Encore Electronics
Model 5020-102
Computer Controlled Amplifier System

- System features
- Rack specifications
- Rack rear panel connections and pinout
- Configuration through serial port
- Rack controller description
- Rack inventory and settings
- Model 176 specs, setup and operation
- Model 179 specs, setup and operation
- Model 664 specs, setup and operation
- Model 665 specs, setup and operation
- Model 176-002 schematic, D15727
- Model 177-001 patch panel schematic, B15728
- Model 178-002 rack controller schematic, C15733
- Model 179-002 schematic, D15906
- Model 664-002 schematic, D15729
- Model 665-002 schematic, D15730
- Model 870-002 power supply schematic, C15731
- Model 5020-102-002 rack schematic, D15732

System features

The 5020-102 rack offers complete remote control of all signal conditioner settings, through an industry-standard Ethernet interface and remote web browser. No additional software needs to be installed to operate the system. In addition, the rack can be controlled by other software (such as LabView) via the Ethernet interface. Control variable information is available in a separate document.

The rack can accommodate a range of signal conditioning modules. Each type of module has a unique identifier, so the status and control webpages match the type of module installed – strain amplifier, accelerometer conditioner, LVDT, etc. All amplifier settings are stored in non-volatile memory in the rack, and restored at power-on. Settings are saved by rack slot, rather than by amplifier module, so if two modules are exchanged, the gain/filter/bridge settings for the slot's attached transducer are maintained. After swapping modules, a static strain amplifier should be re-zeroed and re-balanced. The rack uses an internal DC measurement system for its autozero and autobalance operations. An automatic self-calibration cycle is performed at powerup, 10 minutes later, and every 4 hours thereafter, to ensure accuracy over time.

Because of the remote control possibilities of this system, the amplifiers can be located at the unit under test and operated from across the room, or across the country. To help prevent unwanted modifications of amplifier settings, a username and password are required to access webpages that allow changes to be made. Anyone with network access to the rack can view the current amplifier settings, however.

A brief descriptive text (up to 50 characters) may be stored in the rack, and will be displayed on each status page. This text could indicate what sensors are connected to the particular rack, for example.

In addition to the human-readable webpages, there are simplified text-only pages which simplify integration with other software packages. For example, you can use an Excel spreadsheet to calculate gain settings, then have Excel make those amplifier changes via Ethernet. Current settings are returned after each update request, to verify changes.

Each signal conditioner module slot has a board retainer feature, which works with the module's ejection handle. Press down on the retainer, then rotate the handle downward to release the module. To replace the module, align the bottom edge of the PC board with the card guide, press the retainer down with the board, and align the top edge of the board with the upper card guide. Slide the board in with the handle pointing outward. As the board engages in the rack, rotate the handle upward, and press it against the board to lock the module into the rack.

The ejection handle also has an identification label. The model number is printed on this label, with different coloring used for each type of signal conditioner. The front panel cover has openings to view the labels, as well as the status LEDs. This way, a rack's contents can be quickly verified without removing the cover.

Model 5020-102 rack specifications

Front panel controls	Power on/off switch and indicator Amplifier common isolate/ground switch
Module slots	15 slots on 1” spacing for signal conditioners 1 slot on left side for Model 178 rack controller
Rear panel connectors	5 PT02A14-18S signal input (one per 3 slots) 30 BNC analog output BNC external calibration signal input BNC mux signal output Ethernet RJ45, RS232 9-pin D male
Dimensions	19” wide, 8.75” (5U) tall, 18” deep (plus handles and mating connectors)
Weight	40 pounds with 15 amplifiers installed
Power to slots from Model 870 supply	Unregulated ±25VDC common to all slots for amplifiers Unregulated +18VDC common to all slots for relays/logic Unregulated +25VDC, isolated, two per slot for excitation
Power	115 VAC 50/60Hz, 190VA (2A slow blow fuse)

Rack rear panel connections

The 5020-102 rack has 15 module slots, and 30 pairs of input and output connections. The module slots are arranged in five groups of three. The five signal input connectors are standard PT02A14-18S bulkheads. Each has 6 sets of 3 contacts, for differential signal and shield. For charge transducers and single-gage strain transducers, this allows six transducers to connect to three dual-channel conditioner modules. For full-bridge strain transducers, two pairs are used to connect excitation and return signal to a single-transducer conditioner. The 30 output signals are available on 30 separate BNCs.

A separate 6-channel patch panel (Model 177-001) can be attached to an input connector. This patch panel has 6 paralleled connectors for single-ended (BNC) or differential (3-pin MS3470L8-33P) charge-type accelerometers. Use of this patch panel means three adjacent module slots are loaded with charge conditioners.

30-channel patch panels are also available. The Model 177-002 has 30 BNC connections, while the Model 177-003 has 18 BNCs plus 12 BNCs paralleled with 12 3-pin differential connections. Either of these panels will support a rack fully loaded with 15 dual-channel charge conditioner modules.

An External Cal BNC is provided for attaching a voltage calibration signal. Each amplifier channel can replace its input signal with this calibration signal to verify operation. For charge amplifiers, internal capacitors will convert the calibration voltage to charge. This BNC is floating from amplifier common until used by a specific signal conditioner. When used to provide a differential signal to a floating differential amplifier, the BNC shell should not be ground-referenced externally.

Under remote control, each of the 30 output signals, or the External Cal signal, can be routed to the rear panel MUX OUT BNC. This is typically connected to an external voltmeter for automated testing, with a bandwidth of about 30kHz. The mux output is a buffered copy of the selected amplifier output, but the External Cal signal is unbuffered. The mux output resets to OFF at each power cycle. This prevents multiple racks from accidentally driving the common connection to the voltmeter.

Also under remote control, each module slot's two output BNCs may be connected to the External Cal signal, to bypass the signal conditioner entirely. This can be used to calibrate external data acquisition equipment, even with empty module slots.

The rack has an Ethernet RJ45 jack, a 9-pin RS232 console port, and AC receptacle and fuse. A #10-32 stud is available for additional chassis ground connections. The Model 870 power supply mounted in the 5020-102 rack will operate from 115VAC, 50/60Hz.

Amplifier common is not permanently tied to chassis ground. A toggle switch on the power supply front panel allows this connection to be made. Normally, external equipment will tie the output BNC shells to chassis ground. Multiple ground connections could cause ground loop noise.

Input connector pinouts for single and dual channel modules

Single Full	Single 3-wire	Dual-channel	Model 179	PT02A14-18S
+P 1	+P 1	+IN A 1	+Charge 1	A
-P 1	n/c	-IN A 1	-Charge 1	B
Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground	C
+S 1	R 1	+IN B 1	+mV/g 1	D
-S 1	-S 1	-IN B 1	-mV/g 1	E
Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground	F
+P 2	+P 2	+IN A 2	+Charge 2	G
-P 2	n/c	-IN A 2	-Charge 2	H
Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground	J
+S 2	R 2	+IN B 2	+mV/g 2	K
-S 2	-S 2	-IN B 2	-mV/g 2	L
Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground	M
+P 3	+P 3	+IN A 3	+Charge 3	N
-P 3	n/c	-IN A 3	-Charge 3	P
Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground	R
+S 3	R 3	+IN B 3	+mV/g 3	S
-S 3	-S 3	-IN B 3	-mV/g 3	T
Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground	U

Communication configuration through console port

The rear panel has a 9-pin male serial port, which will connect to a standard PC serial port with a null-modem (laplink) cable. Using a terminal program such as Hyperterminal, establish a connection at 57600 baud, 8 bits, no parity, 1 stop bit, and no flow control.

If the connection is correct at rack powerup, a banner message will be displayed:
`Encore Electronics Model 5020-102 Console Version 1.1`
This indicates the console is ready for commands. If the rack is already operating, commands may be entered at any time, without seeing the banner. For a complete command listing, type `HELP`. To show present network settings, type `SHOW ETH0` - note this is a zero, not an O. This displays IP address, subnet mask, gateway, and other parameters. To make changes, type `SET` followed by a parameter name (ip, netmask, gateway). For example, `SET IP 192.168.5.100`

Starting in 2017 firmware includes a Telnet console accessible through the Ethernet connection as well. Because only one network parameter can be changed at a time, a separate webpage is available at \eth0cfg.zhtml which allows all network settings to be changed at once. When this page is submitted, the rack reboots and reappears at the new IP address.

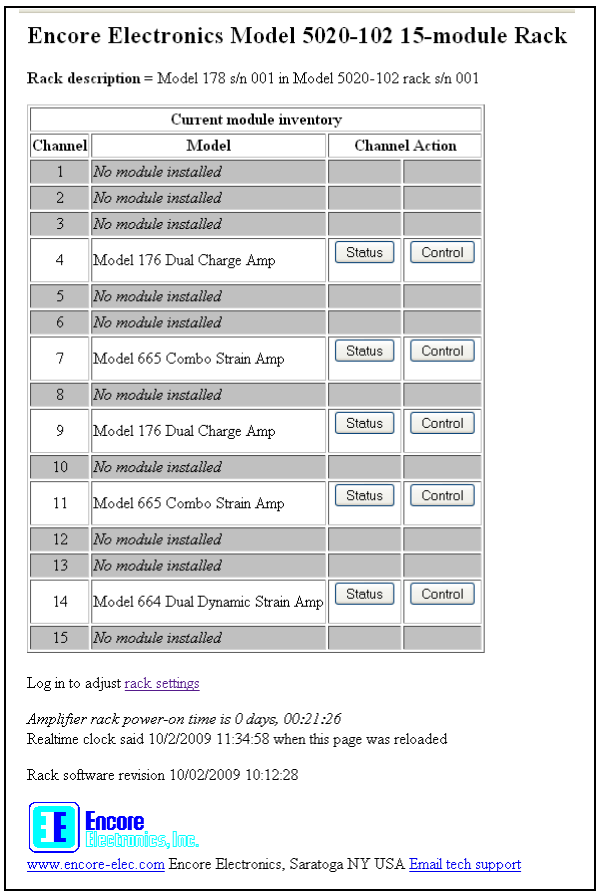
Model 178 rack controller

The Model 178 rack controller is a removable module, similar to the signal conditioner modules. The mating connector is offset from center to ensure the controller won't be interchanged with a signal conditioner. If the controller needs to be removed from the rack, pull the board about halfway out of the rack and disconnect the Ethernet cable from the RJ45 jack on the board. When replacing the controller, make sure the separator plate is in place, to keep the Ethernet cable in the controller's space, away from signal conditioner slot 1.

If a field update of the rack software is required, power off the rack, pull the controller out of the rack, attach the programming cable to the 10-pin header on the RCM3700, reinstall the controller, and turn the rack on. The controller will not operate with the programming cable installed. If practical, unseat all the amplifier cards in the rack while reprogramming the controller, so they are not powered up without control.

The programming cable has two 10-pin connectors, one marked "PROG" and one marked "DIAG". When attaching the "PROG" connector, note that it's easy to mis-match the connector, missing one row of pins. The red stripe on the cable indicates pin 1, and must align with the dot on the RCM3700 board, toward the bottom of the rack. Connect the other end of the programming cable to a PC, and run the Remote Field Update utility. When updating is complete, remove the programming cable and reinstall the control module. Further information on the RCM3700 embedded processor and the RFU utility and cable is available at http://www.digi.com

Model 5020-102 rack inventory webpage



Encore Electronics Model 5020-102 15-module Rack

Rack description = Model 178 s/n 001 in Model 5020-102 rack s/n 001

Current module inventory			
Channel	**Model**	**Channel Action**	
1	*No module installed*		
2	*No module installed*		
3	*No module installed*		
4	Model 176 Dual Charge Amp	Status	Control
5	*No module installed*		
6	*No module installed*		
7	Model 665 Combo Strain Amp	Status	Control
8	*No module installed*		
9	Model 176 Dual Charge Amp	Status	Control
10	*No module installed*		
11	Model 665 Combo Strain Amp	Status	Control
12	*No module installed*		
13	*No module installed*		
14	Model 664 Dual Dynamic Strain Amp	Status	Control
15	*No module installed*		

Log in to adjust rack settings

Amplifier rack power-on time is 0 days, 00:21:26
Realtime clock said 10/2/2009 11:34:58 when this page was reloaded

Rack software revision 10/02/2009 10:12:28

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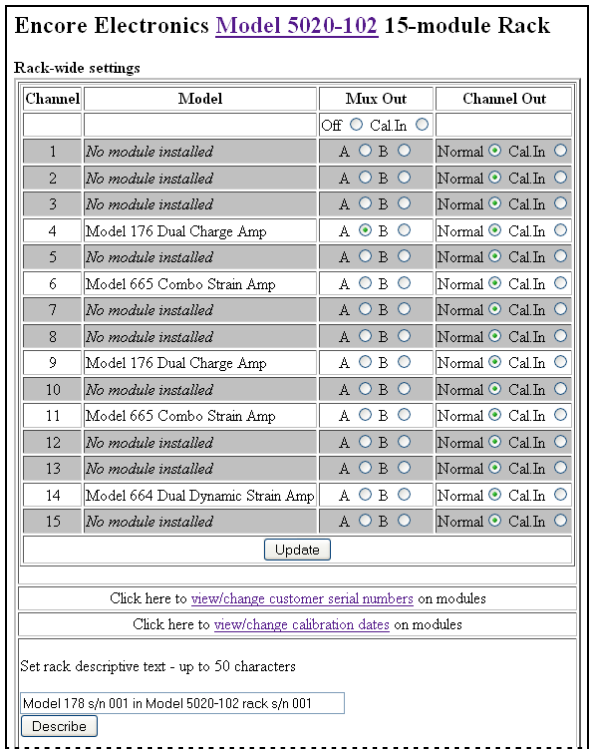
When you first direct your web browser to the IP address of the computer-controlled amplifier rack, you will see a page similar to this one.

This page shows what type of amplifier module is installed in each slot. Empty slots are shown in grey. From here, you can click on the STATUS or CONTROL button for each channel. The STATUS pages are display-only, and available for anyone to view. The CONTROL pages require a username and password, to reduce accidental changes to amplifier settings while a test is running. Once the web browser has entered a valid username and password, the browser remains logged in until it's closed.

The username is '`test`' and the password is '`pass`'.

At the bottom of this page is a link to a RACK SETTINGS page. There are also indications of the rack real-time clock, and rack software version.

Model 5020-102 rack settings webpage



Encore Electronics Model 5020-102 15-module Rack

Rack-wide settings

Channel	Model	Mux Out	Channel Out
		Off ○ Cal In ○	
1	*No module installed*	A ○ B ○	Normal ◉ Cal In ○
2	*No module installed*	A ○ B ○	Normal ◉ Cal In ○
3	*No module installed*	A ○ B ○	Normal ◉ Cal In ○
4	Model 176 Dual Charge Amp	A ◉ B ○	Normal ◉ Cal In ○
5	*No module installed*	A ○ B ○	Normal ◉ Cal In ○
6	Model 665 Combo Strain Amp	A ○ B ○	Normal ◉ Cal In ○
7	*No module installed*	A ○ B ○	Normal ◉ Cal In ○
8	*No module installed*	A ○ B ○	Normal ◉ Cal In ○
9	Model 176 Dual Charge Amp	A ○ B ○	Normal ◉ Cal In ○
10	*No module installed*	A ○ B ○	Normal ◉ Cal In ○
11	Model 665 Combo Strain Amp	A ○ B ○	Normal ◉ Cal In ○
12	*No module installed*	A ○ B ○	Normal ◉ Cal In ○
13	*No module installed*	A ○ B ○	Normal ◉ Cal In ○
14	Model 664 Dual Dynamic Strain Amp	A ○ B ○	Normal ◉ Cal In ○
15	*No module installed*	A ○ B ○	Normal ◉ Cal In ○

Update

Click here to view/change customer serial numbers on modules

Click here to view/change calibration dates on modules

Set rack descriptive text - up to 50 characters

Model 178 s/n 001 in Model 5020-102 rack s/n 001

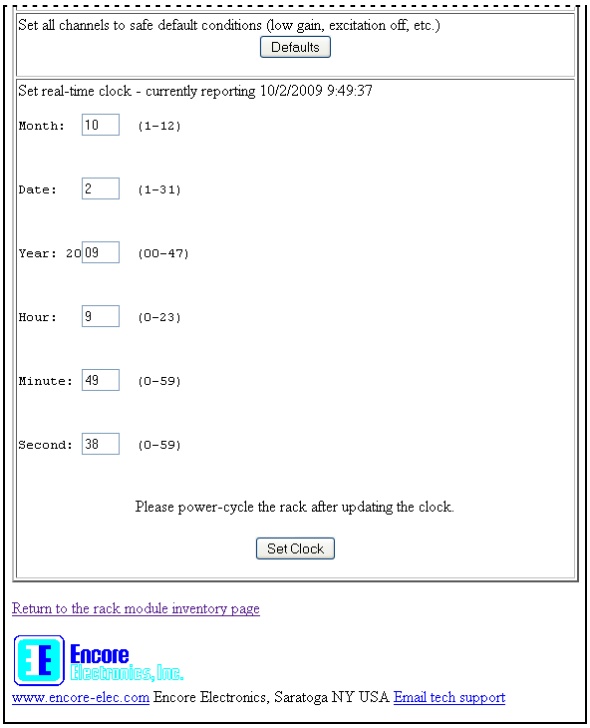
Describe

This page allows you to make several rack-wide changes. The rear panel Mux Out BNC can monitor any of the 30 amplifier channels, or the Cal In BNC. In addition, each slot has a bypass relay which connects the two Amplifier Output BNCs to the Cal In signal, so that system checks can be done with a module removed.

Starting with the -002 versions of the plugin signal conditioners, there is a non-volatile memory on each module. This is used for storing serial number and calibration information. Cal-due dates can be set for 3, 6, 12, or 18 months in the future. Two links are provided to webpages that allow viewing and modification of the stored customer serial number, and calibration date information.

The rack controller can store a 50-character descriptive tag, to help identify a remotely-installed rack rather than relying on knowing each rack's IP address.

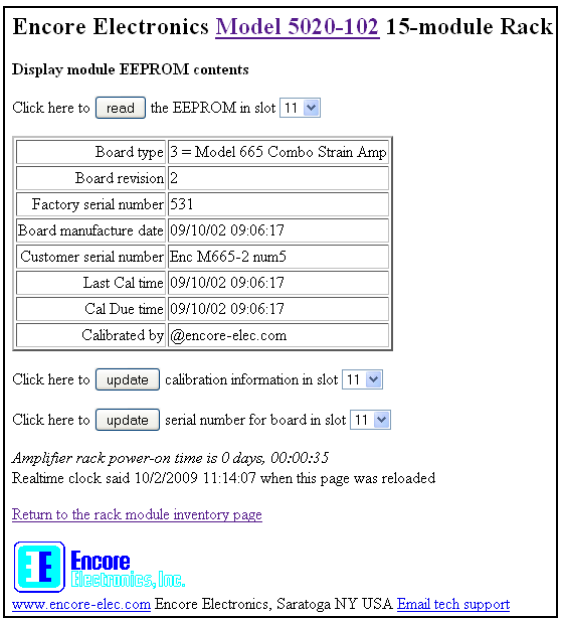
Model 5020-102 rack settings webpage (cont'd)



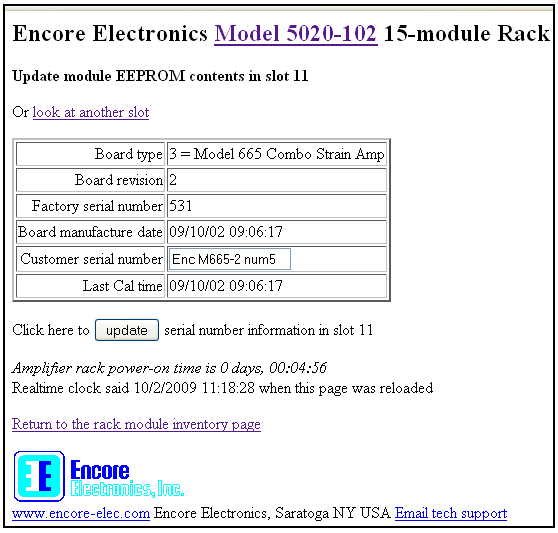
All amplifiers in the rack may be set to a low-output default condition, with low gain, excitation off, filter out, and zero mode. Selecting this option may have an effect on the Mux Out setting, if any modules perform an autozero while entering safe mode. Model 665 combo strain conditioners will autozero after a change in gain or filter selection, or if the main channel switches between AC coupled and DC coupled. After selecting safe mode, the last module to autozero will remain on the Mux Out BNC.

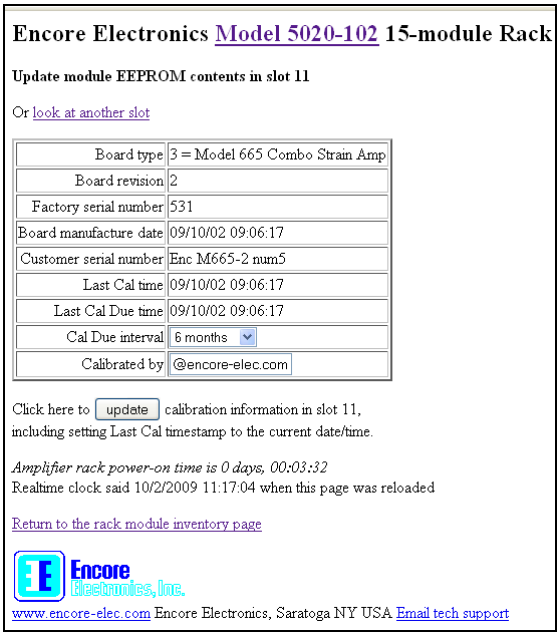
The rack has a real-time clock, which occasionally may need to be reset. This clock is only used by the rack to initiate periodic self calibrations of the internal A/D converter, so absolute time accuracy isn't critical to unit operation. However, this clock is used to set the module calibration date, and calculated cal-due date. After changing the real-time clock, the rack must be power-cycled before updating calibration dates. The clock does not adjust itself for daylight savings time.

Model 5020-102 module calibration memory control



This page allows you to interrogate the on-board memory of the module in any rack slot. The top four rows show factory-set information, which can't be changed. Dates are in `yy/mm/dd hh:mm:ss` format. Below the information display is a link to other pages that allow changing of this information. Forms on those pages allow entry of a 16-character string for module serial number/asset tag number, and another for the employee ID of the person who calibrated the module. The Last Cal time is automatically set to match the rack's real-time clock, and the Cal Due time is calculated from the dropdown box value of 3, 6, 12, or 18 months in the future.





Model 176 amplifier specifications

Accel Sensitivity	Any value from 2.0 to 200 pC/g
Output scaling	1mV/g, 10mV/g, 20mV/g, 100mV/g
Gain accuracy	±1%
Input mode	Differential or single-ended (-IN tied to common)
Maximum input	50,000pC peak per input (50,000pC differential) : 2,500pC peak with sensitivity set to 2.0 – 9.9pC/g 12,500pC peak with sensitivity set to 10 – 49.9pC/g 50,000pC peak with sensitivity set to 50 – 200pC/g
Calibration	Internal 1015pf ±1% capacitors convert ExtCal voltage signal to charge, which can be applied to the amplifier front ends
Filter	8-pole Butterworth lowpass at 12kHz, plus OUT 6-pole Butterworth highpass at 5Hz
Frequency response, with LP filter out	20kHz at 50,000pC peak input level, increasing to >35kHz at 25,000pC peak input level (or lower)
Zero mode	Relays replace charge converter outputs with short to common
Offset	Less than 5mVDC at output
Noise	Less than 3mV RMS, filter in, input disconnected

Model 176 charge amplifier setup and operation

Connect your transducer to the proper input connector. From the control webpage, select the appropriate accelerometer charge sensitivity, differential or single-ended input, scale factor in mV/g, filter in or bypassed.

There are two additional options – external calibration signal, and +IN zero. In single-ended mode, the –IN connection is tied to amplifier common, and all amplification is done on the +IN connection. In differential mode, the conditioner operates on both input connections, resulting in an output proportional to the difference between +IN and –IN. When in differential mode, the +IN may be tied to amplifier common to verify operation of the –IN half. If the +IN half is zeroed in single-ended mode, both inputs are tied to common, so amplifier output is only internal noise.

The external calibration signal comes into the rack as a voltage. Two precision 1015pf capacitors per channel convert this voltage to a charge signal for both +IN and –IN. In single-ended mode, the external cal signal is referenced to amplifier common and applied through one capacitor to the +IN half. With the conditioner set for single-ended mode, 100pC/g and 100mV/g, 1 VRMS applied to the ExtCal input will be amplified at a gain of 1.015, producing 1.015VRMS at the output.

In differential mode, with +IN zero at the normal setting, no output will result, as both +IN and –IN are seeing the same (common mode) signal, with no differential component. With +IN zero selected, the external cal signal is applied to the –IN half, resulting in an output inverted from the cal signal. Differential gain is ½ of single-ended gain, so this cal voltage will be 0.507VRMS.

The front panel LED for each channel will be green in normal operation, and change to red if an amplifier stage has reached the limit of ±10V peak. At high gain (low accelerometer sensitivity) the front end will saturate before the amplifier output reaches its limit, so the LED may be red even with only 5VRMS at the output.

Model 176 status webpage

Encore Electronics Model 5020-102 15-module Rack

Current Model 176-001 amplifier settings - *rack description* = Model 178 s/n 001 in Model 5020-101 s/n 001

Channel	Sens	Mode	Scaling	Filter	Cal	+Zero
1A	2.000pC/g	Differential	100mV/g	12kHz LP	Normal	Normal
1B	200.000pC/g	Single Ended	1mV/g	12kHz LP	Normal	Normal

Amplifier rack power-on time is 0 days, 01:21:49
Realtime clock said 10/23/2008 9:43:56 when this page was reloaded

Return to the rack module inventory page

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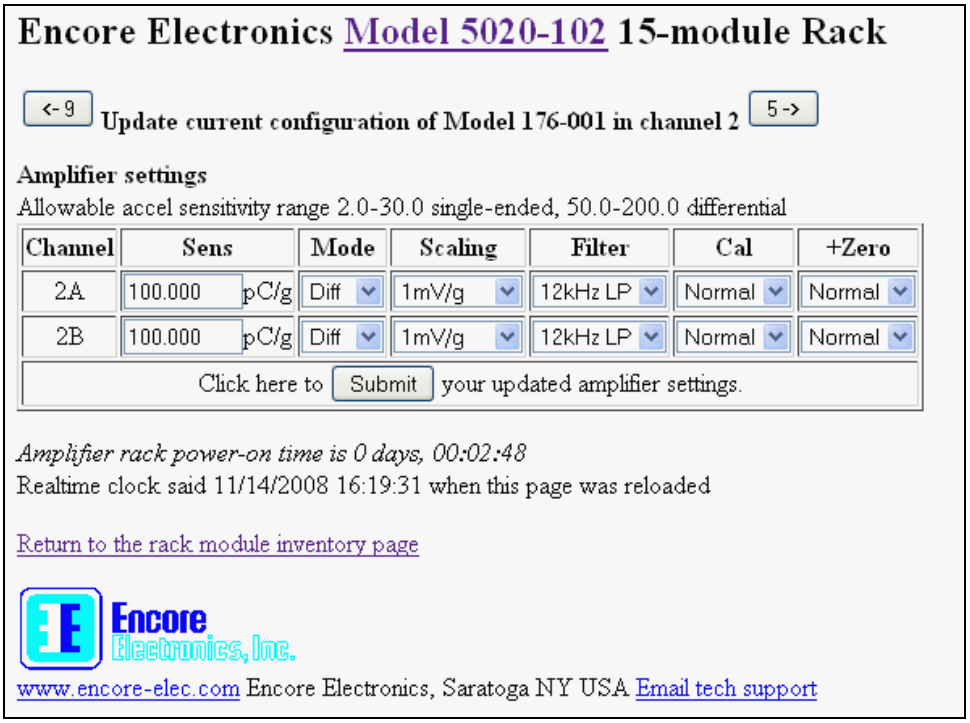
This page shows the present settings of the amplifier in the specified rack channel. The type of amplifier is shown at the top of the page. None of these numbers can be changed here – that's done on the control page.

The contents of the status page will be different from one amplifier type to another. The Model 176 has fully variable gain, where the Model 664 has fixed gains only. A charge amplifier might show gain in units of pC/g, while a strain amplifier would have bridge completion and excitation settings.

Model 176 control webpage



Encore Electronics Model 5020-102 15-module Rack

<- 9 Update current configuration of Model 176-001 in channel 2 5 ->

Amplifier settings

Allowable accel sensitivity range 2.0-30.0 single-ended, 50.0-200.0 differential

Channel	Sens	Mode	Scaling	Filter	Cal	+Zero
2A	100.000 pC/g	Diff	1mV/g	12kHz LP	Normal	Normal
2B	100.000 pC/g	Diff	1mV/g	12kHz LP	Normal	Normal

Click here to Submit your updated amplifier settings.

Amplifier rack power-on time is 0 days, 00:02:48

Realtime clock said 11/14/2008 16:19:31 when this page was reloaded

Return to the rack module inventory page

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This page shows the current settings of the two channels in the selected slot, and allows all parameters to be changed. After making all changes, click on the Submit button. If the accelerometer sensitivity is outside the allowable range of 2.0 to 200.0, the page returns with the erroneous field highlighted in red, for corrections. No updates to amplifier settings will be made until all errors are corrected.

To return to the main rack inventory list, click on the link at the bottom of the page, or the rack model number at the top of the page. There are also buttons to step to adjacent slots. Empty rack slots are skipped – in this example, three modules are installed in slots 2, 5, and 9. These links will wrap around the ends of the rack, from 15⇨1 and 1⇨15. Links are also provided for Encore's main website, as well as an email link for technical support.

Model 179 amplifier specifications

Charge input channel (like the Model 176)

Accel Sensitivity	Any value from 2.0 to 200 pC/g
Output scaling	1mV/g, 10mV/g, 20mV/g, 100mV/g
Gain accuracy	±1%
Input mode	Differential or single-ended (-IN tied to common)
Maximum input	50,000pC peak per input (50,000pC differential) : 2,500pC peak with sensitivity set to 2.0 – 9.9pC/g 12,500pC peak with sensitivity set to 10 – 49.9pC/g 50,000pC peak with sensitivity set to 50 – 200pC/g
Calibration	Internal 1015pf ±1% capacitors convert ExtCal voltage signal to charge, which can be applied to the amplifier front end
Frequency response, with LP filter out	20kHz at 50,000pC peak input level, increasing to >35kHz at 25,000pC peak input level (or lower)
Zero mode	Relays replace charge converter output with short to common

Millivolt input channel, with optional 4mA excitation for transducer

Calibration	External ExtCal voltage signal can be applied to front end
Excitation	4mA constant current can be tied to +S, with –S tied to common
Gain	1 or 100

Features common to both output channels

Filter input signal	Select either charge input or millivolt input
Filter	8-pole Butterworth lowpass at 12kHz, plus OUT 6-pole Butterworth highpass at 5Hz, 15Hz, or 25Hz
Pre-integration Filter	3-pole Butterworth lowpass at 250Hz, 500Hz, or 1kHz
Integration Select	Accel, velocity, displacement, or unfiltered (5Hz-12kHz) accel
RMS/DC Select	Either AC signal or DC representation of RMS value
Limit Detect	Two front-panel LEDs indicate saturation at charge amp, before filters, and at integration stages
Offset	Less than 5mVDC at output
Noise	Less than 3mV RMS, filter in, input disconnected

Model 179 charge amplifier setup and operation

Connect your transducer to the proper input connector, referencing the chart on page 5. On the control webpage, for the charge input select the appropriate accelerometer charge sensitivity, differential or single-ended input, scale factor in mV/g. For the millivolt input channel, select if the 4mA excitation should be on or off. The third block on the webpage chooses either charge or voltage input source. All filtering and integration is done on this selected signal source.

There are two additional options – external calibration signal, and +IN zero. In single-ended mode, the –IN connection is tied to amplifier common, and all amplification is done on the +IN connection. In differential mode, the conditioner operates on both input connections, resulting in an output proportional to the difference between +IN and –IN. When in differential mode, the +IN may be tied to amplifier common to verify operation of the –IN half. If the +IN half is zeroed in single-ended mode, both inputs are tied to common, so amplifier output is only internal noise.

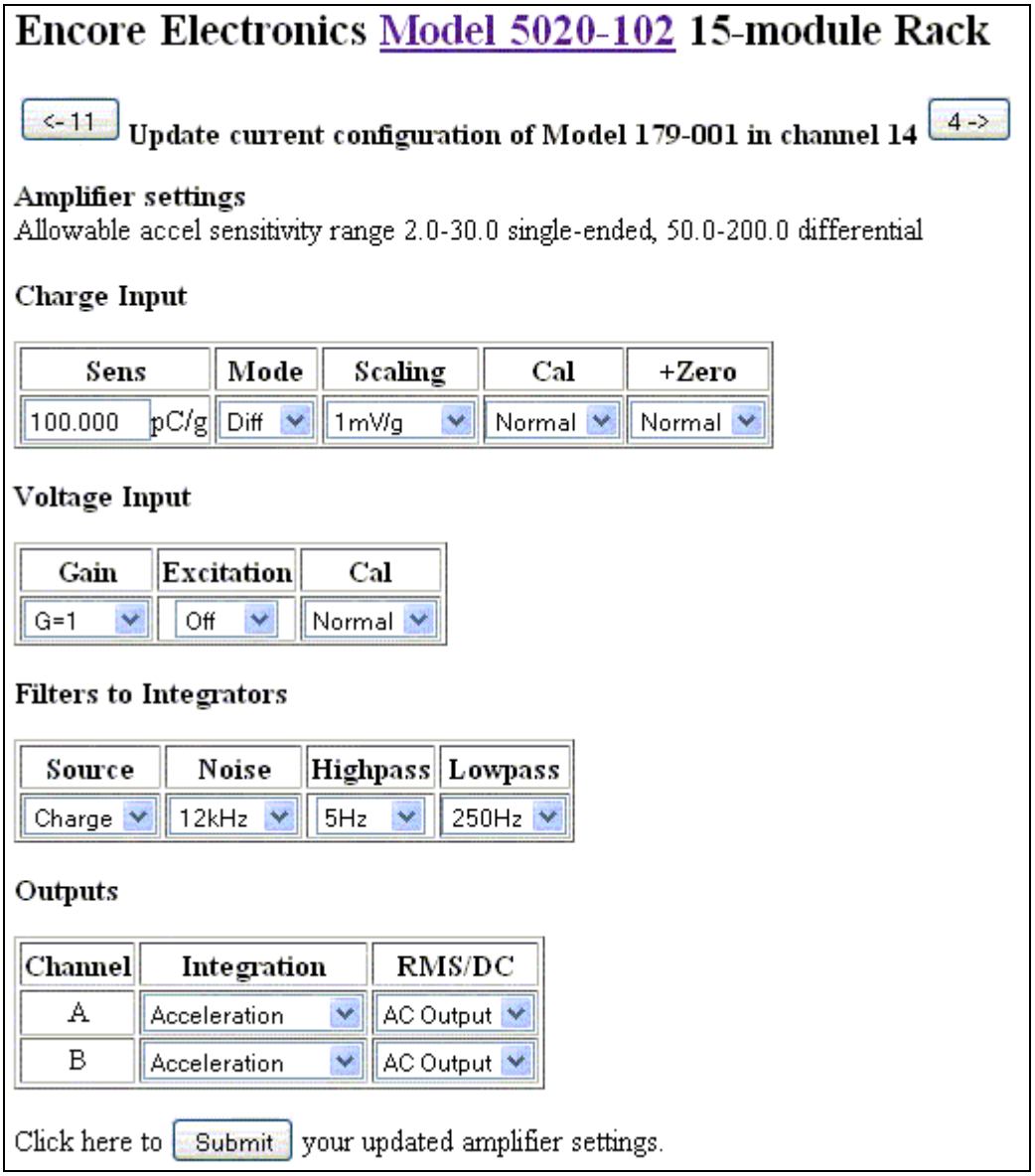
When the millivolt channel has 4mA excitation turned on for IEPE transducers, the –IN line is tied to amplifier common. With excitation turned off, +IN and –IN are a differential input amplifier, floating from ground and AC-coupled.

The external calibration signal comes into the rack as a voltage. Two precision 1015pf capacitors per channel convert this voltage to a charge signal for both +IN and –IN. In single-ended mode, the external cal signal is referenced to amplifier common and applied through one capacitor to the +IN half. With the conditioner set for single-ended mode, 100pC/g and 100mV/g, 1 VRMS applied to the ExtCal input will be amplified at a gain of 1.015, producing 1.015VRMS at the output.

In differential mode, with +IN zero at the normal setting, no output will result, as both +IN and –IN are seeing the same (common mode) signal, with no differential component. With +IN zero selected, the external cal signal is applied to the –IN half, resulting in an output inverted from the cal signal. Differential gain is ½ of single-ended gain, so this cal voltage will be 0.507VRMS.

The front panel LEDs will be green in normal operation, and change to red if an amplifier stage has reached the limit of ±10V peak. The upper LED indicates limiting of the charge input; the lower LED indicates integration stage limiting. At high gain (low accelerometer sensitivity) the front end will saturate before the amplifier output reaches its limit, so an LED may be red even with only 5VRMS at the output.

Model 179 control webpage



This page shows the current settings of the two channels in the selected slot, and allows all parameters to be changed. After making all changes, click on the Submit button. If the accelerometer sensitivity is outside the allowable range of 2.0 to 200.0, the page returns with the erroneous field highlighted in red, for corrections. No updates to amplifier settings will be made until all errors are corrected.

The Model 179 has two inputs and two outputs; however only one input can be selected for processing. This is done in the third box above, marked Filters to Integrators. Either the Charge input or Voltage input can be selected as Source. Any of the three integration stages can be routed to either output channel, in the last box.

Model 179 control webpage (cont'd)

The A and B output channels can independently select accel, velocity, or displacement signals after the 3-pole lowpass filter. Additionally, the full bandwidth 5Hz-12kHz "unfiltered" signal may be sent to either A or B output. It is not possible to route the unfiltered signal to both A and B at the same time, due to loading by the RMS/DC converters. If both are set to unfiltered, the B channel will revert to acceleration only.

To return to the main rack inventory list, click on the link at the bottom of the page, or the rack model number at the top of the page. There are also buttons to step to adjacent slots. Empty rack slots are skipped – in this example, three modules are installed in slots 4, 11, and 14. These links will wrap around the ends of the rack, from 15⇨1 and 1⇨15. Links are also provided for Encore's main website, as well as an email link for technical support.

Model 664 dual-channel dynamic strain amplifier specifications

Amplifier channels	Two independent AC-coupled channels
AC Gain settings	Fixed log steps 1,2,5,10,20,50,100,200,500,1000,2000,5000
Gain accuracy	±1%
Frequency Response	6-pole Butterworth lowpass, selectable at 5kHz, 20kHz, 40kHz or bypassed AC coupled at 5Hz highpass, single pole
Bridge mode	¼ bridge dynamic mode Selecting 0mA disconnects excitation, leaving AC-coupled differential amplifier
Excitation	Excitation sources isolated from amplifier output common 1k ohm in parallel with 1uF connecting each –S to common Programmable from 1.0-25.0 mADC in 0.1mA steps Up to 12.5VDC compliance voltage available
Fault indication	One green LED per channel turns red if amplifier exceeds ±10V
Offset	Less than 5mVDC at output
Noise	Less than 5uV RMS RTI, filter in, input disconnected, g=1000

Model 664 dual-channel dynamic strain amplifier setup and operation

Connect your transducers to the proper input connector pins. From the control webpage, select the appropriate excitation, gain, and filter. Programming excitation below 0.1mADC will disconnect the excitation source, allowing the amplifier to be used as a general-purpose AC-coupled differential amplifier.

There are two additional operating modes – external calibration signal, and zero mode. External cal will replace the bridge signal with an externally supplied voltage from the rack rear panel. Zero mode disconnects the input, allowing for measuring amplifier residual noise and DC offset.

Both channels are AC coupled, with a highpass filter blocking signals below 5Hz. Both channels have a gain range of 1-5000 in log steps (1/2/5 etc.) and lowpass noise filtering selectable at 5kHz, 20kHz, or 40kHz.

Each channel has its own isolated constant current excitation source, programmable from 1.0 to 25.0mADC. Over 12.5VDC of compliance voltage is available, allowing full current through more than 500 ohms. Current leaving the +S terminal is regulated, which provides limiting in the event of accidental gage shorting.

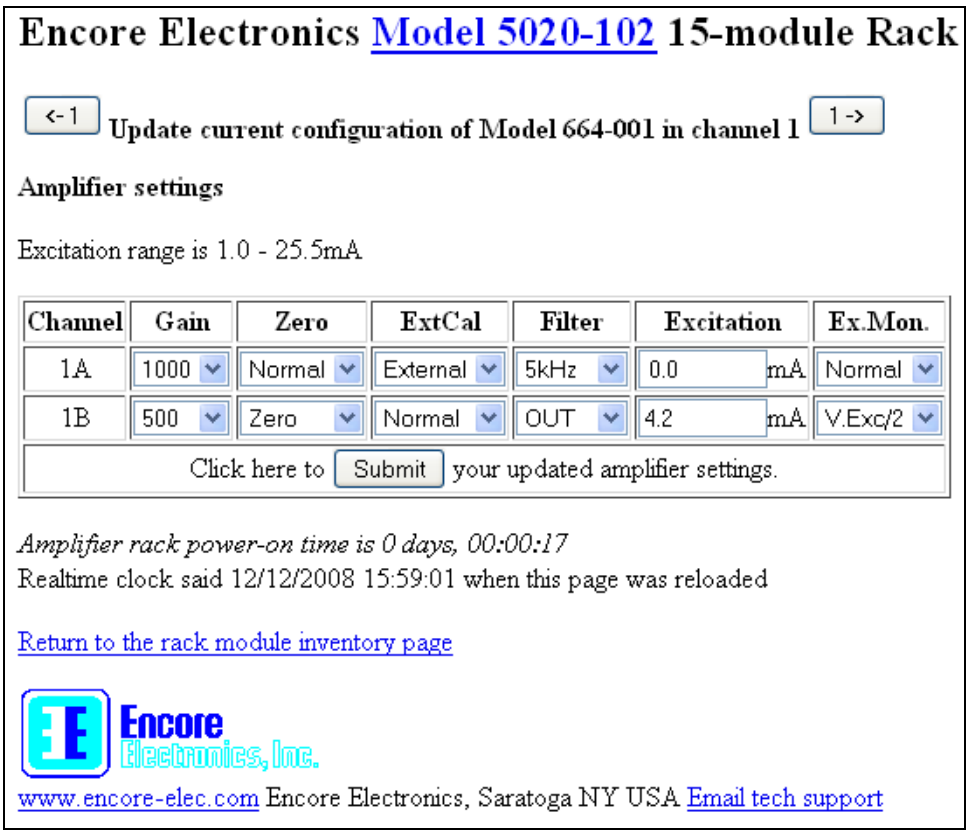
There is an internal 1k resistor connecting -S/-P to the amplifier output common. If the external strain gage has its +S terminal shorted to amplifier common, this 1k resistance will be placed in parallel across the gage. This will not affect the excitation current, but the current will now be shared between the 1k resistor and the external gage, causing a reduction in gage voltage and sensitivity.

If -S/-P is shorted to amplifier common, no additional gage loading will occur. Some configurations may have improvement in noise pickup from having –P tied to common. No damage will occur to the amplifier as a result of shorting either +S or –S to amplifier common.

To verify gage wiring, the amplifier may be connected in DC-coupled mode, with a gain of 1/2. This allows the full 12.5VDC compliance voltage to be measured by DAQ hardware with a ±10V range. This mode is selected on the control webpage under the Ex.Mon. heading. This monitoring circuit applies a load on the gage, causing a reduction in loop resistance and voltage (due to constant current). This parallel resistance is around 13k ohms. For a 120-ohm gage, this drop is about 1%. Overall loop resistance may be calculated by selecting 10mA excitation, reading the resulting DC voltage, and calculating the resistance as R=(2*V)/.01

The front panel LED for each channel will be green in normal operation, and change to red if an amplifier stage has reached the limit of ±10V peak. With a low frequency filter and high frequency signal, the gain stages may limit on signal peaks, which are later removed by the filter. The overload LED detects this condition as well.

Model 664 control webpage



Encore Electronics Model 5020-102 15-module Rack

<-1 Update current configuration of Model 664-001 in channel 1 1->

Amplifier settings

Excitation range is 1.0 - 25.5mA

Channel	Gain	Zero	ExtCal	Filter	Excitation	Ex.Mon.
1A	1000	Normal	External	5kHz	0.0 mA	Normal
1B	500	Zero	Normal	OUT	4.2 mA	V.Exc/2

Click here to Submit your updated amplifier settings.

Amplifier rack power-on time is 0 days, 00:00:17
Realtime clock said 12/12/2008 15:59:01 when this page was reloaded

Return to the rack module inventory page

Encore Electronics, Inc.
www.encore-elec.com Encore Electronics, Saratoga NY USA Email tech support

This page shows the current settings of the module in the selected slot, and allows all parameters to be changed. After making changes, click on the Submit button.

If the excitation is out of the allowable ranges, the page returns with the erroneous field highlighted in red, for corrections. No updates to amplifier settings will be made until all errors are corrected.

To return to the main rack inventory list, click on the link at the bottom of the page, or the rack model number at the top of the page. There are also buttons to step to adjacent slots. In this example, only one board is installed in the rack, so these buttons return you to slot 1.

Model 665 combination strain amplifier specifications

Amplifier channels	Channel A is AC or DC coupled with variable gain and filter Channel B is DC coupled with two gains and fixed filter
AC Gain settings	Fixed log steps 1,2,5,10,20,50,100,200,500,1000,2000,5000
DC Gain settings	1 or 100
Gain accuracy	±1%
AC/DC coupling	Selectable on channel A only
DC offset	Rack control performs auto-zero at each gain or filter change Programmable offset from -100mVDC to +100mVDC Offset affects channel A if DC coupled, else channel B
Frequency Response	AC channel: 6-pole Butterworth lowpass Selectable at 5kHz, 20kHz, 40kHz or bypassed AC coupled at 5Hz highpass, single pole DC channel: 4-pole Butterworth lowpass at 11Hz
Bridge mode	¼ bridge, ¼ bridge 3-wire, ½ bridge, or full bridge with 120Ω and 350Ω internal completion resistors EMF mode disconnects completion, balance, and excitation
Excitation	Excitation source isolated from amplifier output common Constant voltage, programmable from 1.0-15.0 VDC Up to 100mA available Short-circuit current limited to under 40mA
Bridge balance	Autobalance cycle initiated from control webpage Dual 12-bit DACs apply balancing current to +S leg of bridge Balances on channel A if DC coupled, else channel B
Shunt calibration	One of four precision cal resistors applied from –P to –S 11.88k, 19.88k, 49.00k, 99.00k
Fault indication	One green LED per channel turns red if amplifier exceeds ±10V Both LEDs turn red if bridge autobalance cannot be completed
Offset	Less than 3mVDC at output
Noise	Less than 5uV RMS RTI, filter in, input disconnected, g=1000

Model 665 combination strain amplifier setup and operation

Connect your transducer to the proper input connector. Because the 665 connects to a four-wire bridge, two pairs of pins are used for one transducer, unlike the dual-channel signal conditioners. From the control webpage, select the appropriate bridge mode (¼ , ¼ 3-wire, ½, full, or no bridge), excitation, gain, and filter. Programming excitation below 1.0VDC will disconnect the excitation source and short +P to –P.

There are two additional operating modes – external calibration signal, and zero mode. External cal will replace the bridge signal with an externally supplied voltage from the rack rear panel. Zero mode disconnects the input, allowing for measuring amplifier residual noise and DC offset.

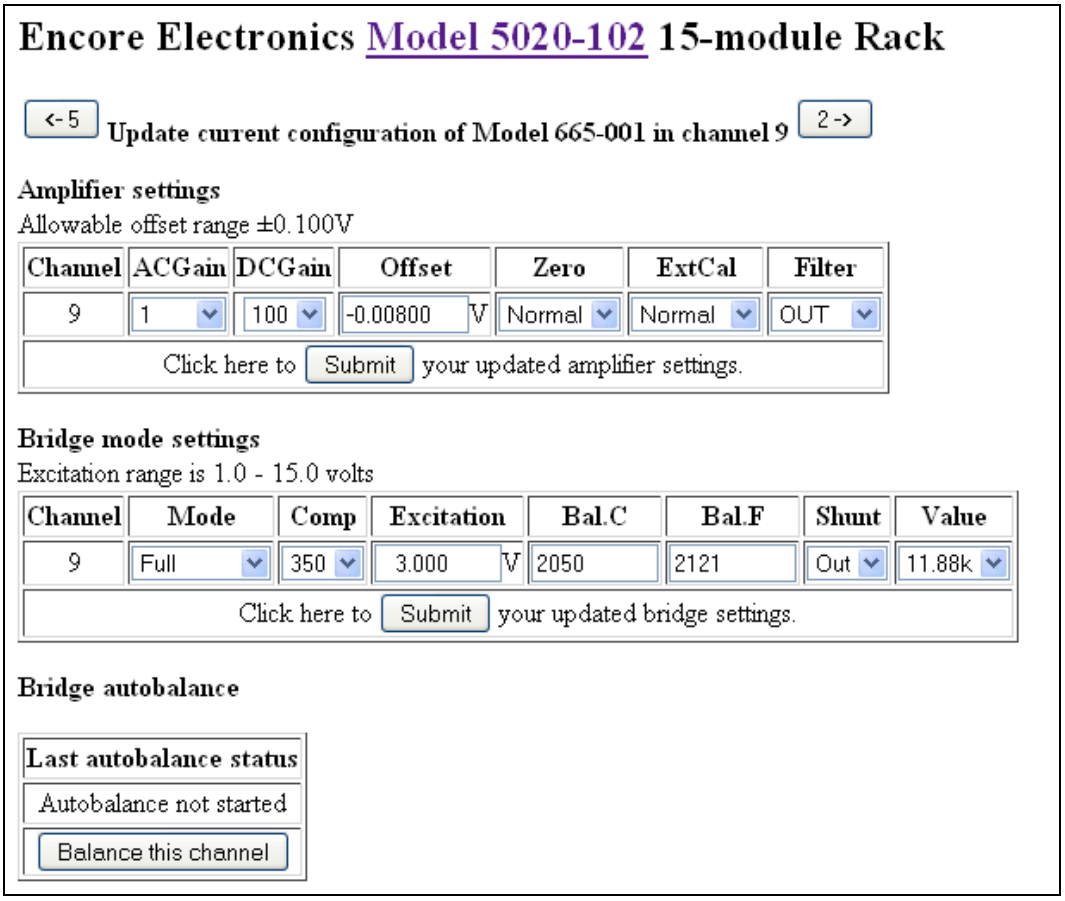
There are two voltage outputs from the bridge transducer. Channel A is an AC output, with a highpass filter blocking signals below 5Hz. Channel B is a DC output, with a lowpass filter blocking signals above 11Hz. The DC channel has two gain settings, 1 or 100. The AC channel has a gain range of 1-5000 in log steps (1/2/5 etc.). The AC channel also has selectable lowpass noise filtering.

Channel A can have its AC coupling bypassed, to operate in DC-coupled mode. When this is selected, the programmable output offset (and amplifier autozero and bridge autobalance) will operate on channel A, rather than Channel B (the fixed DC channel). Channel B's DC offset is unspecified when channel A is DC coupled.

The front panel LED for each channel will be green in normal operation, and change to red if an amplifier stage has reached the limit of ±10V peak. With a low frequency filter and high frequency signal, the gain stages may limit on signal peaks, which are later removed by the filter. The overload LED detects this condition.

When a bridge autobalance is requested, both channel LEDs will turn red if the bridge is unbalanceable. This may be caused by mismatch between selected bridge completion resistance and actual transducer resistance, or bridge mode mismatch (¼ , ½, or full). The autobalance will refuse to start if the amplifier is in external cal or zero mode, or if the excitation is turned off, or if the EMF bridge mode is selected. If a shunt cal is engaged, it will be turned off before the bridge balance is started. After autobalancing, the Coarse and Fine balance values will be displayed. When Channel A is AC coupled, the autobalance uses the DC-coupled Channel B. If Channel A is DC coupled, the autobalance uses it instead.

Model 665 control webpage



This page shows the current settings of the module in the selected slot, and allows all parameters to be changed. After making all changes, click on the Submit button. Note that there are three sections, each with its own Submit button. Each section must be updated separately to operate the amplifier. The line of status text above the "Balance this channel" button will be updated with an error message if the bridge can't be balanced, or the post-balance bridge voltage upon success.

If the excitation or offset are out of the allowable ranges, the page returns with the erroneous field highlighted in red, for corrections. No updates to amplifier settings will be made until all errors are corrected.

To return to the main rack inventory list, click on the link at the bottom of the page, or the rack model number at the top of the page. There are also buttons to step to adjacent slots. Empty rack slots are skipped – in this example, three modules are installed in slots 2, 5, and 9. These links will wrap around the ends of the rack, from 15⇨1 and 1⇨15.