

Model 5130 Party-Line Interface Module

User Guide

Issue 5, July 2013

This User Guide is applicable for serial numbers
M5130-00301 and later

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Introduction

The Model 5130 Party-Line Interface Module is a compact, self-contained unit for use in custom broadcast, live-performance, and general party-line intercom applications. The module provides a high-quality 2-channel party-line to analog line level (“4-wire”) audio signal interface in an easy to use yet technically sophisticated package. The module’s basic functions include two channels of 2-wire-to-4-wire conversion with auto-null capability, input and output level metering, a +28 volt DC party-line power source with two channels of 200 ohm intercom audio termination, and DC output control and status monitoring. Party-line beltpack user devices can be directly connected. Two analog inputs and two analog outputs interface the Model 5130 with a variety of external audio transport, matrix intercom, and infrastructure equipment. Module operation requires only an externally-provided source of 12 volts DC. Advanced features include remote control and monitoring capability when installed with remote access modules available from Studio Technologies.

Applications for the Model 5130 include sports broadcasting booth packages, remote news gathering “fly packs,” stadium

audio/video interface (I/O) locations, and government/corporate/performance space/aerospace test infrastructure projects. The number of Model 5130 modules used in a project can vary widely—from one to dozens. And in each case the performance will be completely “pro” with audio quality, reliability, and installation flexibility matching that of larger-scale products. Typical applications will find the Model 5130’s 4-wire audio inputs and outputs being interfaced with fiber-optic transport modules, matrix intercom systems, and audio/video routers.

The Model 5130 provides a full-featured 2-channel interface which includes two 2-wire-to-4-wire hybrid circuits with automatic nulling capability. The analog hybrid circuitry provides excellent audio quality and high return-loss. Audio level meters provide confirmation of system performance during setup and operation. The Model 5130’s party-line interface is accessible using a 3-pin male XLR connector. This allows industry-standard party-line intercom user beltpacks to be directly interfaced. With a maximum output current of 180 milliamperes, up to three of the popular RTS® BP325 devices can be directly connected. Devices from Clear-Com® are also compatible.

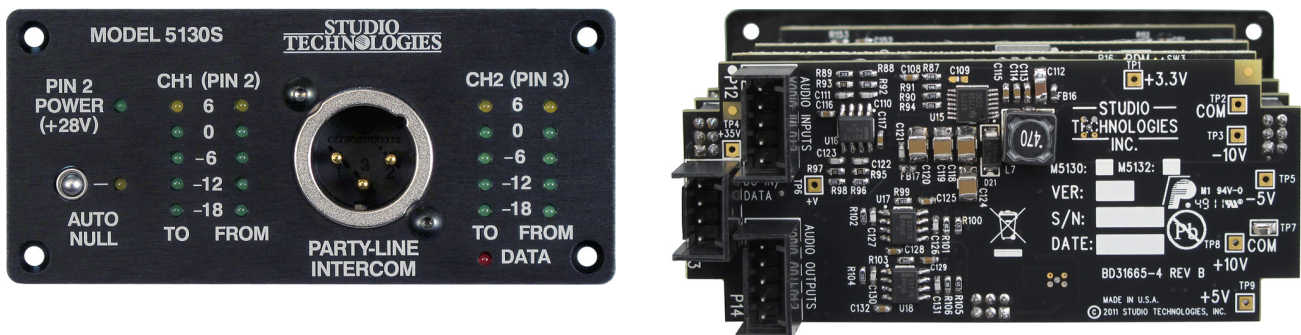


Figure 1. Model 5130S Party-Line Interface Module Front and Back Views

The 4-wire audio inputs and outputs were carefully designed for use in permanent as well as field applications. Filtering on the inputs minimizes the chance that radio frequency (RF) energy will interfere with the audio input sources. Other components were included to address ESD (“static”) and DC over-voltage conditions. In addition, the DC power input is protected from accidental polarity reversal.

For operation, the Model 5130 only requires connection of analog audio inputs and outputs, along with an external source of nominal 12 volts DC. The acceptable input voltage range is 10 to 18, allowing a variety of power sources to be utilized. Power supply circuitry within the Model 5130 creates the voltages required for the analog and digital circuitry.

Standard connectors are used throughout the Model 5130. The party-line intercom interface is accessed using a 3-pin male XLR connector. The 4-wire audio input and output connections are made using 5-position, 0.1-inch “header” connectors. The DC power input and data bus connections use a 4-position, 0.1-inch header. Low-cost IDC (insulation displacement) mating connectors allow simple interconnection with the audio input, audio output, DC input, and RS-485 data signals.

For compliance with international broadcast audio level standards two versions of the Model 5130 are available. The Model 5130S supports SMPTE® audio levels where the analog audio reference level is +4 dBu. The Model 5130E supports applications that require European Broadcast Union (EBU) compliance with an analog audio reference level of 0 dBu.

Model 5130 Party-Line Interface Modules do not include a mounting enclosure or chassis. They are intended for mounting in custom 19-inch rack panels, equipment boxes, broadcast furniture, “NEMA” I/O boxes, or other specialized enclosures. It is expected that integration firms will create applications that use Model 5130 modules as part of complete broadcast, production, corporate, and government solutions. Sophisticated users will be able to create “one-off” solutions to solve unique challenges.

Party-Line Power Source

The party-line intercom power supply circuitry provides a low-noise, current-limited source with a nominal 28 volt DC output. Termination networks provide the required 200 ohm impedance for the audio signals associated with the two party-line intercom channels. With these features the Model 5130’s party-line intercom interface is essentially identical to that created by stand-alone intercom power supplies or powered master stations.

Logic circuitry contained within the Model 5130 monitors the voltage on pin 2 for a low-voltage/over-current condition. If detected, the DC output will automatically enter a protection mode. Once the fault condition is removed normal operation will again resume. The pin 2 status LED offers the user a simple “go/no go” indication for rapid troubleshooting.

Analog Hybrids with Auto Nulling

The 2-wire-to-4-wire hybrids provide low noise, low distortion, good frequency response, and high return-loss (“nulling”), even when presented with a wide range

of party-line conditions. Unlike telephone-line (“POTS”) oriented DSP-based hybrid circuits, the Model 5130’s analog circuitry maintains extended frequency response. With this wide audio bandwidth, natural-sounding voice signals can be sent to, and received from, the connected party-line user devices. This bandwidth also allows high-frequency “call light” and “mic kill” signals to pass through to connected 4-wire equipment.

The Model 5130’s sophisticated auto nulling function uses analog circuitry under microprocessor control to achieve significant trans-hybrid loss. This return-loss “null” is achieved by making a series of software-directed adjustments to account for the resistive, inductive, and capacitive conditions that are present on the connected party-line user devices and associated cabling. Whenever a user presses the Model 5130’s auto null button digital circuitry adjusts the 2-wire-to-4-wire hybrids to achieve their maximum return-loss for both interface channels. The nulling process is automatic, lasting less than 15 seconds, and only takes place upon user request. The resulting null parameters are stored in non-volatile memory.

Audio Inputs and Outputs

Two analog line-level inputs and two outputs are associated with the 4-wire portion of the Model 5130’s circuitry. These are intended to interconnect with a variety of devices, including matrix intercom systems, audio-over-fiber transport systems, and specialized audio equipment. The audio input and output circuitry is electronically balanced and capacitor coupled to minimize the chance that hum, noise, or interfacing issues will occur. The two

Model 5130 versions allow compatibility with equipment that supports SMPTE (+4 dBu) and EBU (0 dBu) analog audio level standards.

Indicators

The Model 5130 contains four 5-segment LED level meters. Two meters display the level of the signals being received from the party-line channels and two display the level being sent to the party-line channels. At the time of installation and setup the meters are invaluable in helping to confirm correct operation. During normal operation the meters offer rapid confirmation of the audio signals flowing into and out of the module. Three additional LED indicators are also provided, offering status indications of the party-line DC power supply, auto null, and remote control data functions.

Pro Audio Quality

The Model 5130’s audio circuitry was designed in the spirit of professional audio equipment rather than that found in typical party-line intercom gear. High-performance components are used throughout, providing low-distortion, low-noise, and high headroom. The party-line DC power source offers a unique level of performance—its ability to deliver power while maintaining audio quality is simply unmatched.

Installation

Integration of the Model 5130 into the selected application is quite simple, only requiring connecting analog audio inputs and outputs along with DC power. Some applications will also require connection to the RS-485 data bus. The audio signals

have a nominal level of either +4 or 0 dBu, depending on the Model 5130 version being installed. The DC power source is nominal 12 volts with an acceptable range of 10 to 18 volts. The RS-485 data bus is a single pair of wires that would interconnect the Model 5130, along with other Model 5100-Series modules, to a remote access card. After the connections have been completed, the module can then be secured into the designated mounting location.

Audio Inputs

The Model 5130 allows two channels of analog line-level audio to be connected. Each signal is associated with one of the two party-line interface channels. The input circuitry is electronically balanced and capacitor coupled. The nominal input level of Model 5130S (SMPTE) version modules is +4 dBu with a maximum allowable input level of +24 dBu. The nominal input level of Model 5130E (EBU) version modules is 0 dBu with a maximum allowable level of +18 dBu.

Connections to the audio inputs are made using a 5-position header connector located on the Model 5130's rear-most circuit board. For details on appropriate mating connectors refer to Appendix B located at the end of this document.

For connecting to balanced sources the signal + (high), signal – (low), and common/shield connections should be used. With unbalanced sources connect source signal high to the Model 5130's signal + (high) and source signal low to both the signal – (low) and common/shield connections. Refer to Figure 2 for details.

Pin Number	Function
1	Common/Shield
2	+ CH1
3	– CH1
4	+ CH2
5	– CH2

Figure 2. Audio Inputs

Audio Outputs

Associated with each of the Model 5130's two party-line interface channels is a balanced (differential), line-level analog audio output. The circuitry is electronically balanced and capacitor coupled. The nominal output level of a Model 5130S (SMPTE) version module is +4 dBu with a maximum output level of +24 dBu. The nominal level of a Model 5130E (EBU) version module is 0 dBu with a maximum level of +18 dBu.

Connections to the audio outputs are made using a 5-position header connector located on the Model 5130's rear-most circuit board. For details on appropriate mating connectors refer to Appendix B located at the end of this document.

For connection to balanced inputs on related equipment the signal + (high) and signal – (low) connections should be used. Pin 1, common/shield, may or may not need to be connected as dictated by the specific installation. Refer to Figure 3 for details.

When interfacing the outputs to unbalanced inputs on associated equipment connect only to the Model 5130's signal + (high) and common/shield. Do not make any connections to the Model 5130's – (low) terminals.

Pin Number	Function
1	Common/Shield
2	+ CH1
3	– CH1
4	+ CH2
5	– CH2

Figure 3. Audio Outputs

DC Input and Data

A 4-position header, located adjacent to the audio input and output headers, is used to connect DC power and RS-485 data to the Model 5130. For details on appropriate mating connectors refer to Appendix B located at the end of this document.

A source of nominal 12 volts DC, with an acceptable range of 10 to 18, is required for Model 5130 operation. The maximum current is 800 milliamperes at 12 volts DC.

For remote control operation an RS-485 data bus connection from a compatible Studio Technologies' remote access module is required. Most applications will only have the DC power connections implemented so these two pins will typically remain unconnected. Refer to Figure 4 for details.

Pin Number	Function
1	– DC (Common)
2	+ DC (10-18 volts)
3	+ Data (RS-485)
4	– Data (RS-485)

Figure 4. DC Input/Data

Mounting

The Model 5130 is intended for mounting into an installation-specific enclosure or rack panel. Refer to Appendix A for the unit's dimensions and mounting screw locations. Please contact the factory to discuss mounting options.

Configuration

RS-485 Address ID

One configuration setting must be performed for applications that implement remote control of Model 5130 functions. Up to sixteen Model 5100-Series modules can "share" an RS-485 data bus but each must have a unique address ID. Selecting the device's address ID involves setting four DIP switches. Refer to Figure 5 for details.

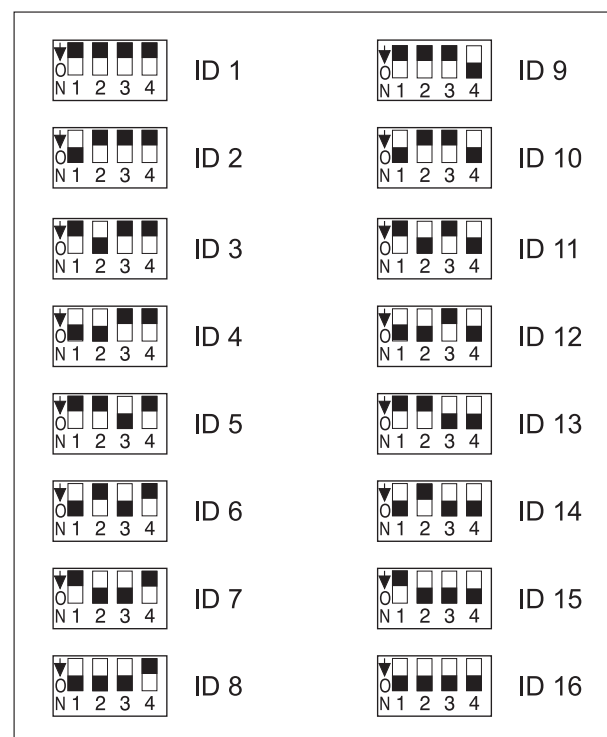


Figure 5. RS-485 Address ID Settings

Operation

The Model 5130 is designed for continuous operation with no internal adjustment, calibration, or maintenance required.

The auto null function is used whenever significant changes are made to the number of user devices or the interface cabling connected to the party-line interface. It also should be used if the characteristics of a connected party-line intercom system change. Activating the auto null function is simple, only requiring the pressing of the auto null pushbutton switch.

Maintaining the correct levels coming from the 4-wire audio sources is very important. This will ensure proper signal levels are presented to party-line users and maintain optimal audio fidelity. The audio level meters and pin 2 power LED will assist users in confirming that correct operation is taking place. In addition, the under-voltage shutdown function will help to protect the party-line intercom power supply should a fault condition be detected.

Auto Null

The Model 5130 contains circuitry to automatically null the two 2-wire-to-4-wire interfaces. Normally this process is performed at the time of initial Model 5130 user set up and operation, but there's no reason why "auto nulling" can't be initiated anytime one desires. The only time that auto null must be performed is if conditions have changed vis-à-vis the party-line intercom user devices and wiring connected to a Model 5130's party-line intercom interface connector. Even a slight change to a party-line intercom circuit, such as adding or removing a section of cable, is sufficient to require that the auto null process be performed.

A pushbutton switch, located on the Model 5130's front panel, is used to activate the auto null process. To initiate auto null requires simply pressing and releasing ("tapping") the button. An LED provides a visual indication of the auto null process, flashing when the auto null process is active. The sequence takes less than 15 seconds to complete.

An auto null sequence begins with the muting of the 4-wire audio input and output signal paths. This is followed by a short period of 24 kHz signal that is sent out both the party-line intercom interface channels. This will turn off microphones on those connected user devices that are compatible with the RTS TW-series "mic kill" protocol. The actual auto nulling process is performed next. A series of tones will be sent out the party-line interface channels. Other Model 5130 circuitry, under software control, will rapidly perform adjustments to achieve the best null possible. After the null adjustments have been made the results are stored in non-volatile memory. Once the process is complete the audio input and output paths are again activated.

If possible, prior to performing an auto null it's polite to warn all personnel who are actively using the connected party-line intercom devices. The tones sent to the party-line intercom channels during the nulling process are not excessively loud or obnoxious, but most users might want to remove their headsets during the process. In addition to warning users, it might be a good time to ask them to mute any active microphones. While the automatic "mic kill" signal will apply to many user devices it may not apply to all. Muting microphones is significant as obtaining a "deep" null requires that no extraneous signals be present on the party-line circuit.

Auto Null and Operating Mode

There is one situation where pressing the auto null button will not start the auto null process. If the Model 5130 has been configured for operating mode 1, a minimal amount of DC current must be drawn from the party-line interface to indicate that a 2-wire party-line device has been connected. If this threshold (15 milliamperes) has not been reached the circuitry, under firmware control, assumes that nothing has been connected to the XLR connector associated with the party-line interface and the auto null process will not start. (Technically, if nothing has been connected to the party-line interface, performing an auto null sequence would result in an inappropriate 2-wire-to-4-wire converter calibration.) If the auto null button is pressed and the minimum DC current level has not been reached the auto null LED will flash six times and then stop. This indicates that the button press was recognized but that the minimum DC current draw requirement was not met.

If the Model 5130 has been configured for operating mode 2 the auto null function is always available. A minimum amount of DC current is not required to be drawn from the 2-wire party-line interface. This operating mode was provided for applications where the 2-wire party-line interface is interconnected to a valid device (or devices) but DC current is not being drawn. An example of this would be connecting Studio Technologies' Model 200-Series announcer's or producer's consoles which are being locally powered. (Model 200-Series devices can be powered by the Model 5130 but in most cases an external source of 24 volts DC will be connected.) In this case each Model 200-Series device would be a completely "valid" connection to the Model 5130 although no DC current would be drawn by it.

To view and, if desired, change the operating mode refer to the Technical Notes section of this guide.

Level Meters

The four audio level meters on the Model 5130 are calibrated differently from typical "VU" meter scales. Their "steps" are labeled in reference to the level of the signals being sent to, and received from, the party-line interface. The ballistics of the meters is also different, being a cross between VU and peak.

During operation the green "0" LEDs will light in response to audio levels of -10 dBu being present on the party-line channels. When a 5130S (SMPTE level) module has its "0" LEDs lighting they correspond to $+4$ dBu being present on its associated 4-wire audio input or output connections. In the case of a 5130E (EBU level) module the audio input and output level would be 0 dBu.

The four green LEDs of each meter indicate that the levels are in the normal range. The yellow LED lights when a signal is approximately 6 or more dB above the nominal (-10 dBu to or from the party-line channel) level. Optimal signals will result in the four green LEDs lighting almost solidly with the yellow LED lighting only on peak signals.

Party-Line Power Supply

One or more party-line user devices can be directly connected and powered by the Model 5130's party-line interface. The only restriction on the number of user devices that can be connected is that the total current draw must be equal to or less than 180 milliamperes. Broadcast-standard

devices such as the RTS BP325 are directly compatible and will provide excellent performance. Up to three of these units can typically be supported.

For reference, this paragraph provides details on the signals that are present on the party-line intercom interface's 3-pin male XLR connector. Pin 1 provides common for power and audio; pin 2 has 28 volts DC with channel 1 audio; pin 3 has channel 2 audio. The nominal audio output level on the two channels is -10 dBu, no matter if the module is a 5130S or a 5130E. The maximum current draw from pin 2 to pin 1 is 180 milliamperes. The circuitry associated with pin 3 is protected from damage should pin 2 (nominal 28 volts DC) become accidentally connected to it.

DC Voltage Monitoring

The pin 2 power LED can be a highly useful "tool" for understanding the status of the party-line intercom connection. It does this by providing an indication of the DC voltage that is present on pin 2 (with respect to pin 1) of the Model 5130's party-line interface connector. The Model 5130's microcontroller integrated circuit, under software control, "watches" to ensure that the DC voltage present on pin 2 of the party-line intercom interface is at an acceptable level. The under-voltage threshold for pin 2 is 24 volts. This is four volts less than the normal level of 28 volts DC. The LED will "flash" at a moderate cadence if the voltage on the interface falls below the acceptable 24 volt value. This can be caused by a temporary over-current or short-circuit condition, such as when interconnecting user devices to the party-line intercom interface using portable cabling.

Fault Condition

If the Model 5130 is in an under-voltage condition that's present for a continuous 1-second period it will cause a fault condition to be recognized. The pin 2 power LED will indicate this condition by changing from being continuously lit to flashing. In addition, the output voltage on the party-line power supply circuit will automatically shut down to an essentially off condition. A 5-second "cool-down" period will then take place, after which the output voltage will again become active. As soon as the output is enabled normal output voltage monitoring will again take place. A continuous short circuit presented to the party-line intercom output will result in a continuous 4-seconds-on, 5-seconds-off error cycle. It's important to note that during the 5-second-off period no voltage monitoring takes place. Removing the fault condition will not result in the output voltage immediately turning on again; the 5-second shut-down period must first elapse.

Technical Notes

Maintaining Correct Input Signal Levels

The Model 5130's 4-wire audio inputs and outputs are designed for compatibility with either SMPTE (5130S) or EBU (5130E) audio level standards. Applying signals to these audio inputs at a significantly lower level than the intended nominal will reduce the signal-to-noise ratio (raising the perceived noise floor) and can prevent the connected user devices from operating optimally. Applying signal levels significantly higher than nominal will reduce the headroom and greatly increase the chance of

reaching audio “clipping.” Obviously, these cautions are not unique to the Model 5130, but apply to most audio equipment. The front-panel level meters provide an easy means of confirming that a Model 5130 is being presented with the correct audio levels.

For the Model 5130S the nominal 4-wire input and output signal levels are +4 dBu. For the Model 5130E the nominal levels are 0 dBu. For both versions the nominal output level to the two channels associated with the party-line interface is –10 dBu. (Of course pin 2 on the party-line interface connector has both DC and audio present on it.)

To confirm correct party-line intercom operation at locations away from where the Model 5130 is installed, it’s possible to use the Model 72 Level Meter/Interface, also available from Studio Technologies. The Model 72 is a compact, portable device that plugs directly into a party-line intercom or IFB circuit and provides two useful functions. Two 5-segment LED meters display the audio levels present on pins 2 and 3. And two “dry” line-level audio outputs are provided, one for each channel. Complete information on the Model 72 is available on the Studio Technologies website.

Party-Line Interface Current Draw

The Model 5130’s party-line output is designed to provide up to 180 milliamperes of DC current. By design, the power supply circuit is protected so that an overload condition, or even a complete short circuit, should not cause damage. Exceeding 180 milliamperes for more than one second will cause the auto shut-down mode to become active. A continuous overload condition will cause the output voltage to cycle through a

4-seconds-on, 5-seconds-off sequence. Restoring the output load to be within the rated 180 milliamperes will allow the party-line output to again operate normally. In extreme cases, such as where the Model 5130 is located in an environment with elevated temperatures, a few minutes may be required from the time an overload condition is removed to when normal operation will again take place. Please don’t test the Model 5130’s ability to sustain frequent overload or short-circuit conditions! The long-term reliability of the unit can be impacted by the stresses caused by these fault conditions.

The pin 2 power LED makes it simple to know if an excessive load, or a short circuit, is being placed on the party-line output. Technically the LED, under software control, provides a direct indication of the party-line’s DC output voltage. And the output voltage is directly related to the amount of current being drawn.

The LED lights steadily when the party-line DC output voltage is within its normal range. During normal operation the DC level on pin 2 of the party-line XLR output connector will be approximately 28 volts. The LED will begin to flash on and off if the level falls below approximately 24 volts DC for at least one second. This will typically occur because the current draw is greater than nominally 180 milliamperes.

There’s really only one piece of advice when it comes to understanding how to use the pin 2 power LED: if it flashes there’s a problem that must be corrected! The most likely cause will be too many user devices being connected to the party-line output connector. It’s also possible that a wiring problem could cause a partial or full short circuit between the output XLR’s

pin 1 (common) and pin 2 (power with channel one audio) pins. Troubleshooting should prove quick and easy. Begin by disconnecting the party-line user devices. Observe the pin 2 power LED and see if the problem has gone away. If not, review the interconnecting cables and find the fault condition. Within five seconds of the problem being “cleared” the pin 2 LED will stop flashing.

Cable Length

There are no “hard and fast” rules defining the maximum cable length possible when connecting user devices to the Model 5130’s party-line intercom output. The maximum cable length is directly related to the amount of resistance in the connecting cable; the lower the resistance per foot (or meter), the longer the cable can be. Although cable capacitance affects high-frequency performance, resistance is the limiting factor in most cases. For example, a contemporary microphone cable is Belden 1172A which has 18 ohms resistance per conductor per 1000 feet. Since we’re using two conductors to carry the signal (pins 1 and 2) you’d get 36 ohms per 1000 feet of cable. By knowing the cable resistance value, along with the minimum voltage and maximum load current required by a party-line intercom user device, a simple “ohms law” calculation will tell you the maximum cable length.

Let’s use the example of an RTS BP325 beltpack being connected to the Model 5130’s party-line XLR connector. We’ll select Belden 1172A as the interconnecting cable. For correct operation, a BP325 needs at least 18 volts DC between pins 1 and 2 of its interface connector. And the BP325 has a rated maximum current draw of approximately 60 milliamperes. The Model

5130 presents a party-line voltage of 28 volts across pins 1 and 2 and can supply a maximum current of 180 milliamperes. (As the BP325’s current draw is well within the Model 5130’s capability, this is not a limiting factor.) The difference between the voltage supplied by the Model 5130 (28 volts) and the voltage required by the BP325 (18 volts) allows a 10 volt maximum drop over the interconnecting cable. Using the current draw and maximum voltage drop figures, the maximum cable resistance can easily be calculated: 10 volts divided by 0.060 amperes equals 167 ohms. And finally, with 1172A’s 36 ohms (total) per 1000 feet of cable, a maximum of approximately 4600 feet (1424 meters) of cable can be used and still be less than or equal to 167 ohms. Using this example as a guide, entering the appropriate values will allow you to determine the maximum cable length for your application.

Cabling Issues – Crosstalk

The Model 5130’s party-line interface conforms to the broadcast-industry standard for sending DC power and two channels of audio over a single pair with shielded audio cable. This implementation allows standard portable cables, such as those used for microphone signals, to interconnect various party-line user devices. This method is undoubtedly convenient and practical, but is not without limitations. The main audio quality issue is the possibility of crosstalk between the two audio channels. This issue arises due to the capacitance presented by the two wires that form the twisted pair. The greater the capacitance presented and the longer the cable run, the greater the crosstalk. Is this normally a problem during actual use? No. But it’s something that should be noted.

Software Version Display

After the Model 5130's power-up sequence has completed, some of the unit's LEDs are used to automatically display the software version number. This is useful when working with factory personnel on application support and troubleshooting situations. The five LEDs associated with the channel 1 FROM audio level meter are used to display the major release number with a range of 1 through 5. The five LEDs associated with the channel 2 FROM audio level meter are used to display the release sub-number which ranges from 0 to 5. (No lit channel 2 LEDs indicates sub-number 0.) The software version number will display for approximately one second after the power-up sequence has completed but before normal operation begins. Refer to Figure 6 for a detailed view of the LEDs and the corresponding software version numbering scheme.

Note that while it's easy to determine which software version is loaded into the Model 5130 a trip back to the factory is required to update it. The 8-bit microcontroller that provides the unit's logic "horsepower" also includes internal FLASH memory. This non-volatile memory is used to store the operating software ("firmware"). Re-programming this memory requires using a specialized programming unit. While not outrageous in price, it still costs in the range of US\$500. The programmer uses a ribbon cable and socket to interface with a 6-pin "header" on one of the Model 5130's printed circuit boards. And, as you would guess, once connected, reprogramming takes only a matter of seconds. But unfortunately the programmer is not something that would be found in a typical "field shop" or repair facility.

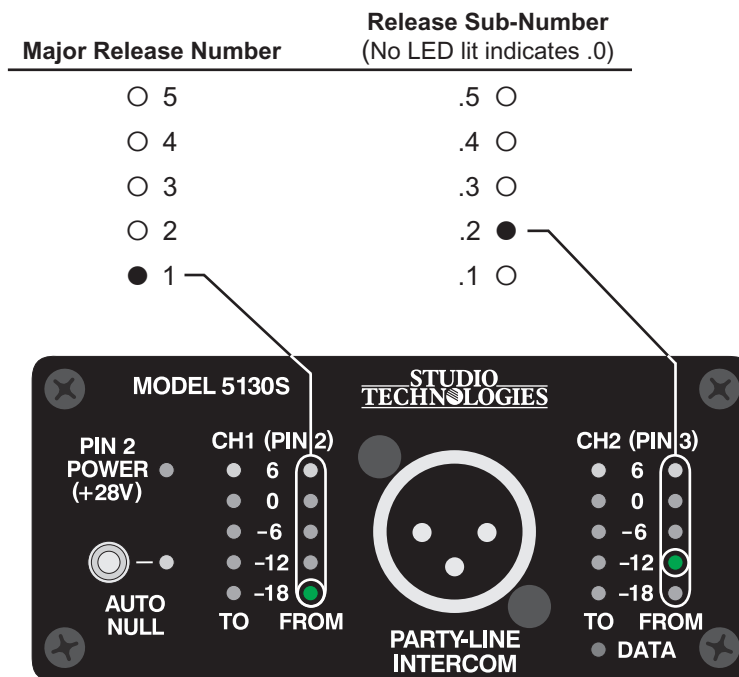


Figure 6. Detail of front panel showing the level meter LEDs that display the software version. In this example, the software version is 1.2.

Operating Modes

To allow optimal performance in a variety of applications the Model 5130 can function in either of two operating modes.

The difference between the two modes is somewhat subtle, relating to how the 4-wire audio output muting function responds to the party-line interface's DC output current detection function.

When the Model 5130 has been configured for operating mode 1 the two 4-wire audio outputs will remain muted unless a DC current of 15 milliamperes or greater is actively being supplied by the 2-wire party-line interface. This 15 milliamperes threshold was selected as being representative of what the smallest amount of DC current a typical party-line device would require. Requiring that a party-line device be connected (as evidenced by DC current being drawn) will minimize the chance that undesirable audio signals will be sent to the connected 4-wire equipment. These undesirable signals would typically consist of a portion of the 4-wire audio input being "bounced" back through the Model 5130's unterminated 2-wire to 4-wire hybrid circuit. This condition is especially undesirable for optimal audio performance with 4-wire intercom systems.

It might be helpful to clarify why operating mode 1 can be valuable. When the DC current drawn from the party-line interface is less than 15 milliamperes the module determines that no party-line device, such as a user beltpack, has been connected. When no user device is connected it's probable that the Model 5130's two 2-wire to 4-wire hybrid circuits are not fully nulled. If the circuits are not fully nulled then the return loss value will be low and a large percentage of the signal present on the

4-wire audio input will be "returned." The automatic muting of the 4-wire audio outputs will prevent this signal from being sent to connected devices.

When the Model 5130 has been selected for operating mode 2 the two 4-wire audio outputs are always active. In operating mode 2 there is no requirement that a minimum amount of DC current be drawn from the 2-wire party-line interface. This mode is provided for atypical but legitimate applications where devices connected to the Model 5130's 2-wire party-line interface do not draw DC current. (Or draw an amount that's less than the 15 milliamperes threshold.) Such devices might be powered locally but are still intended to be connected to party-line interface circuits that have a -10 dBu (nominal) audio operating level and a 200 ohm (nominal) terminating impedance on each channel. An example of this would be connecting one of the Studio Technologies' Model 200-Series of announcer's or producer's consoles which is being locally powered. (The Model 200-Series device can be powered by the Model 5130 but in most cases an external source of 24 volts DC will be connected.) In this case the Model 200-Series device would be a completely "valid" connection to the Model 5130 but no DC current would be drawn by it. Only by selecting operating mode 2 would it function correctly with the Model 5130.

Viewing and Changing the Operating Mode

A Model 5130's operating mode can be viewed and, if desired, changed by way of a power-up/button-press sequence. With the Model 5130 in the un-powered state (no source of 12 volt DC applied), press and hold the auto null button. Then

apply power while continuing to press the button. The module will go through its normal power-up sequence and upon completion light one of two LEDs. If the Model 5130 is configured for operating mode 1 the CH1 TO -18 LED will light. If the module is configured for operating mode 2 the CH1 TO -12 LED will light. Refer to Figure 7 for details. From the factory the Model 5130 is typically configured for operating mode 1.

If the button is released within a few seconds of the LED displaying the operating mode no change will be made and the Model 5130 will begin normal operation. However, if after the operating mode is displayed, the auto null button remains

pressed for approximately five additional seconds the mode will automatically change (“toggle”). For example, if the “-18” LED indicates that operating mode 1 is the current configuration, continuing to hold the auto null button will cause the configuration to change to operating mode 2. It should be very clear that a change has occurred as the LED will change from “-18” to “-12.” After the change has occurred, releasing the button will cause the revised configuration to be saved and the Model 5130 will begin operation under the revised mode. When described in words this procedure seems fairly technical. But a couple of practice sessions will show how simple it actually is.

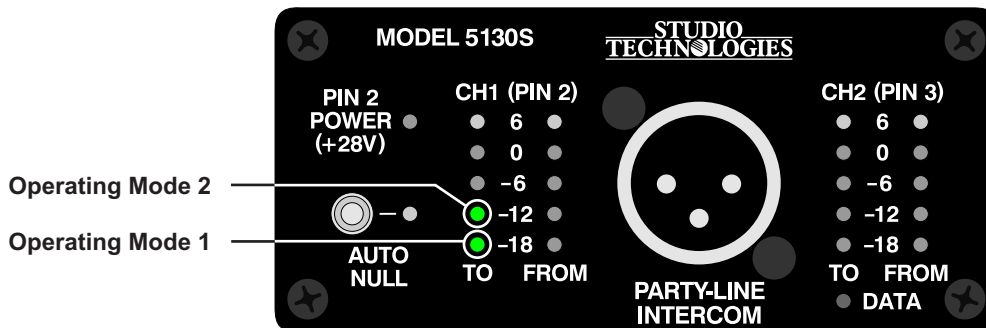


Figure 7. Detail of front panel showing operating modes 1 and 2.

Specifications

General Audio:

Frequency Response (analog input to party-line interface):

- 3.0 dB @ 80 Hz
- 2.5 dB @ 100 Hz
- 2.3 dB @ 20 kHz
- 3.0 dB @ 24 kHz

Distortion (THD+N, measured at 1 kHz, analog input to party-line interface):

- Party-Line Interface Pin 2: 0.06%
- Party-Line Interface Pin 3: 0.02%

Signal-to-Noise Ratio (measured at 1 kHz, analog input to party-line interface):

- Party-Line Interface Pin 2: 60 dB
- Party-Line Interface Pin 3: 86 dB

Audio Inputs: 2

Type: analog, electronically balanced, capacitor-coupled, 20 k ohms

Nominal Level: +4 dBu (Model 5130S), 0 dBu (Model 5130E)

Maximum Level: +24 dBu

Audio Outputs: 2

Type: analog, electronically balanced, capacitor-coupled, intended to drive balanced loads of 2 k ohms or greater

Nominal Level: +4 dBu (Model 5130S), 0 dBu (Model 5130E)

Maximum Level: +24 dBu into 10 k ohms

Source Impedance: 200 ohms, nominal, differential

Party-Line Intercom Interface:

Type: 2-channel party-line, unbalanced (common on pin 1, DC modulated with channel 1 audio on pin 2, channel 2 audio on pin 3)

Compatibility: single- and dual-channel intercom system such as from RTS® and Clear-Com®

Nominal Audio Level: -10 dBu

Maximum Audio Output Level:

- Pin 2:** +9 dBu with +23 dBu (Model 5130S) on audio input
- Pin 3:** +10 dBu with +24 dBu (Model 5130S) on audio input

DC Output Voltage (pin 2 to pin 1): 28 volts nominal

DC Output Current (pin 2 to pin 1): 180 milliamperes maximum; requires ≥ 15 mA current draw for detection of connected device

Impedance (pin 2 to pin 1; pin 3 to pin 1): 200 ohms, nominal

Hybrids: 2

Topology: 3-section analog circuitry compensates for resistive, inductive, and capacitive 2-wire party-line loads

Nulling Method: automatic upon user initiation, processor implements digital control of analog circuitry; settings stored in non-volatile memory

Nulling Line Impedance Range: 120 to 240 ohms

Nulling Cable Length Range: 0 to 3500 feet

Trans-Hybrid Loss: >45 dB, typical at 1 kHz

Meters: 4, 5-segment LED, modified VU ballistics

Remote Control Capability: audio level monitoring, pin 2 DC output status, auto null activation

Connectors:

Party-Line Intercom: 3-pin male XLR

Audio Inputs and Outputs: 2, 5-position male header. Refer to Appendix B for mating connector details.

DC Input/Data: 4-position male header. Refer to Appendix B for mating connector details.

Power Requirement: 12 volts DC nominal, 800 mA max; acceptable range 10-18 volts DC, 950 mA max at 10 volts

Dimensions (Overall):

- 3.75 inches wide (9.5 cm)
- 1.69 inches high (4.3 cm)
- 2.30 inches deep (5.8 cm)

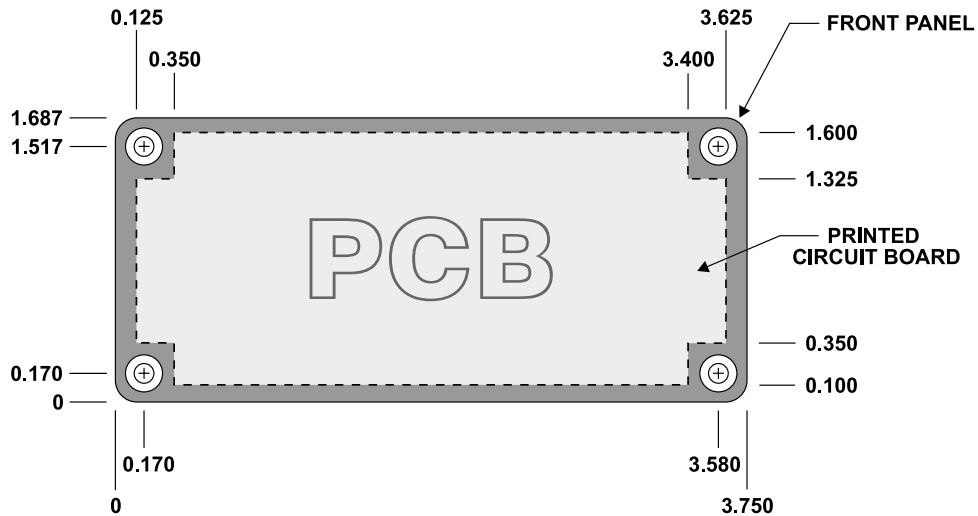
Mounting: requires custom implementation; no mounting method provided. Refer to Appendix A for details.

Weight: 0.2 pounds (91 g)

Specifications and information contained in this User Guide subject to change without notice.

Appendix A—Model 5130 Front Panel and Printed Circuit Board (PCB) Dimensions

STUDIO TECHNOLOGIES, INC.
MODEL 5100-SERIES SINGLE-WIDTH FRONT PANEL
AND PRINTED CIRCUIT BOARD DIMENSIONS
(DIMENSIONS SHOWN IN INCHES)
(AS OF SEPTEMBER 2013, APPLIES TO
MODELS 5110, 5120, 5121, 5130, 5132, 5134, 5150, 5152, 5154, 5180, AND 5190)



NOTES:

- 1) OPENING MUST BE MADE IN CUSTOM-MOUNTING ARRANGEMENT SO THAT PCB IS ALLOWED TO FREELY PASS THROUGH.
- 2) FRONT-PANEL MOUNTING LOCATIONS DIMENSIONED FOR #4 COUNTERSUNK SCREWS (4 PLACES). UNDERCUT FLAT-HEAD MACHINE SCREWS RECOMMENDED.
- 3) RECOMMENDED MOUNTING-HOLE LOCATIONS SHOULD BE DRILLED AND TAPPED FOR 4-40 SCREW THREADS (4 PLACES).

WARNING:
THIS DRAWING SHOWS THE DIMENSIONS OF THE PRINTED CIRCUIT BOARD.
PANEL OPENING MUST BE MADE LARGER TO ALLOW PCB TO PASS THROUGH!
CONTACT FACTORY IF YOU HAVE QUESTIONS.

Appendix B—Interconnection Details

The required mating receptacles are from the TE Connectivity (formerly AMP) MTA-100 series of IDC (insulation displacement) connectors. This series was selected because of its low-cost and wide range of offerings. Separate connectors are offered for compatibility with 22, 24, 26, and 28 AWG (American Wire Gauge) insulated wire. The connector color indicates its AWG-compatibility. Unfortunately, with flexibility can come some confusion. The MTA-100 offers a number of different connectors that will work with the Model 5130's audio input, audio output, and DC input/data headers. Before obtaining receptacles it's important to determine two things: wire gauge and wiring arrangement.

Audio Inputs and Outputs

- For 22 AWG wire this receptacle (red in color) is recommended:
TE Connectivity (AMP) 3-643813-5
Digi-Key part number A31109-ND (www.digikey.com)
Mouser part number 571-3-643813-5 (www.mouser.com)
- For 24 AWG wire this receptacle (white in color) is recommended:
TE Connectivity (AMP) 3-643814-5
Digi-Key part number A31020-N
Mouser part number 571-3-643814-5

DC Input/Data

- For 22 AWG wire this receptacle (red in color) is recommended:
TE Connectivity (AMP) 3-644540-4
Digi-Key part number A31122-ND
Mouser part number 571-3-644540-4

Tools for Connecting Wires to the Mating Receptacles

For applications where just a few Model 5100-Series modules are going to be installed a manual IDC termination tool is recommended. While requiring a steady hand to achieve reliable wire connections to the mating receptacles, the price, at less than US\$40, is fairly reasonable:

- “T Handle” termination hand tool:
TE Connectivity (AMP) 59803-1
Digi-Key part number A9982-ND
Mouser part number 571-598031

Appendix B—Interconnection Details, continued

Tools for Connecting Wires to the Mating Receptacles, continued

For applications where a larger number of Model 5100-Series modules are going to be installed it's worth considering a semi-automatic termination tool. The recommended tool consists of a handle assembly and crimp die for MTA-100 receptacles. The total price for both, approximately US\$300 as of this writing, is steep but the performance that this tool assembly provides is excellent. We feel that the time savings and reliability of the connections warrants the price when many terminations are going to be made:

- Handle Tool, Pistol Grip:
 - TE Connectivity (AMP) 58074-1
 - Digi-Key part number A2031-ND*
 - Mouser part number 571-580741*
- Crimp Head Die Assembly for MTA-100 Receptacles:
 - TE Connectivity (AMP) 58246-1
 - Digi-Key part number A1998-ND*
 - Mouser part number 571-58246-1*

Headers on the Printed Circuit Board

The actual part numbers of the header connectors that are soldered into the Model 5130's printed circuit board are provided in this section. But do not order these part numbers with the intent of interconnecting signals with the Model 5130! We are providing these details only so that interested technical personnel can have the full background on the Model 5130's interconnect system. The appropriate mating receptacles are detailed in a previous section of this Appendix.

- Audio Inputs and Outputs:
 - TE Connectivity (AMP) 2-644486-5 (**DO NOT ORDER THIS NUMBER!**)
- DC Input/Data:
 - TE Connectivity (AMP) 2-644486-4 (**DO NOT ORDER THIS NUMBER!**)