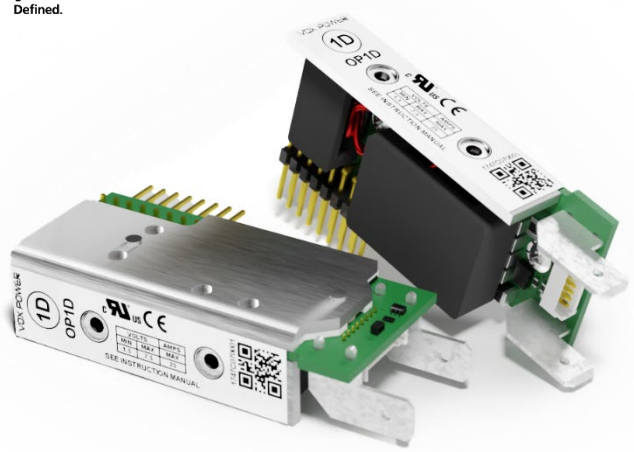
NEVO+ Series

USER MANUAL

Digital Output Modules



OP1D: 0V-7.5V, 25A, 125W

OP2D: 0V-15V, 15A, 150W

OP3D: 0V-30V, 7.5A, 150W

OP4D: 0V-58V, 3.75A, 150W

OPA2D: 0V-15V, 25A, 300W

OPA3D: 0V-30V, 15A, 300W

This NEVO+ series user manual has been prepared by the Vox Power design team to assist qualified engineers in correctly implementing the product and to achieve the best reliability and performance possible.

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NEVO Digital Output Modules Overview

NEVO digital output modules have been developed to enhance standard NEVO output module range by including a PMBus 1.2 compatible digital control and monitoring interface. The digital interface can be added to a standard module by adding a "D" suffix to the base part number. Eg. OP1D or OPA2D.
The following digital output modules are available, OP1D, OP2D, OP3D, OP4D, OPA2D, OPA3D.
The main electrical specifications remain the same and are defined in the original datasheets while additional features and operational differences are described in this supplimental user manual.

Improved Features

- Allows for accurate monitoring of voltage, current, power, temperature, faults and warnings.
- Allows for control of voltage setting, current limit and warning thresholds.
- Improved reverse current protection allows direct connection to batteries or other external power sources.
- Can start into pre-biased loads without discharging external voltage

Operational Differences

- The voltage adjustment potentiometer is removed and output voltage can only be set by digital commands.
- The signal connector J5 has an additional 2 pins for clock and data communications.
- Voltage and Current analog controls are retained but have different control functions.

Contents

Electrical Specifications

All specifications are at T_A= +25°C unless otherwise stated.

Parameter	Specification
Control and measurement resolution – Voltage	10mV
Control and measurement resolution – Current	10mA
Control and measurement accuracy - Voltage	0.5%V_{MAX} + 0.5% reading
Control and measurement accuracy - Current	1%I_{RATED} + 0.5% reading. ±50mA minimum.
Measurement accuracy - Temperature	+/-10°C
SDA & SCL Pins – Voltage	0V to 5V
SDA & SCL Pins – Current (sink only)	10mA maximum
SDA & SCL Pins – Pull up resistance	Internal 130kΩ typical. Add external as required by SMBus.
SMBus Speed	100kHz
Flash Data retention	10 years minimum at Ta = 125°C
Flash erase cycles	10k minimum at Ta = 125°C. 2048 bytes per erase cycle. 20480k parameter saves.

Note that the SDA and SCL pins are referenced to the COM pin (J5.7). The circuit is not isolated, and the COM pin is at approximately the same potential as the output negative power terminal (J4).

SMBus Transactions

The SMBus transaction types supported by NEVO digital output modules are summarised below. A more detailed explanation can be found in the official SMBus specification.

Transaction type	Usage	Description
Send_Byte	Used for write transactions with 0 bytes of data	[S][ADD/W] {A} [CMD] {A} [P]
Write_Byte	Used for write transactions with 1 bytes of data	[S][ADD/W] {A} [CMD] {A} [DATA] {A} [P]
Read_Byte	Used for read transactions with 1 bytes of data	[S][ADD/W] {A} [CMD] [Sr][ADD/R] {A}{DATA} [N][P]
Write_Word	Used for write transactions with 2 bytes of data	[S][ADD/W] {A} [CMD] {A} [$DATA_{LSB}$] {A} [$DATA_{MSB}$] {A} [P]
Read_Word	Used for read transactions with 2 bytes of data	[S][ADD/W] {A} [CMD] [Sr][ADD/R] {A}{$DATA_{LSB}$} [A] {$DATA_{MSB}$} [N][P]
Block_Write	Used for write transactions with >2 bytes of data	[S][ADD/W] {A} [CMD] {A} [LEN] {A} [DATA1] {A} [DATA2] {A}…[DATAn] {A} [P]
Block_Read	Used for read transactions with >2 bytes of data	[S][ADD/W] {A} [CMD] {A} [Sr][ADD/R] {A}{LEN} [A] {DATA1} [A] {DATA2} [A]…{DATAn} [N] [P]
Group_Protocol (Write only)	Used for write transactions to multiple devices. Can send 1 or more bytes of data.	[S][ADD1/W] {A1} [CMD1] {A1} [DATA1.1] {A1}…[DATA1.x] {A1} [Sr][ADD2/W] {A2} [CMD2] {A2} [DATA2.1] {A2}…[DATA2.x] {ACK2} [Sr][ADDn/W] {An} [CMDn] {An} [DATAn.1] {An}…[DATAn.x] {An} [P]
Zone_Write	Used for write transactions to multiple devices configured to the active zone. Can send 1 or more bytes of data.	[S][ZWADD/W] {A} [CMD] {A} [DATA] {A} [P] – Write_Byte [S][ZWADD/W] {A} [CMD] {A} [$DATA_{LSB}$] {A} [$DATA_{MSB}$] {A} [P] – Write_Word [S][ZWADD/W] {A} [CMD] {A} [LEN] {A} [DATA1] {A} [DATA2] {A}…[DATAn] {A} [P] – Block_Write

Note: [] = Leader, {} = Follower, A = ACK, N = NACK, P = Stop, S = Start, Sr = Repeat start, ADD = Device Address, /R = Read bit, /W = Write bit, ZWADD = Zone Write Address 0x37h

Data Formats

The data formats used by NEVO digital output modules are summarised below. A more detailed explanation can be found in the official PMBus specification.

Format	
DIRECT, R0	Signed 2's compliment number with multiplier of 1. Example: Value 100 = Real units 100
DIRECT, R1	Signed 2's compliment number with multiplier of 0.1. Example: Value 100 = Real units 10
DIRECT, R2	Signed 2's compliment number with multiplier of 0.01. Example: Value 100 = Real units 1
ASCII	ASCII code text. Example: Values 79,80,49 = ASCII text "OP1"
CMD CODE	Unsigned integer representing a PMBus command code. Example: Value 33 = VOUT_COMMAND
Bit field	Unsigned integer representing a bit filed. See bit field definitions table

User Command List

Control commands

Commands that control the operation of the device. All can have their data stored to non-volatile memory.

NAME	CMD	Data Bytes	Read/Write	Default	Storable	Format	Real units
OPERATION	1	1	R & W	128	Y	Bit field	-
VOUT_COMMAND	33	2	R & W	See table 3	Y	DIRECT, R2	V
VOUT_DROOP	40	2	R & W	0	Y	DIRECT, R0	mΩ
VOUT_OV_WARN_LIMIT	66	2	R & W	See table 3	Y	DIRECT, R2	V
VOUT_UV_WARN_LIMIT	68	2	R & W	See table 3	Y	DIRECT, R2	V
IOUT_OC_FAULT_LIMIT	70	2	R & W	See table 3	Y	DIRECT, R2	A
TON_MAX_FAULT_LIMIT	98	2	R & W	150	Y	DIRECT, R1	mS
MFR_SETTINGS	209	1	R & W	1	Y	Bit field	-
ZONE_CONFIG	7	2	R & W	254,254	Y	See PMBus Spec	-
MFR_SMBUS_ADDRESS	208	1	R & W	112	Y	See PMBus Spec	-

OPERATION

If bit 7 is cleared the output is disabled. If bit 7 is set the output is enabled but can be inhibited using the appropriate inhibit lines on J2 of the NEVO chassis.

VOUT_COMMAND

Sets or reads the output voltage setting.
e.g. Value = 500 sets the output voltage to 5.00V.

VOUT_DROOP

Sets or reads the output droop resistance in mΩ. This is useful when implementing droop mode current sharing.
e.g. Value = 300 sets the droop resistance to 300mΩ. The output voltage will fall by 300mV/A.

VOUT_OV & VOUT_UV

Sets or reads the over voltage (OV) and under voltage (UV) warning thresholds. The values are absolute and give fixed threshold levels.
e.g. Value = 550 sets the warning threshold voltage to 5.50V.
When changing the output voltage, the UV & OV thresholds may need to be changed in the correct sequence to prevent triggering fault flags.
Note that the device LED indicator and power good (PG) signal (J2 NEVO chassis) operate from the UV and OV thresholds.

IOUT_OC_FAULT_LIMIT

Sets or reads the output current limit.
e.g. Value = 2000 sets the output current limit to 20.00A.

TON_MAX_FAULT_LIMIT

Sets or reads the allowed startup time in mS.
e.g. Value = 500 sets the allowed startup time 500mS.
The undervoltage warning is disabled until this time has expired.
If startup takes too long the device will continue operation but will set the appropriate fault flags.
Setting to TON_MAX_FAULT_LIMIT to 0 allows indefinite startup time. e.g. TON_MAX_FAULT disabled.

MFR_SETTINGS

This setting compensates for open sense offset to give the correct terminal voltage when sense lines are left open.
Bit 1 should be set when sense lines are left open. (Internal voltage sensing)
Bit 1 should be cleared when sense lines are used. (External voltage sensing)

ZONE_CONFIG

Sets or reads the device ZONE WRITE and ZONE READ addresses. See the PMBus specification and addressing section of this manual for details.

MFR_SMBUS_ADDRESS

Reads or sets the SMBus address. This command is only operational when the device is inhibited using the inhibit control pin (INHx) on J2.
Attempts to read/write MFR_SMBUS_ADDRESS when the device is enabled will be NACK'd.

Storage Commands

Commands that control non-volatile memory storage.

NAME	CMD	Data Bytes	Read/Write	Default	Storable	Format	Real units
STORE_DEFAULT_ALL	17	0	W	-	N	-	-
RESTORE_DEFAULT_ALL	18	0	W	-	N	-	-
STORE_DEFAULT_CODE	19	1	W	-	N	CMD CODE	-
RESTORE_DEFAULT_CODE	20	1	W	-	N	CMD CODE	-
MFR_FACTORY_RESET	210	0	W	-	N	-	-

Settings stored to default memory are loaded to active settings at initial power up and overwrite factory settings.

STORE DEFAULT ALL

Copies all active control settings for storage to default non-volatile memory at shut down. Device shutdown by OPERATION command, INHIBIT signal or power cycle is required to complete storage.

RESTORE DEFAULT ALL

Loads all settings from default non-volatile memory to active settings.

STORE DEFAULT CODE

Copies a specific active control settings for storage to default non-volatile memory at shut down. Device shutdown by OPERATION command, INHIBIT signal or power cycle is required to complete storage.
e.g. STORE_DEFAULT_CODE (VOUT_COMMAND) stores the current VOUT_COMMAND setting to the default non-volatile memory at shut down.

RESTORE DEFAULT CODE

Loads a specific setting from default non-volatile memory to an active setting.
e.g. RESTORE_DEFAULT_CODE (VOUT_COMMAND) loads the stored VOUT_COMMAND setting to the current settings.

MFR_FACTORY_RESET

Disables the device output and overwrites the default non-volatile memory with all original factory settings (except MFR_SMBUS_ADDRESS) then restarts the unit.

Measurement and Device Information Commands

Commands that can be used to readback measurements and device information.

NAME	CMD	Data Bytes	Read/Write	Default	Storable	Format	Real units
READ_VOUT	139	2	R	-	N	DIRECT, R2	V
READ_IOUT	140	2	R	-	N	DIRECT, R2	A
READ_TEMP1	141	2	R	-	N	DIRECT, R2	°C
READ_POUT	150	2	R	-	N	DIRECT, R2	W
MFR_READ_ALL	211	10	BR	-	N	Various	-
MFR_MODEL	154	8	BR	See table A1	N	ASCII	-
MFR_REVISION	155	8	BR	-	N	ASCII	-
MFR_SERIAL	158	11	BR	-	N	ASCII	-
MFR_VOUT_MIN	164	2	R	0	N	DIRECT, R2	V
MFR_VOUT_MAX	165	2	R	See table A1	N	DIRECT, R2	V
MFR_IOUT_MAX	166	2	R	See table A1	N	DIRECT, R2	A
MFR_POUT_MAX	167	2	R	See table A1	N	DIRECT, R1	W
MFR_TAMB_MAX	168	2	R	7000	N	DIRECT, R2	°C
MFR_TAMB_MIN	169	2	R	-2000	N	DIRECT, R2	°C
CAPABILITY	25	1	R	32	N	See PMBus Spec.	-
ON/OFF CONFIG	2	1	R	29	N	Bit field	-

READ_VOUT
Reads the output voltage. e.g. Returned value = 500 means the output voltage is 5.00V.

READ_IOUT
Reads the output current. e.g. Returned value = 1250 means the output current is 12.50A.

READ_TEMP1
Reads the device internal temperature. e.g. Returned value = 4250 means the internal temperature is 42.50°C.

READ_POUT
Reads the device output power. e.g. Returned value = 1255 means the output power is 125.5W.

MFR_READ_ALL
Reads multiple device parameters in one Block_Read transaction with 10 bytes of data and clears all status registers.
The parameters are returned in the following data format,
[$VOUT_{LSB}$, $VOUT_{MSB}$, $IOUT_{LSB}$, $IOUT_{MSB}$, $POUT_{LSB}$, $POUT_{MSB}$, $TEMP_{LSB}$, $TEMP_{MSB}$, STATUS_BYTE, VOUT_STATUS]

MFR_MODEL
Reads the device model. e.g. Returned value = "OP1D".

MFR_REVISION
Reads the device revision. e.g. Returned value = "01.00.00".

MFR_SERIAL
Reads the device serial. e.g. Returned value = "2532C0W0000".

MFR_VOUT_MIN
Reads the device minimum rated output voltage specification. e.g. Returned value = 0.

MFR_VOUT_MAX
Reads the device maximum rated output voltage specification. e.g. Returned value = 750 means the maximum rated output voltage is 7.50V.

MFR_IOUT_MAX
Reads the device maximum rated output current specification. e.g. Returned value = 2500 means the maximum rated output current is 25.00A.

MFR_POUT_MAX
Reads the device maximum rated output power specification. e.g. Returned value = 2250 means the maximum rated output current is 225.0W.

MFR_TAMB_MIN
Reads the device minimum rated ambient temperature specification. e.g. Returned value = -2000 means the minimum rated ambient temperature is -20.00°C.

MFR_TAMB_MAX
Reads the device maximum rated ambient temperature specification. e.g. Returned value = 7000 means the maximum rated ambient temperature is 70.00°C.

CAPABILITY
Reads the device capabilities. See appendix 2 and PMBus specification for details.
Always returns 0. (PEC not supported, Bus speed 100kHz, SMBALERT not supported, DIRECT Numeric format, AVSBus not supported)

ON/OFF CONFIG
Reads the device ON/OFF configuration. See appendix 2 and PMBus specification for details.
Always returns 29. (CONTROL pin & OPERATION CMD required for device to run, CONTROL pin active low, Turn off immediate)

Status Commands

Commands that can be used to readback and clear device status information.

NAME	CMD	Data Bytes	Read/Write	Default	Storable	Format	Real units
STATUS_BYTE	120	1	R & W	0	N	Bit field	-
STATUS_WORD	121	2	R & W	0	N	Bit field	-
STATUS_VOUT	122	1	R & W	0	N	Bit field	-
STATUS_IOUT	123	1	R & W	0	N	Bit field	-
STATUS_TEMP	125	1	R & W	0	N	Bit field	-
STATUS_CML	126	1	R & W	0	N	Bit field	-
CLEAR FAULTS	3	0	W	-	N	-	-

STATUS_VOUT

Reads or clears the device VOUT status byte. See faults & warnings section, appendix 2 and PMBus specification for operational details.

STATUS_IOUT

Reads or clears the device IOUT status byte. See faults & warnings section, appendix 2 and PMBus specification for operational details.

STATUS_TEMP

Reads or clears the device TEMP status byte. See faults & warnings section, appendix 2 and PMBus specification for operational details.

STATUS_CML

Reads or clears the device CML status byte. See faults & warnings section, appendix 2 and PMBus specification for operational details.

STATUS_BYTE

Reads or clears the device status byte. See appendix 2 and PMBus specification for operational details.

STATUS_WORD

Reads or clears the device status word. See appendix 2 and PMBus specification for operational details.

CLEAR_FAULTS

Clears all device fault registers.

Special Function Commands

The commands listed below perform special functions.

NAME	CMD	Data Bytes	Read/Write	Default	Storable	Format	Real units
ZONE_ACTIVE	8	2	R & W	0	N	See PMBus Spec	

ZONE_ACTIVE

Sets or reads the device ZONE ACTIVE read and write addresses. See the PMBus specification and addressing section of this manual for details.

Faults & Warnings

Device faults and warnings are communicated through the lower-level status registers STATUS_VOUT, STATUS_IOUT, STATUS_TEMP & STATUS_CML registers. The upper-level status registers STATUS_BYTE and STATUS_WORD give summary of the lower-level registers as described in the PMBus specification.

Output Over-Voltage Warning (OV)

If the output voltage exceeds the VOUT_OV_WARN level the OV_WARN bit is set in the STATUS_VOUT register.

Output Under-Voltage Warning (UV) and TON_MAX_FAULT_LIMIT

The TON_MAX_FAULT_LIMIT sets the allowed startup time for the device, and the under-voltage detection is disabled at startup until this time has expired. Once the TON_MAX_FAULT_LIMIT time has elapsed, under-voltage detection is enabled and if the output voltage goes below the VOUT_UV_WARN level the UV_WARN bit is set in the STATUS_VOUT register.
If the output voltage does not exceed the VOUT_UV_WARN level when TON_MAX_FAULT_LIMIT is reached, then the TON_MAX bit is set in the STATUS_VOUT register.

Output Over Current Fault (OC)

If the output current exceeds the IOUT_OC_FAULT_LIMIT the output voltage will reduce to maintain a constant output current, and the IOUT_OC_FAULT bit will be set in the STATUS_IOUT register.

Internal Over Temperature Warning (OT)

If the internal temperature sensor reading exceeds 110°C the OT_WARN bit will be set in the STATUS_TEMP register.

Communication Faults (CML)

The table below shows the implemented communication faults.

Communication fault description	STATUS_CML bits set
Attempt to write data that exceeds the limits in table A1	INVD_DATA
Attempt to set unused bits in table A2	INVD_DATA
Attempt to write to read-only register	INVD_DATA
Attempt to read from write-only register	INVD_CMD
Attempt to write to Zone Active register not from Zone Write Address	INVD_CMD
First packet byte with read bit set	OTHER_COMM_FLT
HOST sends too many bytes	INVD_DATA & OTHER_COMM_FLT
Attempt to Store/Restore an unsupported command	INVD_DATA
Attempt to Read/Write an unsupported command	INVD_CMD

Clearing Fault Status Registers

All lower-level status registers are persistent and do not clear when the fault is removed. These registers can be cleared by writing "1" to the relevant bit in the relevant register, sending the CLEAR_FAULTS command or turning the device off.
The STATUS_BYTE and STATUS_WORD register bits are automatically cleared when the lower-level registers that caused the bits to be set are cleared.

Power Good (PGOOD)

If output voltage exceeds the VOUT_OV_WARN level or the output voltage goes below the VOUT_UV_WARN level the PGOOD bit is set in the STATUS_WORD register. Otherwise, the PGOOD bit is cleared.

Device Inhibited (OFF)

If the device is inhibited by either the OPERATION command or the J2 inhibit control the OFF bit is set in the STATUS_WORD register. Otherwise, the OFF bit is cleared.

Addressing

General Call Address (0)

NEVO digital modules support the General Call (GC) address (0). The GC address can be used to send write commands to all devices simultaneously. Read commands may return corrupted data when multiple devices attempt to respond.
In NEVO digital modules it can also be used in conjunction with inhibit signals to read and write new SMBus device addresses.

Device Address

NEVO digital modules can have their SMBus address set to any value from 1 to 127 using the MFR_SMBUS_ADDRESS command.
However, the following addresses should not be used as they are reserved by the SMBus standard,

SMBus reserved addresses					
0x00h	GENERAL CALL	0x0Bh	Smart Battery	0x78h-0x7Bh	10-bit addressing
0x37h	ZONE WRITE	0x0Ch	SMBus Alert Response	0x7Ch-0x7Fh	Reserved
0x28h	ZONE READ	0x2Ch	Reserved	0x44h	Reserved
0x08h	SMBus HOST	0x2Dh	Reserved	0x01h	CBUS
0x09h	Smart Battery Charger	0x40h-0x43h	Reserved	0x02h-0x07h	Reserved
0x0Ah	Smart Battery Selector	0x61h	SMBus device Default Address	0x48h-0x4	Prototype address

New SMBus addresses written to the device will become active immediately but will not be stored to non-volatile memory.
To store to non-volatile memory, send STORE_DEFAULT_ALL or STORE_DEFAULT_CODE (MFR_SMBUS_ADDRESS) using the new SMBus address.

Multi Device Systems

If multiple devices are connected to the same SMBus in a system, they must have unique SMBus device addresses. If not, read operations will return corrupt data and write operations will apply to all devices with the same address and it will not be possible to set individual addresses.
When NEVO PSUs are initially configured with digital modules they may initially have identical or unknown addresses, hence a generalised discovery and SMBus address re-programming method is required.

Address Discovery

As the MFR_SMBUS_ADDRESS command will only respond when it's INHx line is asserted (i.e. Unit is turned off by the inhibit line). Units that do not have INHx line asserted will not respond to MFR_SMBUS_ADDRESS command.
By asserting INHx for each module in turn it is possible to determine the SMBus address and slot for each module.

Procedure to discover unknown device addresses

Power the NEVO chassis, assert INHx to disable only the device in slot x, all other slots must be enabled, read MFR_SMBUS_ADDRESS using the General Call address, release INHx

Procedure to change the device address and store to non-volatile memory

Power the NEVO chassis, assert INHx to disable only the device in slot x, all other slots must be enabled, write MFR_SMBUS_ADDRESS (NewSMBusADDRESS) using the General Call address, write STORE_DEFAULT_CODE (MFR_SMBUS_ADDRESS) using the General Call address, release INHx

Note that if there are any other devices on the SMBus that would respond to the commands sent using the General Call address, they must be disconnected.

Zone Addressing

Zone addressing is useful when devices are configured in parallel or series combinations as it allows sending commands to multiple modules with synchronised execution. Devices can be assigned to any zone from 0 to 254 although certain zones should be avoided as detailed below.

Reserved Zones

Reserved for Manufacturer (128 – 191), Reserved for Future Use (192 – 253).

No Zone (254)

Devices set to this zone will not respond to All Zone (255) commands. Devices cannot be assigned to All Zone (255).

All Zone (255)

When the active zone is set to 255 all devices not set to No Zone (254) will respond. Zone active cannot be set to No Zone (254).

To assign devices to a zone, set the zone write address for each device using the ZONE_CONFIG command. Then send commands to all devices configured to that zone by setting the active zone using the ZONE_ACTIVE command and send the device commands using a ZONE_WRITE. See SMBus transactions section, PMBus specification and PMBus Application Note AN001 for ZONE_WRITE operational details.

ZONE_READ is not supported.

Example

Device 1 and Device 2 are to be configured in parallel. Each device is assigned to zone 0 using the ZONE_CONFIG command.
Then the active zone is set to 0 and a zone write command issued to perform an operation on device 1 and device 2 simultaneously.

Reverse Current

NEVO digital output modules implement diode mode behaviour at light loads reduce reverse currents into the modules. This allows direct connection to external power sources such as batteries. The table below details the measured reverse power for each model.

Model	V_{SET} (V)	V_{EXT} (V)	Reverse power (W) (Module enabled)	Reverse power (W) (Module disabled)
OP1D	1	5	0.45	0.0075
OP2D	2	12	0.6	0.015
OP3D	3	24	0.7	0.045
OP4D	5	48	1.7	0.170
OPA2D	2	12	0.4	0.015
OPA3D	3	24	1	0.045

Analog Controls

NEVO digital output modules have the similar analog voltage ($V_{CONTROL}$) and current ($I_{CONTROL}$) controls as standard output modules but with modified control functions.
The voltage control function on digital modules is,
$V_{OUT} = ((1.2-V_{CTRL})/1.14)*V_{MAX} + V_{SET}$ or $V_{CTRL} = 1.2+(V_{SET}-V_{OUT})*1.14/V_{MAX}$

When using analog voltage control it is recommended to set the output voltage to 0V using the VOUT_COMMAND.
The control function then simplifies to,
$V_{OUT} = ((1.2-V_{CTRL})/1.14)*V_{MAX}$ or $V_{CTRL} = 1.2-(V_{OUT}*1.14)/V_{MAX}$

For example, OP1D has the simplified voltage control function, $V_{OUT} = ((1.2-V_{CTRL})/1.14)*7.5$

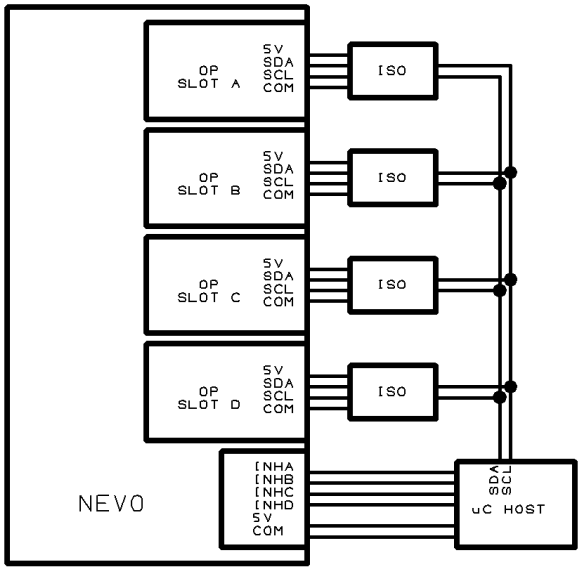
The analog current control function for all digital modules is,
$I_{OUT} = (V_{CTRL}-0.83)*I_{RATED}/0.612$ or $V_{CTRL} = 0.83 + I_{OUT}*0.612/I_{RATED}$

For example, OP1D has the current control function, $I_{OUT} = (V_{CTRL}-0.83)*25/0.612$

Paralleling digital and standard modules is not allowed. Series connection is allowed.

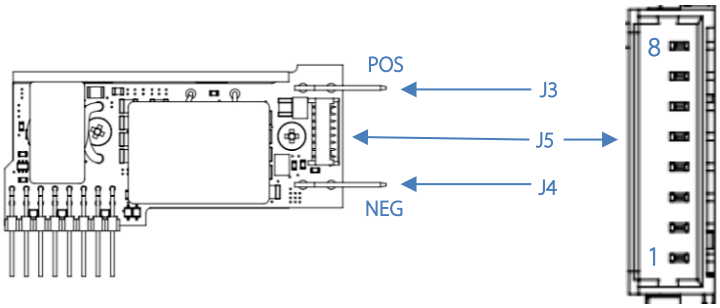
Isolation

The SMBus interface on digital modules is not isolated from the module output. It is referenced to the COM pin on J5 which is internally connected to the negative output on J4. If a fully isolated multi-output system is required, external isolators must be added as shown in the diagram below. Contact Vox Power for recommended devices.



Connectors

PINOUTS	
J3	
Circuit	Details
1	Positive Output
J4	
Circuit	Details
1	Negative Output
J5	
Circuit	Details
1	SCL
2	SDA
3	- Sense
4	+ Sense
5	Voltage Control
6	Current Control / Share / Out
7	COM
8	+5V 10mA local bias supply



MATING PART DETAILS				
Ref.	Details	Manufacturer	Housing	Terminal
J3/J4[1]	OUTPUT POWER TERMINAL: TAB SIZE 6.35mmx0.8mm	VARIOUS	N/A	N/A
J5	OUTPUT SIGNALS: 8 Pin, 1.25mm, with Friction lock, 28-32 AWG	MOLEX	510210800	50058800

Notes
1. Terminal and Wire current rating must exceed maximum short circuit output current. Eg. Output 1 = 25A*1.25 = 31.25Amps
2. Direct equivalents may be used for any connector parts
3. All cables must be rated 105°C min, equivalent to UL1015

Appendix 1 Defaults & Limits

NAME	MODEL	DEFAULT SETTING	MIN LIMIT	MAX LIMIT
OPERATION	ALL	128	0	128
VOUT_COMMAND	OP1D	500	0	750
	OP2D/OPA2D	1200	0	1500
	OP3D/OPA3D	2400	0	3000
	OP4D	4800	0	6000
VOUT_OV_WARN_LIMIT	OP1D	550	0	800
	OP2D/OPA2D	1320	0	1650
	OP3D/OPA3D	2640	0	3300
	OP4D	5280	0	6300
VOUT_UV_WARN_LIMIT	OP1D	450	0	800
	OP2D/OPA2D	1080	0	1650
	OP3D/OPA3D	2160	0	3300
	OP4D	4320	0	6300
VOUT_DROOP	OP1D	0	0	100
	OP2D	0	0	150
	OP3D	0	0	250
	OP4D	0	0	550
	OPA2D	0	0	100
	OPA3D	0	0	150
IOUT_OC_FAULT_LIMIT	OP1D/OPA2D	2875	0	2875
	OP2D/OPA3D	1725	0	1725
	OP3D	863	0	863
	OP4D	431	0	431
TON_MAX_FAULT_LIMIT	ALL	150	0	5000
MFR_SETTINGS	ALL	1	0	1
MFR_SMBUS_ADDRESS	ALL	112	1	127
ZONE_CONFIG	ALL	254,254	0,0	254,254
ZONE_ACTIVE	ALL	0,0	0,0	255,255 (254,254 not allowed)
MFR_VOUT_MAX	OP1D	750		
	OP2D/OPA2D	1500		
	OP3D/OPA3D	3000		
	OP4D	6000		
MFR_IOUT_MAX	OP1D/OPA2D	2500		
	OP2D/OPA3D	1500		
	OP3D	750		
	OP4D	375		
MFR_MODEL	OP1D	OP1D		
	OP2D	OP2D		
	OP3D	OP3D		
	OP4D	OP4D		
	OPA2D	OPA2D		
	OPA3D	OPA3D		
MFR_POUT_MAX	OP1D	1875		
	OP2D/OP3D/OP4D	2250		
	OPA2D	3750		
	OPA3D	4500		
CAPABILITY	ALL	0		
ON/OFF CONFIG	ALL	29		

Table A1

Appendix 2 Bit Field Definitions

NAME	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
OPERATION	ON/OFF STATE	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
ON/OFF CONFIG	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	CONTROL PIN	POLARITY	OFF DELAY
CAPABILITY	PEC	BUS SPEED	BUS SPEED	SMBALERT#	FORMAT	FORMAT	AVSBUS	NOT USED
STATUS_VOUT[1]	NOT USED	VOUT_OV WARN	VOUT_UV WARN	NOT USED	NOT USED	TON_MAX FAULT	NOT USED	NOT USED
STATUS_IOUT[1]	IOUT_OC FAULT	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
STATUS_TEMP[1]	NOT USED	OT_WARN	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
STATUS_CML[1]	INVD_CMD	INVD_DATA	NOT USED	NOT USED	NOT USED	NOT USED	OTHER_COM FAULT	NOT USED
STATUS_BYTE/ $STATUS\_WORD_{LSB}$[1]	NOT USED	OFF	NOT USED	IOUT_OC FAULT	NOT USED	TEMP1 WARN	CML EVENT	NONE
$STATUS\_WORD_{MSB}$[1]	VOUT_FAULT WARN	IOUT_FAULT WARN	NOT USED	NOT USED	PGOOD	NOT USED	NOT USED	NOT USED
MFR_SETTINGS	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	SENSE INT/EXT

Notes:
1. Writing a "1" to any bit in this register will clear the bit.

Table A2