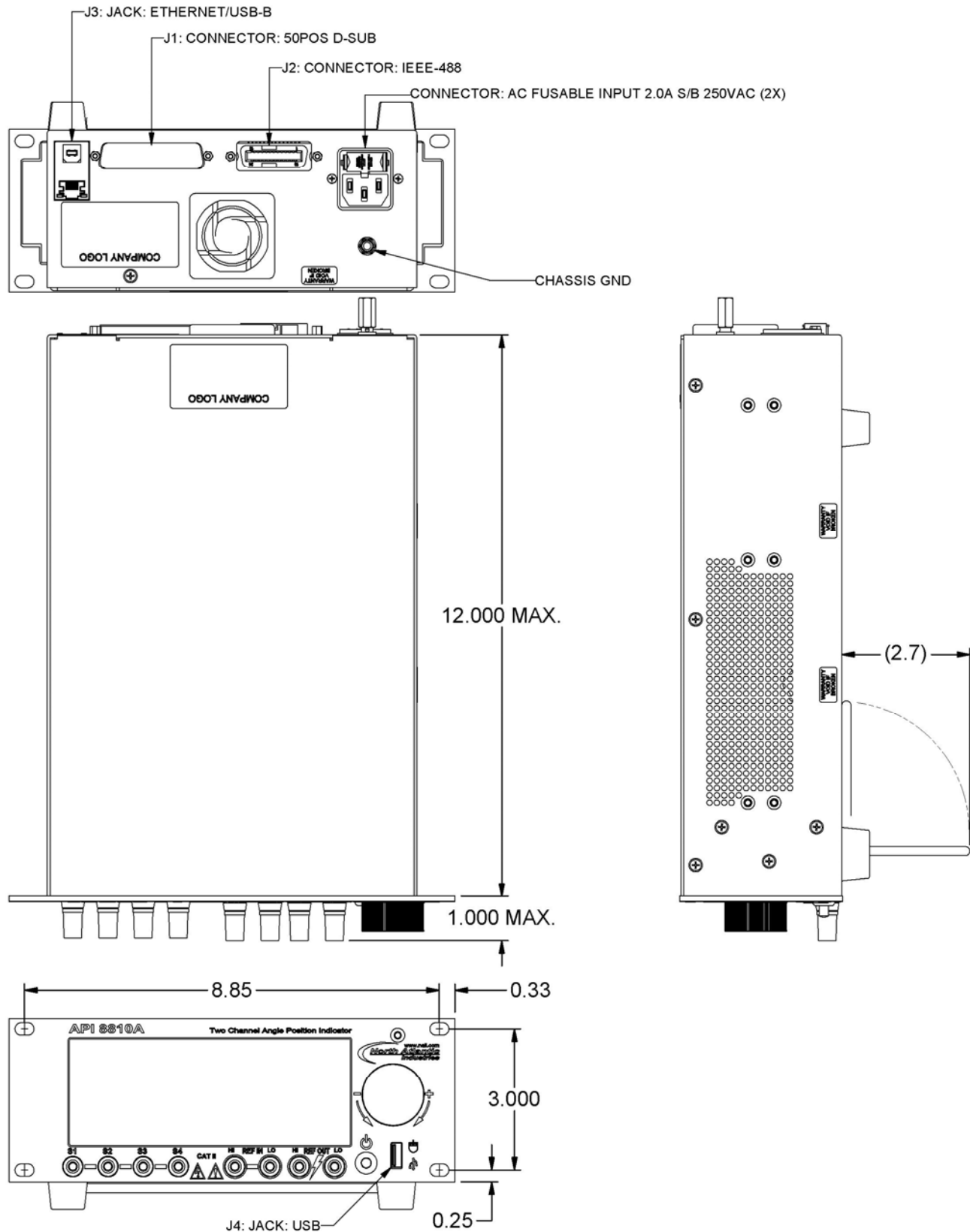
When unit is turned on it will automatically initiate self-calibration. After warm-up of 15 minutes, unit will again automatically calibrate the channel or channels being used. Once calibrated, unit will monitor usage. Should frequency or voltage of measured signal change by more than 12.5%, unit will 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 (USB 2.0).
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
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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 replaced 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 DECLARATION OF CONFORMITY



DECLARATION OF CONFORMITY

We **NORTH ATLANTIC INDUSTRIES, INC.**
110 WILBUR PLACE,
BOHEMIA, NY 11716-2416

declare under our sole responsibility that the following products

8810A Series

To which this declaration relates is in conformity with the following standard(s) or other normative document(s):

EMISSIONS PER EN 61326:1997/A1:1998/A2:2001

CISPR16:1999	Class A, Conducted Emissions
CISPR16:1999	Class A, Radiated Emissions
IEC 61000-3-2:2000	Harmonics
IEC 61000-3-3:1994	Flicker

IMMUNITY PER EN 61326:1997/A1:1998/A2:2001

IEC 1000-4-2:1995	Electrostatic Discharge
IEC 1000-4-3:1995	Radiated Immunity
IEC 1000-4-4:1995	EFT/Burst, Power and I/O Leads
IEC 1000-4-5:1995	Surge Immunity, Power Leads
IEC 1000-4-6:1996	Conducted Immunity, Power and I/O Leads
IEC 1000-4-11:1994	Voltage Dips and Interrupts

SAFETY PER EN 61010-1:2001

IEC 61010-1:2001	Safety
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Following the provisions of COUNCIL DIRECTIVE 89/336/EEC
73/23/EEC

Place Bohemia NY, USA

(original on file)

(Signature)

Date 4/30/07

Roger Maurizio

(Full Name)

Quality Manager

(Position)

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

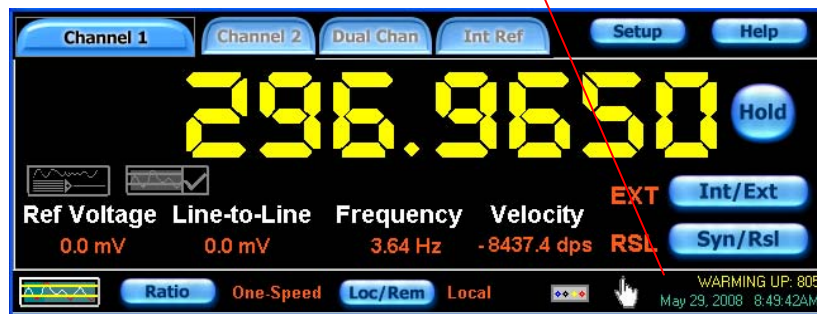
Effective: Manufactured Date Code (DC) 0821 and higher

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.

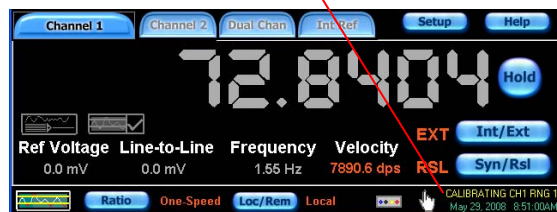


(Fig. 1 – Front Panel Display with warm-up timer)

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”)

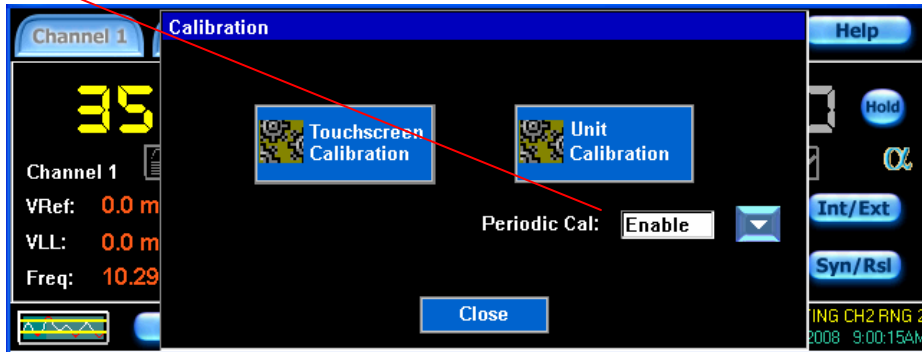


(Fig. 3 – Front Panel Display with channel display “grayed”)

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 of “999.9999”.

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	11/7/07
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	6/9/08
H2	Reformatted Document, revised Bandwidth spec, added note to J1 connector table	FR	6/26/08