VXIbus

UP TO 16 CHANNELS of 3-WIRE LVDT/RVDT STIMULUS

ON-BOARD PROGRAMMABLE EXCITATION SUPPLY (2 max)

FEATURES

- Programmable output voltage
- On-board optional programmable excitation
- Continuous background BIT testing
- Extensive diagnostics
- Wideband 360 Hz to 20 kHz
- Optional Ratiometric or Self leveling conversion
- Message based C size VXI card for SCPI/Native or Mate CIIL. Plug-and-Play Driver with VISA Library available.
- Dynamic address configuration
- VXIbus data rate of 2 megabytes/sec
- Data is processed within 100 μs
- Occupies only a single slot
- No adjustments or trimming

DESCRIPTION

This single slot, message based VXIbus instrument can be populated with either one or two modules. Each module is accessed by separate address switches. Each module provides **eight (8) LVDT/RVDT 3-wire with wraparound self test and an optional programmable excitation supply. Therefore, a total of sixteen (16) 3-wire channels and up to two excitation supplies can be supplied within one single slot enclosure.** An optional feature permits programming each output for either ratiometric or self-leveling mode. In the Ratiometric mode, the output voltage will vary directly with the excitation voltage. Standard is ratiometric. For an optional software modulation feature used to modulate position output of any individual channel about a given position, consult factory. Output position can be modulated at up to ±1 (or FS) in amplitude, at up to 100 Hz and will be modulated about the last programmed position. This card is a uniquely versatile instrument because each excitation input and output voltage is programmable. In addition, each channel can be programmed to be controlled by an external DC voltage. (See part number).

SPECIFICATIONS: APPLIES TO EACH 8 CHANNEL MODULE

Number of Outputs:	Eight.
Output voltage (Va and Vb):	0-24 Vrms ±1% at no load. Transformer isolated. Output voltage is programmable as % of F.S.
Output phasing:	Either Va + Vb = K or Va – Vb = K, programmable
Accuracy:	Va + Vb = K ±1% or Va – Vb = K ±1%
Resolution:	16 bits (.001526% FS)
Linearity:	0.05% FS (at 20 kHz 0.2% FS)
Load:	3.5 ma. max. Outputs are short circuit protected.
Regulation:	1% 10Kohms to no load 2% with a 4 Kohm load
Excitation:	2.0 to 28 Vrms Programmable and Transformer isolated.
Excitation Current:	1.5 mA max. per channel @ 360 Hz.
Excitation Frequency:	360 Hz to 20 KHz. Output voltage will not vary more than 1% over frequency.
Phase Shift:	1.5° max
Ratiometric/Self-leveling:	In the Ratiometric mode, the output voltage will vary directly with the excitation voltage. In the Self-leveling mode, the programmed output voltage will remain constant even though the excitation varies. The Self-Leveling mode is optional. See part number.
Optional Modulation:	Output position can be modulated at up to ±1 (or FS) in amplitude, at up to 100 Hz and will be modulated about the last programmed position.See part number. Consult Factory.
Optional DC input:	Differential. ±10 VDC or ±5 VDC. See part number.
Output Control:	The Va and Vb outputs are controllable by either Internal or External commands. **In the External Mode**, the Va and Vb outputs are controlled by an external analog signal. This differential input signal of ±10 VDC or ±5 VDC (see part number) corresponds to 0 to100% position.
Latency:	Va to Vb latency: The differential latency between Va and Vb output changes as a function of position change will be less than 500 nsec. External Position to Output Latency: The time between an analog position input voltage change and the corresponding Va & Vb output change will not exceed 200 μs. Internal Position to Output Latency: The time between a position change commanded over the VXI bus for any given channel and the corresponding Va and Vb outputs changing will not exceed 8 msec.
VXIbus Data rate:	2 megabytes/second
Temperature, operating:	-10°C to +65°C
Temperature, storage:	-40°C to +85°
Relative humidity:	to 93% RH non-condensing
Shock:	Designed to meet 15G, 11 ms
Vibration:	Designed to meet MIL-T-28800C for class V equipment.
Altitude, operating:	10,000 feet
Altitude, non operating:	40,000 feet
Power Requirements:	±12 VDC at 600 mA +5 VDC at 500 mA
Size:	"C" size (13.386" x 9.187") with 1.2" pitch. (349mm x 234 mm) with 30 mm pitch
Weight:	4.3 lbs. (1.95 Kg)
Calibration intervals:	No calibration is required
Connectors:	Mating connectors are not supplied.
Excitation Supply	Optional. (See part number).
Voltage:	2.0-28 Vrms programmable (resolution 0.1 Vrms). Accuracy ±2%.
Frequency:	400 Hz to 10 kHz ±1% with 1 Hz resolution.
Regulation:	10% max. No load to full load.
Output power:	5 VA max. at 40° min. inductive.

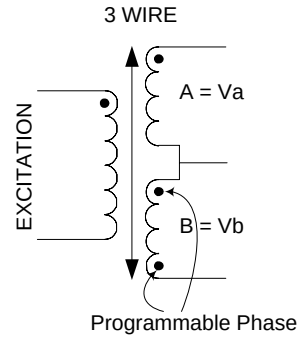
Power Requirements

	±12Vdc	+5Vdc
Board – no Modules	15mA	600mA
Add per 2 Channels Module	560mA	1A
Excitation Module	N/A	1A @ 5VA Load (3A Peak)

PRINCIPAL OF OPERATION (LVDT)

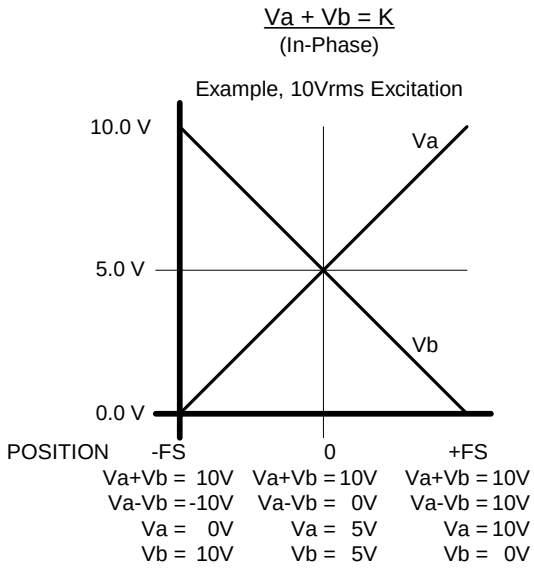
Typically the primary is excited by an ac source, causing a magnetic flux to be generated within the transducer. Voltages are induced in the two secondaries, with the magnitude varying with the position of the core. Usually, the secondaries are connected in series opposition, causing a net output voltage of zero when the core is at the electrical center. When the core is displaced in either direction from center the voltage increases linearly either in phase or out of phase with the excitation depending on the direction.

Output Configuration



POSITION = (Va-Vb) / (Va+Vb)

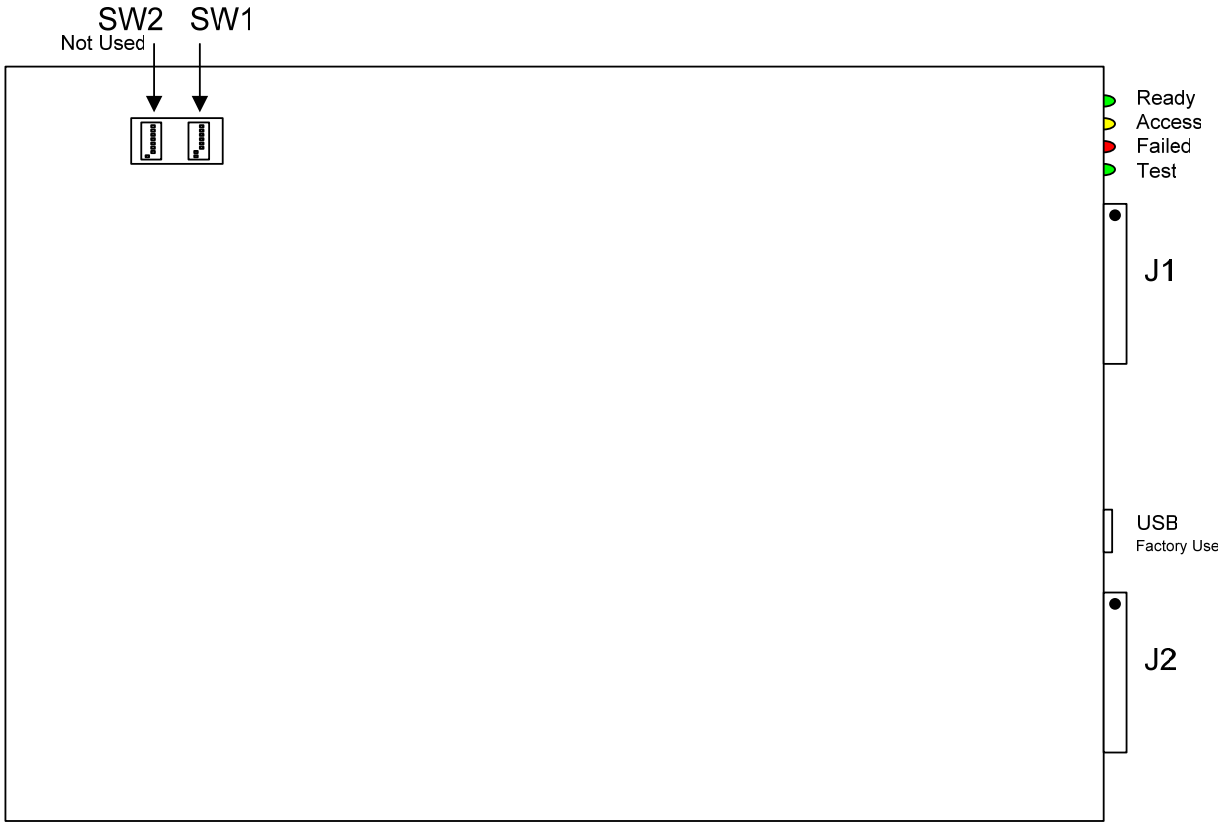
LVDT Coil Voltage vs. Position



CARD ADDRESS

Address Dip Switches 1 and 2 can each be configured for logical addresses 1 to 255, where OFF=1 and ON=0. LSB is position 1. Card SW1 is default configured for logical address 128, to address the first set of 8 channels.

Decimal	Logical Address 128 (Default)	Logical Address 33 (Example)
1 (LSB)	SW1, position 1=0 (ON)	SW1, position 1=1 (OFF)
2	SW1, position 2=0 (ON)	SW1, position 2=0 (ON)
4	SW1, position 3=0 (ON)	SW1, position 3=0 (ON)
8	SW1, position 4=0 (ON)	SW1, position 4=0 (ON)
16	SW1, position 5=0 (ON)	SW1, position 5=0 (ON)
32	SW1, position 6=0 (ON)	SW1, position 6=1 (OFF)
64	SW1, position 7=0 (ON)	SW1, position 7=0 (ON)
128 (MSB)	SW1, position 8=1 (OFF)	SW1, position 8=0 (ON)



65DL2 Bottom View

FRONT PANEL STATUS INDICATORS

Status Indicators	Function
READY	Indicates that unit is ready to accept commands
ACCESS	Indicator is lit when VXI bus controller sends or reads a message or status.
FAILED	Lights on power-up and goes out after unit has passes system self-test. Stays lit if device has failed Self-Test or Calibration. Indicator will also light in response to Controller SYSFAIL output
TEST	Illuminates while Internal Self-Test is running, flashes while in Calibration.

PROGRAMMING

One VXI 65DL2 can be ordered to support either 8 or 16 3-wire channels (see part number). Use SW1 to configure the address for the first 8 channels (channels 0-7). If 16 channels are provided, address channels 8-15 as a second set of 8 channels (channels 0-7) using SW2. For 16 channel applications, use configured address (SW1 and SW2) to differentiate between both sets of 8 channels. Use Mate/CIIL Syntax to address any 1 channel of 8 at that associated logical address.

NOTE: To support output phase programming, native command

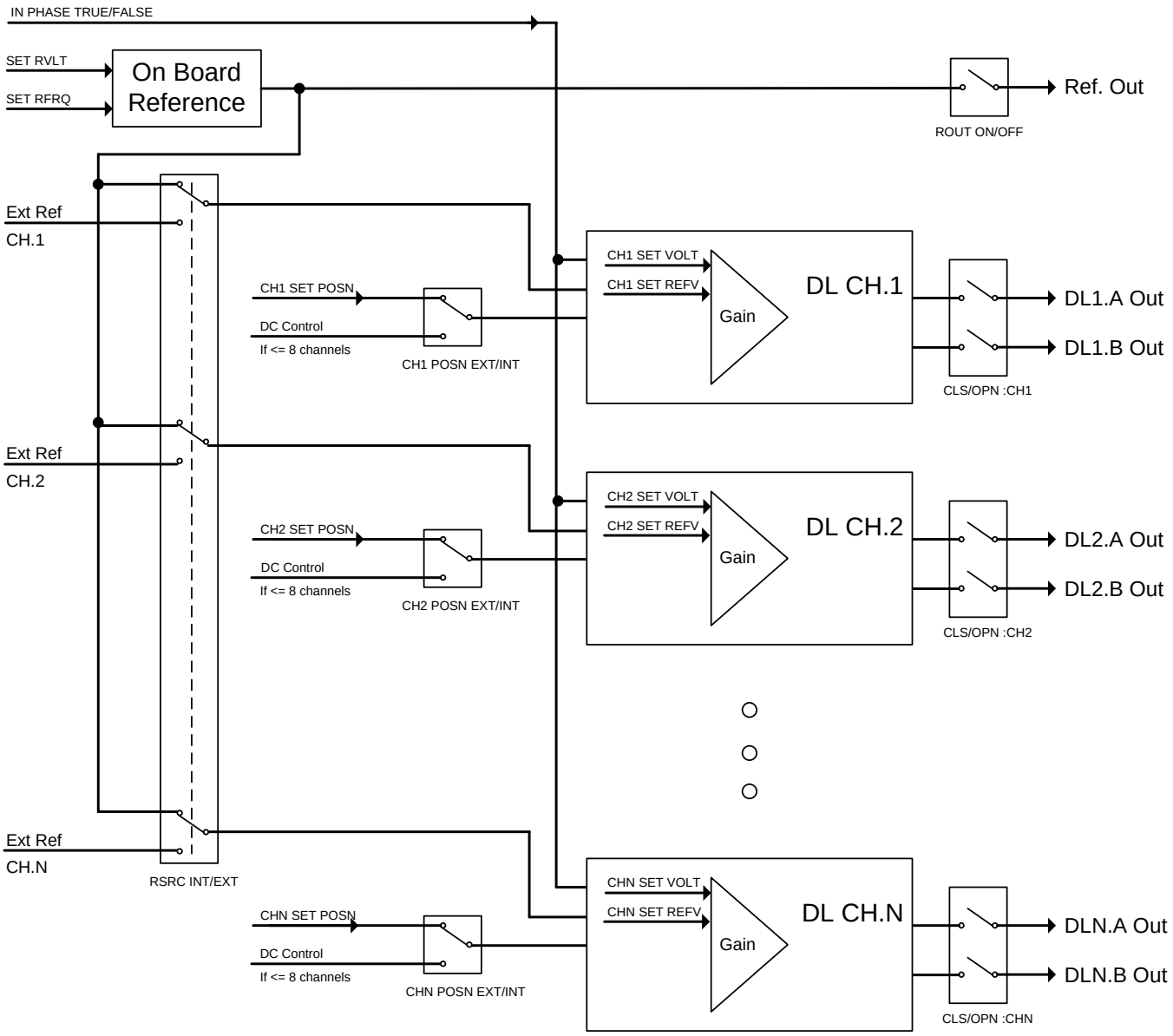
IN_PHASE [TRUE/FALSE]

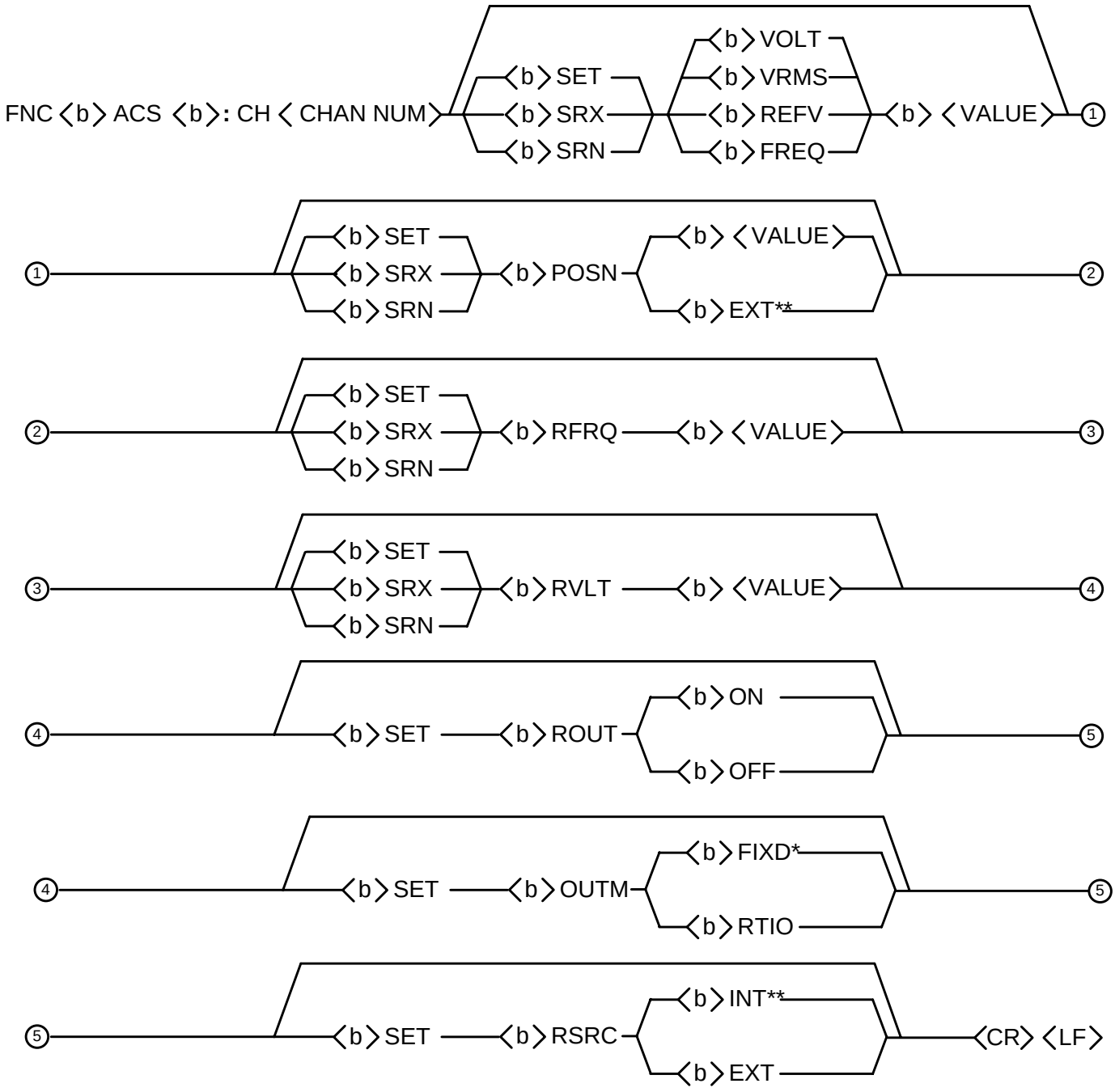
where TRUE configures output for Va – Vb = K and FALSE configures output for Va + Vb = K

was added.

The following sections define MATE/CIIL and SCPI formats with supporting examples.

Function Block Diagram





Note: * SET<b>OUTM<b>FIXD sets to Self Leveling Output. RTIO is for Ratiometric output.
** SET<b>RSRC<b>INT sets ALL channels to internal reference source.
Reference sources for individual channels cannot be set individually.

CLS <b> : CH < CHAN NUM> ——— <CR> <LF>

OPN <b> : CH < CHAN NUM> ——— <CR> <LF>

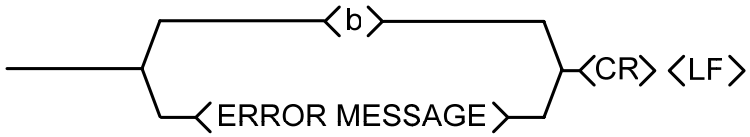
RST <b> ACS <b> : CH < CHAN NUM> ——— <CR> <LF>

STA <CR> <LF>

IST <CR> <LF>

CNF <CR> <LF>

RESPONSE TO STA



CH < CHAN NUM> where CHAN NUM = 0 TO 7 OR 00 TO 07

POWER ON or RESET Command Default Values

RELAY(S)	OPEN
VOLTAGE	= 0.0 Volts
POSITION	= 50 %
RSRC	= EXT
REFV	= 10 Vrms

Error Reporting

1. VXIbus Commands

Errors indicated by (ERR*) bit in response register
Errors reported in response to error query command

2. Operational or syntax errors

Error messages sent in response to serial message (STA)

Response to (IST, CNF)

Open Isolation Relays
Input sequence of voltages to each cannel from internal source
Perform measurements
Compared with stored values
Max Self-test time = 60 seconds

Data Field

ASCII FLOATING POINT	±.DDDDDDDDDDE±DD MANTISSA = 1 to 14 Digits EXPONENT = 1 or 2 Digits
ASCII DECIMAL	±DDDD.DDDDD 1 to 14 Digits Decimal point at any position
ASCII INTEGER	±DDDDDDDD 1 to 15 Digits
ASCII SCIENTIFIC	±D.DDDDDDDDE±DD MANTISSA = 1 to 14 Digits EXPONENT = 1 or 2 Digits EXPONENT Range Limited -09 to +09

± Sign is Optional

No Sign = +

LVDT/RVDT Command Summary

FNC	(SET, SRX, SRN) set up instrument
CLS	Close input path
OPN	open input path
RST	reset channel
STA	report status
CNF	perform confidence test
IST	perform built in test
IN_PHASE	*Native command added to support output phase programming where* TRUE configures output for Va – Vb = K and FALSE configures output for Va + Vb = K

Notation

< >	field boundaries	
<b>	ASCII blank	
<CR> <LF>	ASCII carriage return followed by ASCII line feed	
<NOUN>	ACS	
<SET CODE>	SET	
	SRX	*positive limit*
	SRN	*negative limit*
<MCHAR>	VOLT	
	VRMS	
	REFV	
	FREQ	
	POSN	
	RFRQ	*Added by NAI for Reference Programming*
	RVLT	*Added by NAI for Reference Programming*
	ROUT	*Added by NAI for Reference Programming*
	RSRC	*Added by NAI for Reference Programming* ***WHEN SET TO INTERNAL, DC INPUT IS DISABLED. REFERENCE SOURCES TO INDIVIDUAL CHANNELS CANNOT BE SET INDIVIDUALLY.***
<CHAN NUM>	0 to 7, or 00 to 07	
<VALUE>	See FNC Command Format	
<MODIFIER>	VOLT or VRMS	*Output Voltage*
	REFV	*Reference Voltage*
	FREQ	*Frequency*
	POSN	*Output Position, Center = 50%*

Command Format

FNC **instrument set-up**

FNC<b><NOUN><b>:CH <CHAN NUM> [<b><SETCODE><b><MODIFIER><b><VALUE>]***<CR><LF>

<NOUN>	ACS		(error msg) #1
<CHAN NUM>	0 to 7, or 00 to 07		(error msg) #4
<SETCODE>	SRX	*Maximum value*	
	SET		
	SRN	*Minimum value*	(error msg) #5
<MODIFIER>	VOLT or VRMS	*Voltage Span*	
	REFV	*Expected Ref voltage input*	
	FREQ	*No effect*	
	POSN	*Output Position*	(error msg) #7
<VALUE>	REFV	*2 to 10 Vrms*	
	FREQ	*360 to 20,000 Hz*	
	POSN	*0 to 100%,* *or EXT (External)*	

CLS **close isolation relay**

CLS<b>:CH <CHAN NUM> <CR><LF>

OPN **open isolation relay**

OPN<b>:CH <CHAN NUM> <CR><LF>

RST **reset**

RST<b>ACS<b>:CH <CHAN NUM> <CR><LF>

STA **report status**

STA <CR><LF>

Response

<b><CR><LF>	Normal
<error msg><CR><LF>	Error

IST **internal self test**

IST <CR><LF>

CNF **confidence**

CNF<CR><LF> *Confidence test requires up to 60 seconds before results are available*

*** Optional field or structure field repeated as often as required

Error Messages

1. “F07ACSnn (MOD): COMMAND ERROR”;
2. “F07ACSnn (MOD): NOUN ERROR”;
3. “F07ACSnn (MOD): MISSING CR”;
4. “F07ACSnn (MOD): CHANNEL NUMBER ERROR”;
5. “F07ACSnn (MOD): SET CODE ERROR”;
6. “F07ACSnn (MOD): MCHAR ERROR”;
7. “F07ACSnn (MOD): MODIFIER ERROR”;
8. “F07ACSnn (MOD): VALUE ERROR”;
9. “F07ACSnn (MOD): XPONENT RANGE ERROR”;
10. “F07ACSnn (MOD): NO SPACE”;
11. “F07ACSnn (MOD): BIT FAIL”;
12. “F07ACSnn (MOD): MESSAGE OVERFLOW”;
13. “F07ACSnn (MOD): MESSAGE SYNTAX ERROR”;

Where nn is the channel number

Programming Examples

Provided below are two programming examples. The 65DL2 is programmed using command strings of ASCII text, or command messages. These messages are displayed in quotes for convenience.

Example to set channel 0 for full 10 Vrms reference external, 10 Volts Line-Line and Full Scale (FS) position (100%)
SET RSRC EXT sets ALL channels to external references sources.
Reference sources to individual channels cannot be set individually.

"FNC ACS :CH0 SET RSRC EXT"	*Set Reference to External*
"FNC ACS :CH0 SET REFV 10 SET VOLT 10 SET POSN 100"	*Program Output Configuration*
"CLS :CH0"	*Close Channel 0*
"STA"	*Send Status Request*
Read Device	*Expected Response is blank, or ASCII 32*
" "	

Example to set channel 0 for 10 Vrms reference internal, 10 Volts Line-Line, 400Hz, and FS position (100%)
When setting Reference Source to Internal, DC Input control is disable or ignored.
SET RSRC INT sets ALL channels to internal references sources.
Reference sources to individual channels cannot be set individually.

"FNC ACS :CH0 SET RSRC INT"	*Set Reference to Internal*
"FNC ACS :CH0 SET RVLT 10 SET RFRQ 400 SET POSN 100"	*Program Output Configuration*
"FNC ACS :CH0 SET ROUT ON"	*Turn Reference ON*
"CLS :CH0"	*Close Channel 0*
"STA"	*Send Status Request*
Read Device	*Expected Response is blank, or ASCII 32*
" "	

Example to set channel 0 for 10 Vrms reference external, 10 Volts Line-Line and position to DC Input
SET RSRC EXT sets ALL channels to external references sources.
Reference sources to individual channels cannot be set individually.

"FNC ACS :CH0 SET RSRC EXT"	*Set Reference to External*
"FNC ACS :CH0 SET REFV 10 SET VOLT 10 SET POSN EXT"	*Program Output Configuration, Ext DC Input*
"CLS :CH0"	*Close Channel 0*
"STA"	*Send Status Request*
Read Device	*Expected Response is blank, or ASCII 32*
" "	

User sets external DC Source to 10 volts (Option B)

Example to initiate and query confidence test

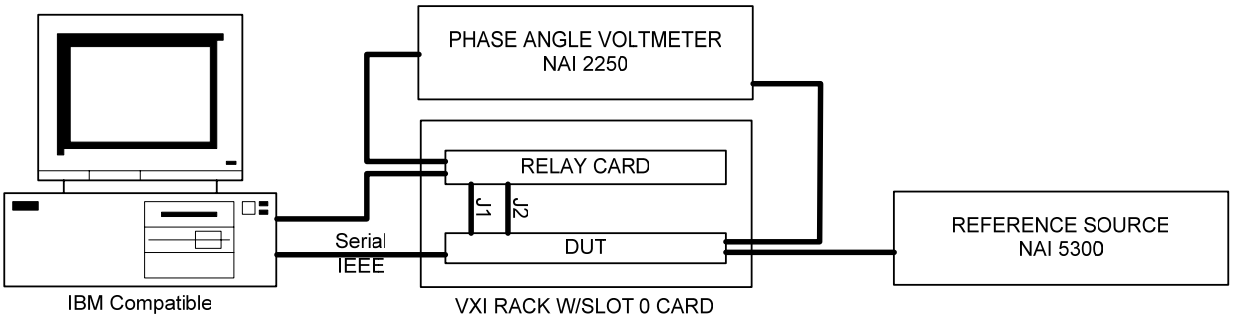
"CNF"	*Initiate Confidence Test*
Wait or implement parallel task	*Confidence Test requires 60 second to complete Poll DATA OUT READY Bit.*
Read Device	*Expected Response is blank, or ASCII 32*
" "	

SCPI SYNTAX

Contact Factory

VERIFICATION TEST SET-UP

This unit does not require field calibration because it is self calibrating. Use the following setup, or similar, to verify performance.



CONNECTORS:

J1, *J2: HDL78SLB Mate: HDT78PD with strain relief 745082-1 **J3: DB25P; Mate: DB25S;

J1			
Pin	Description	Pin	Description
3	Va	11	Va
4	Common Ch.0	12	Common Ch.4
42	Vb	50	Vb
22	Excitation HI	30	Excitation HI
61	Excitation Lo	69	Excitation Lo
5	Va	13	Va
6	Common Ch.1	14	Common Ch.5
44	Vb	52	Vb
24	Excitation HI	32	Excitation HI
63	Excitation Lo	71	Excitation Lo
7	Va	15	Va
8	Common Ch.2	16	Common Ch.6
46	Vb	54	Vb
26	Excitation HI	34	Excitation HI
65	Excitation Lo	73	Excitation Lo
9	Va	17	Va
10	Common Ch.3	18	Common Ch.7
48	Vb	56	Vb
28	Excitation HI	36	Excitation HI
67	Excitation Lo	75	Excitation Lo
20	Internal Exc.Hi Out	59	Internal Exc.Lo Out

J2			
Pin	Description	Pin	Description
3	Va	11	Va
4	Common Ch.0	12	Common Ch.4
42	Vb	50	Vb
22	Excitation HI	30	Excitation HI
61	Excitation Lo	69	Excitation Lo
5	Va	13	Va
6	Common Ch.1	14	Common Ch.5
44	Vb	52	Vb
24	Excitation HI	32	Excitation HI
63	Excitation Lo	71	Excitation Lo
7	Va	15	Va
8	Common Ch.2	16	Common Ch.6
46	Vb	54	Vb
26	Excitation HI	34	Excitation HI
65	Excitation Lo	73	Excitation Lo
9	Va	17	Va
10	Common Ch.3	18	Common Ch.7
48	Vb	56	Vb
28	Excitation HI	36	Excitation HI
67	Excitation Lo	75	Excitation Lo
20	Internal Exc. Hi Out	59	Internal Exc. Lo Out

J3	
Pin	Description
1	DC Hi Ch. 0
2	DC Lo Ch. 0
3	DC Hi Ch. 1
4	DC Lo Ch. 1
5	DC Hi Ch. 2
6	DC Lo Ch. 2
7	DC Hi Ch. 3
8	DC Lo Ch. 3
9	DC Hi Ch. 4
10	DC Lo Ch. 4
11	DC Hi Ch. 5
12	DC Lo Ch. 5
22	DC Hi Ch. 6
23	DC Lo Ch. 6
24	DC Hi Ch. 7
25	DC Lo Ch. 7

***J2 is only supplied when 16 channels are specified**
**** J3 is only supplied when external DC is specified (For 8 channel units only)**

For 12 channels units, 8 channels are on J1 and 4 channels are on J2.

DO NOT CONNECT TO ANY UNDESIGNATED PINS.

PART NUMBER DESIGNATION

65DL2 - XX X 0 X X X X

TOTAL NUMBER OF CHANNELS
08 = Eight channels
12 = Twelve channels
16 = Sixteen channels

EXTERNAL DC CONTROL
C = None
B = ±10 VDC
A = ±5 VDC

3-WIRE OUTPUT

PROGRAMMING
M = Mate CIIL
S = SCPI (Consult Factory)

MODULATION
0 = None
M = Modulation capability
(Consult Factory)

PROGRAMMABLE OUTPUT MODE
0 = Standard ratiometric
P = Programmable ratiometric or self leveling outputs.

EXCITATION SUPPLY
0 = None
R = One 5 VA Excitation supply
T = Two 5 VA Excitation supplies. (Only for 16 channel design)

REVISION PAGE

Revision	Description of Change	Engineer	Date
4.0	Initial Release	GS	5/05/03
4.1	Appends Output Voltage spec from ±34 to 0–24Vrms ±1% at no load. Added Card Address. Added Programming section to define 8 or 16 channel addressing.	GS	5/19/3
4.2	Adds Programming Examples. Addes Assy Dwgs. Adds RSRC INT.	GS	6/3/3
5.0	Added two excitation supplies for 16 ch. Design; various clarifications	FH	12/17/03
5.1	Clarified P/N designation	FH	12/18/03
6.0	native command **IN_PHASE [TRUE/FALSE]** added where TRUE configures output for Va – Vb = K and FALSE configures output for Va + Vb = K	GS	7/29/04
6.1	Adds 12 channels	GS	12/7/4
6.2	Adds Function Block Diagram	GS	3/2/5
6.3	Update Function Block Diagram	GS	3/3/5
6.4	Adds OUTM for self leveling vs ratiometric output.	GS	7/12/5
6.5	CHANGED ADDRESS	DD	05/07/07