

Model 5132 Party-Line Interface Module

User Guide

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This User Guide is applicable for serial numbers
M5132-00301 and later with firmware 4.2 and higher

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Introduction

The Model 5132 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. With the internal party-line power source enabled, beltpack user devices can be directly connected. Alternatively, the Model 5132 can be connected into an existing party-line circuit that includes a power source and intercom audio terminations. Two analog inputs and two analog outputs interface the Model 5132 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 a Studio Technologies’ Model 5190 Remote Access Module.

Applications for the Model 5132 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 5132 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 5132’s line-level audio inputs and outputs being interfaced with fiber-optical transport modules, matrix intercom systems, and audio/video routers. The flexibility of the Model 5132’s party-line intercom interface allows direct connection to either intercom beltpack devices or an existing party-line intercom circuit.

The Model 5132 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 5132’s party-line interface is accessible using a 3-pin male XLR connector. This allows industry-standard party-line

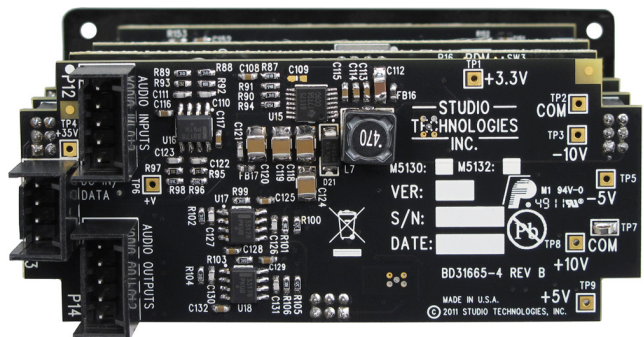
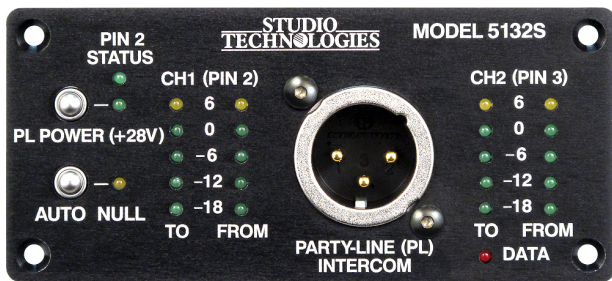


Figure 1. Model 5132S Party-Line Interface Module Front and Back Views

intercom user beltpacks to be directly interfaced. With a maximum output current of 180 milliamperes (mA), up to three of the popular RTS® BP325 devices can be directly connected. Devices from Clear-Com® are also compatible.

The Model 5132 is directly compatible with applications that must interface with existing party-line intercom circuits. The internal power source and 200 ohm terminations can be disabled by way of a pushbutton switch on the Model 5132's front panel.

The line-level audio inputs and outputs were carefully designed for use in permanent as well as field applications. Filtering on the inputs and outputs minimizes the chance that radio frequency (RF) energy will interfere with the audio signals. Other components were included to address ESD ("static") and DC over-voltage conditions. The party-line power source is monitored for protection against damage due to fault conditions. In addition, the module's DC power input is protected from accidental polarity reversal.

For operation, the Model 5132 only requires connection of an analog audio input, an analog audio output, and 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 5132 creates the voltages required for the analog and digital circuitry.

Standard connectors are used throughout the Model 5132. Users will access the party-line intercom interface using a 3-pin male XLR connector. The line-level audio input and output connections are made using 5-position "header" connectors. The DC power input and data bus connections use a 4-position header. Low-cost IDC (insulation

displacement connector) mating sockets allow simple interconnection between the headers and 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 5132 are available. The Model 5132S supports SMPTE® audio levels where the analog audio reference level is +4 dBu. The Model 5132E supports applications that require European Broadcast Union (EBU) compliance with an analog audio reference level of 0 dBu.

Model 5132 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 5132 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 Interface

The Model 5132's party-line interface is very flexible, offering excellent performance when operating both "stand alone" or interconnected with an existing intercom circuit. When enabled, the internal 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 5132's party-line intercom interface is essentially identical to that created by stand-alone intercom power supplies or powered master stations.

Two LEDs, located on the Model 5132's front panel, provide an indication of the power source's on/off state and the state of the DC voltage present on pin 2 of the party-line intercom XLR connector. Logic circuitry contained within the Model 5132 monitors the voltage on pin 2. When the Model 5132 is providing intercom power this function will monitor 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. When an external source of intercom power is present 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 5132'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 equipment.

The Model 5132'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, as well as, if present, a connected external intercom circuit. Whenever a user presses the Model 5132's Auto Null push-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 outputs are associated with the "4-wire" audio portion of the Model 5132'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 5132 versions allow compatibility with equipment that supports SMPTE (+4 dBu) and EBU (0 dBu) analog audio level standards.

Indicators

The Model 5132 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. Four additional LED indicators are

also provided offering status indications of the internal party-line power supply, pin 2 status, auto null, and remote control data functions.

Pro Audio Quality

The Model 5132's audio circuitry was designed in the spirit of professional audio equipment rather than that found in typical party-line intercom devices. High-performance components are used throughout, providing low-distortion, low-noise, and high headroom. The internal party-line 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 5132 into the selected application is quite simple, only requiring connection to the analog audio inputs, analog audio outputs, and DC power input. Some applications will also require connection to the RS-485 interface. The audio signals will have a nominal level of either +4 or 0 dBu, depending on the Model 5132 version being installed.

The DC power source should be nominal 12 volts with an acceptable range of 10 to 18 volts. The RS-485 data bus is a single pair of wires that interconnect the Model 5132, along with other Model 5100-Series modules, to a Model 5190 Remote Access Module. After the connections have been completed, the module can then be secured into the designated mounting location.

Audio Inputs

The Model 5132 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 5132S (SMPTE) version modules is +4 dBu with a maximum allowable input level of +24 dBu. The nominal input level of Model 5132E (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 5132's rear-most circuit board. For details on appropriate mating connectors refer to Appendix A 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 5132'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	+ } Channel 1
3	
4	+ } Channel 2
5	

Figure 2. Audio Inputs

Audio Outputs

Associated with each of the Model 5132'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 5132S (SMPTE) version module is +4 dBu with a maximum output level of +24 dBu. The nominal level of a Model 5132E (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 5132's rear-most circuit board. For details on appropriate mating connectors refer to Appendix A 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 5132's signal + (high) and common/shield. Do not make any connections to the Model 5132's – (low) terminals.

Pin Number	Function
1	Common/Shield
2	+ } Channel 1
3	
4	+ } Channel 2
5	

Figure 3. Audio Outputs

DC Input and Data Bus

A 4-position header, located adjacent to the audio input and output headers, is used to connect DC power and the RS-485 data bus to the Model 5132. For details on appropriate mating connectors refer to Appendix A 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 5132 operation. The maximum current is 800 mA at 12 volts DC.

For remote control operation an RS-485 data bus connection from a Studio Technologies' Model 5190 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 and Data Bus Connections

Mounting

The Model 5132 is intended for mounting into an installation-specific enclosure or rack panel. Refer to Appendix B for the unit's dimensions and mounting screw locations. Please contact the factory to discuss mounting options.

Configuration

RS-485 Address

One configuration setting must be performed for applications that implement remote control of Model 5132 functions. While up to 16 Model 5100-Series modules can “share” the RS-485 data bus, each module must have a unique address. Selecting the device’s address involves setting four configuration switches. Refer to Figure 5 for details.

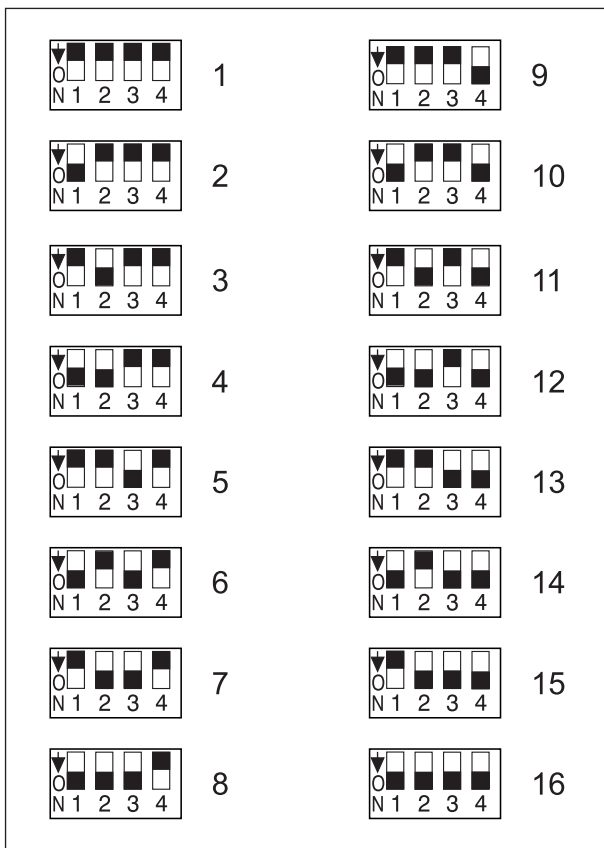


Figure 5. RS-485 Address Settings

Operation

The Model 5132 is designed for continuous operation with no internal adjustment, calibration, or maintenance required. Two

pushbutton switches allow the user to select the on/off status of the internal party-line power source as well as activating the auto null function. Depending on how the Model 5132 is to be used the internal party-line power source can be enabled or disabled. It would be enabled whenever user beltpacks are going to be the only devices connected directly to the Model 5132. The internal power source should be turned off whenever the Model 5132 is going to be connected to an existing party-line intercom circuit that includes power and audio terminations.

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 should also be used if the characteristics of a connected party-line intercom circuit 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 line-level audio sources is very important. This will ensure that proper signal levels are presented to party-line users and that optimal audio fidelity is maintained. The audio level meters, PL Power (+28V) LED, and Pin 2 Status LED will assist users in confirming that correct operation is taking place. In addition, the under-voltage shut-down function will help to protect the internal party-line power supply should a fault condition be detected.

Party-Line Power

A pushbutton switch and status LED are associated with the Model 5132’s internal party-line power source. A momentarily press of the PL Power (+28V) pushbutton will “toggle” (alternate) between the power

on and power off modes. When the LED located next to the pushbutton is lit 28 volts DC will be applied to pin 2 of the XLR connector. In addition, audio terminations (200 ohm AC loads) will be connected to the two intercom channels. (Technically, independent nominal 200 ohm AC-coupled loads are connected from pin 2 to pin 1 and from pin 3 to pin 1.) If user backpack devices are to be directly connected and powered by the Model 5132 the internal party-line power function must be enabled.

If the Model 5132's party-line intercom interface is to be connected to an existing party-line intercom circuit the Model 5132's party-line power source should be turned off. In this mode the LED labeled PL Power (+28V) will not be lit, +28 volt DC will not be applied to pin 2, and 200 ohm audio terminations will not be provided.

If the Model 5132's internal party-line power source is enabled when the interface is connected to an existing party-line intercom circuit no damage will result. But the audio levels will no longer be correct as the intercom channels will now be "double terminated." The Model 5132's 200 ohm terminations will be active at the same time as those of the external intercom circuit. The intercom "bus" termination will drop to approximately 100 ohms and the audio level will drop by at least 6 dB. This will cause audio level issues for users as well as preventing satisfactory Model 5132 auto nulling from being able to take place.

Auto Null

The Model 5132 contains circuitry to automatically null the two 2-wire-to-4-wire interfaces. Normally this process is performed at the time of initial Model 5132 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, the wiring connected to a Model 5132's party-line intercom interface connector, and, if present, an external party-line intercom circuit. Even a small change to a party-line intercom circuit, such as adding or removing a section of cable, can be sufficient to require that the auto null process be performed.

The Auto Null pushbutton switch, located on the Model 5132's front panel, is used to activate the auto null process. To initiate auto null requires simply pressing and releasing ("tapping") the button. An associated 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.

The auto null function can only be enabled if the party-line interface is fully active. This requires a party-line current draw of approximately 5 milliamperes or more if the Model 5132 is selected to provide party-line power. If the module is selected to interface with an external party-line circuit a voltage of greater than approximately 18 must be present on pin 2 of the interface connector. If either of these conditions is not met the auto null function cannot be enabled. This will be indicated by the Auto Null LED flashing rapidly for a few seconds.

An auto null sequence begins with the muting of the line-level 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 5132 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 important as obtaining a “deep” null requires that no extraneous audio signals be present on the party-line circuit.

Operating Mode

A configurable feature allows Model 5132 units to be selected from two operating modes. This is provided so that modules can be used in both standard and non-standard applications. By default Model 5132 units are configured for what is called operating mode 1. This is appropriate in most applications. But special situations can benefit from using operating mode 2. Refer to the Technical Notes section of this guide for details on how to determine the Model 5132’s selected operating mode and, if required, how to change it.

Operating mode 1 is appropriate for most applications and is considered the default. When a Model 5132 is selected for operating mode 1 full module operation requires that current must be drawn from the party-line interface (when the Model 5132 is providing party-line power) or a DC voltage must be present on pin 2 of the party-line interface (when the Model 5132 is not providing party-line power). The Pin 2 Status LED on the front panel provides an indication that the module is ready for full operation. If neither of these conditions is met the two line-level audio outputs are muted, the auto null function can’t be enabled, and the Pin 2 Status LED is not lit. Muting the audio outputs ensures that unwanted audio is not sent to connected equipment. Preventing the auto null process from starting keeps an incorrect auto null from occurring. These operating requirements are desirable for most applications and will provide maximum performance.

But not all legitimate applications will meet these requirements and that’s why operating mode 2 is provided. There will be situations where DC current will not be drawn from the Model 5132’s party-line interface. In other cases no DC voltage will be provided to pin 2 of the party-line interface. With operating mode 2 the line-level audio outputs are always enabled and the auto null function can be used. No current draw or DC voltage on pin 2 is required for full module operation to take place.

A specific example where mode 2 would be appropriate is when an application requires connecting the Model 5132’s party-line interface to two separate audio channels associated with two Clear-Com® single-channel party-line intercom circuits. These audio channels would not draw current or

have DC voltage present on them so enabling the Model 5132's party-line interface would not be possible. Mode 2 would allow the audio interface channels to be fully functional; the two line-level outputs would be active and the audio null function can be enabled.

Another example of where mode 2 would be useful is when a Model 5132's party-line interface is connected to one or more Studio Technologies' Model 200-Series announcer's or producer's consoles and the consoles are being locally powered. (Model 200-Series devices can be powered by way of a party-line intercom circuit or by way of an external source of 24 volts DC; the latter is preferred.) In the case of a Model 200-Series device being locally powered it would be a completely "valid" connection to the Model 5132. Mode 2 would enable the line-level outputs and allow audio null activation even though no DC current is being drawn or DC voltage is being provided to the Model 5132's party-line interface.

Level Meters

The four audio level meters on the Model 5132 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 intercom channels. When a 5132S (SMPTE level) module has its 0 LEDs lighting they correspond to $+4$ dBu being present on its associated line-level audio input or output

connections. In the case of a 5132E (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.

Internal Party-Line Power Supply

If the Model 5132's internal party-line intercom power source is enabled one or more party-line user devices can be directly connected and powered by the 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 mA. 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. When the internal party-line power supply is active pin 1 provides common for power and audio; pin 2 has both 28 volts DC and channel 1 audio; pin 3 has channel 2 audio. The nominal audio output level on the two channels is -10 dBu, whether or not the module is a 5132S or a 5132E. The maximum current draw from pin 2 to pin 1 is 180 mA. The circuitry associated with pin 3 is protected from damage should it accidentally be interconnected to pin 2 (28 volts DC).

DC Voltage Monitoring

The Pin 2 Status 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 5132’s party-line interface connector. The Model 5132’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 for the selected operating state. When the Model 5132’s internal party-line power source is enabled 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 defective cables are used to interconnect user devices to the party-line intercom interface.

If the Model 5132 is selected for use with an external party-line circuit the Pin 2 Status LED will function in a slightly different way. It will light whenever the signal on pin 2 is greater than approximately 18 volts DC. The LED will not light if the voltage is less than 18 volts DC. The status LED functions will allow a user to quickly determine if an active party-line circuit has been connected.

Fault Condition

If the Model 5132 is providing party-line power and an under-voltage condition is present for a continuous 1-second period it will cause a fault condition to be recognized. The Pin 2 Status LED will indicate

this condition by changing from being continuously lit to flashing. In addition, the output voltage on the internal party-line power supply circuit will automatically shut down. 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 connector 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 5132’s line-level audio inputs and outputs are designed for compatibility with either SMPTE (5132S) or EBU (5132E) 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 5132, but apply to most audio equipment. The front-panel level meters provide an easy means of confirming that a Model 5132 is being presented with the correct audio levels.

For the Model 5132S the nominal line-level input and output signal levels are +4 dBu. For the Model 5132E 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.

To confirm correct party-line intercom operation at locations away from where the Model 5132 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. Two "dry" line-level audio outputs are also 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 5132's internal party-line power supply circuit is designed to provide up to 180 mA of DC current. By design, the internal power supply circuit is protected so that an overload condition, or even a complete short circuit, should not cause damage. Exceeding 180 mA for more than one second will cause the auto shut-down mode to become active. A continuous overload condition will cause the internal power supply to cycle through a 4-seconds-on, 5-seconds-off sequence. Restoring the output load to be within the rated 180 mA will allow the internal power supply output to again operate normally. In extreme cases, such as when the Model 5132 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 5132'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 Status LED makes it easy to know if an excessive load, or a short circuit, is being placed on the internal power supply output. Technically the LED, under software control, provides a direct indication of the party-line's DC voltage. And, when the internal party-line power supply is active, the output voltage is directly related to the amount of current being drawn.

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

There's really only one piece of advice when it comes to understanding how to use the Pin 2 Status LED when the internal power supply is enabled: 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 while leaving the cabling connected. Observe the Pin 2 Status LED and see if the

problem has gone away. If the problem is no longer present, check the user device(s) to see which is causing the fault. If the problem has not gone away, review the interconnecting cables and find the cause of the fault condition. Within five seconds of the problem being “cleared” the Pin 2 Status 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 5132’s party-line intercom output and using the Model 5132’s internal party-line intercom power source. 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 of 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 5132’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 mA. The Model 5132 presents a

party-line voltage of 28 volts across pins 1 and 2 and can supply a maximum current of 180 mA. (As the BP325’s current draw is well within the Model 5132’s capability, this is not a limiting factor.) The difference between the voltage supplied by the Model 5132 (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 5132’s party-line interface conforms to the broadcast-industry standard for sending DC power and two channels of audio over a single pair-with-shield audio cable. This implementation allows standard portable cables, such as those used with microphones, 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 5132'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 Ch1 (Pin 2) From audio level meter are used to display the major version number with a range of 1 through 5. The five LEDs associated with the Ch2 (Pin 3) From audio level meter are used to display the version 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 5132 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 5132'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.

Major Version Number	Version Sub-Number (No LED lit indicates .0)
○ 5	.5 ○
● 4	.4 ○
○ 3	.3 ○
○ 2	.2 ●
○ 1	.1 ○

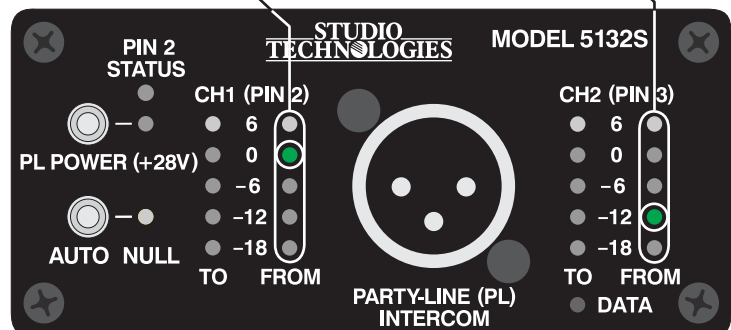


Figure 6. Detail of front panel showing the level meter LEDs that display the software version. In this example, the software version is 4.2.

Operating Modes

The Model 5132 allows its overall operating mode to be configured. This topic was discussed in the Operation section of this guide but additional information is provided in the following paragraphs.

To allow optimal performance in a variety of applications the Model 5132 can function in either of two operating modes. The difference between the two modes is somewhat subtle, mainly relating to how the line-level audio output muting function responds to the party-line interface's DC output current/DC voltage detection function. It also impacts operation of the auto null function and the Pin 2 Status LED.

When the Model 5132 has been configured for operating mode 1 the two line-level audio outputs will remain muted unless a DC current of 5 mA or greater is actively being supplied by the party-line interface (if the module is set to provide party-line power). 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 line-level audio equipment. These undesirable signals would typically consist of a portion of the audio input being "bounced" back through the Model 5132's unterminated 2-wire-to-4-wire hybrid circuit. This condition is especially undesirable for optimal audio performance with 4-wire matrix intercom systems.

A similar scenario will take place for operating mode 1 if the Model 5132 has been set to not supply party-line power. If 18 volts DC or greater is not present on pin 2 of the party-line interface the line-level audio outputs will remain muted. And in both cases if the line-level audio outputs are muted the

auto null function can't be enabled and the Pin 2 Status LED will not light.

When the Model 5132 has been selected for operating mode 2 the two line-level audio outputs are always active and the auto null function can always be enabled. In operating mode 2 there is no requirement that a minimum amount of DC current be drawn from the party-line interface or that a DC voltage be present on pin 2 of the party-line interface connector. This mode is provided for atypical, but legitimate, applications where devices connected to the Model 5132's party-line interface do not draw DC current or supply DC voltage.

Viewing and Changing the Operating Mode

A Model 5132's operating mode can be viewed and, if desired, changed by way of a power-up/button-press sequence. With the Model 5132 in the un-powered state (no source of 12 volt DC applied), press and hold the Auto Null pushbutton. Then apply power while continuing to press the Auto Null button. The module will go through its normal power-up sequence and upon completion light one of two meter LEDs. If the Model 5132 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 5132 is typically configured for operating mode 1.

If the Auto Null button is released within a few seconds of the meter LED displaying the operating mode no change will be made and the Model 5132 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 lit 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 5132 will begin operation under the selected mode. When described in words this procedure seems fairly technical. But a couple of practice sessions will show how simple it actually is.

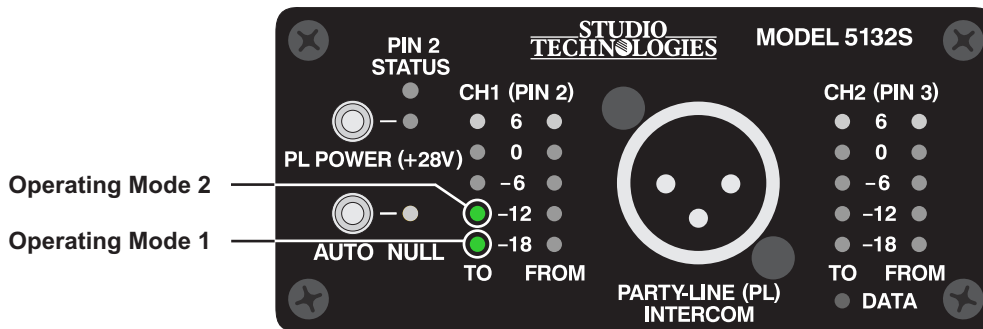


Figure 7. Detail of front panel showing operating modes

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 5132S), 0 dBu (Model 5132E)

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 5132S), 0 dBu (Model 5132E)

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 circuits and user devices from vendors such as RTS® and Clear-Com®

Nominal Audio Level: -10 dBu

Maximum Audio Output Level:

- Pin 2:** +9 dBu with +23 dBu (Model 5132S) on audio input
- Pin 3:** +10 dBu with +24 dBu (Model 5132S) on audio input

DC Output Voltage (pin 2 to pin 1), local party-line power enabled: 28 volts nominal, selectable on/off

DC Output Current (pin 2 to pin 1) local party-line power enabled: 180 mA maximum; requires ≥5 mA current draw for detection of connected device

Impedance (pin 2 to pin 1; pin 3 to pin 1), local party-line power enabled: 200 ohms, nominal

Impedance (pin 2 to pin 1; pin 3 to pin 1), local party-line power disabled: >10 k ohms

Hybrids: 2

Topology: 3-section analog circuitry compensates for resistive, inductive, and capacitive 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: pin 2 DC output status, auto null and "mic kill" activation

Connectors:

Party-Line Intercom: 1, 3-pin male XLR

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

DC Input/Data: 1, 4-position male header. Refer to Appendix A 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 B for details.

Weight: 0.2 pounds (91 g)

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

Appendix A—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 5132'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 A—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*

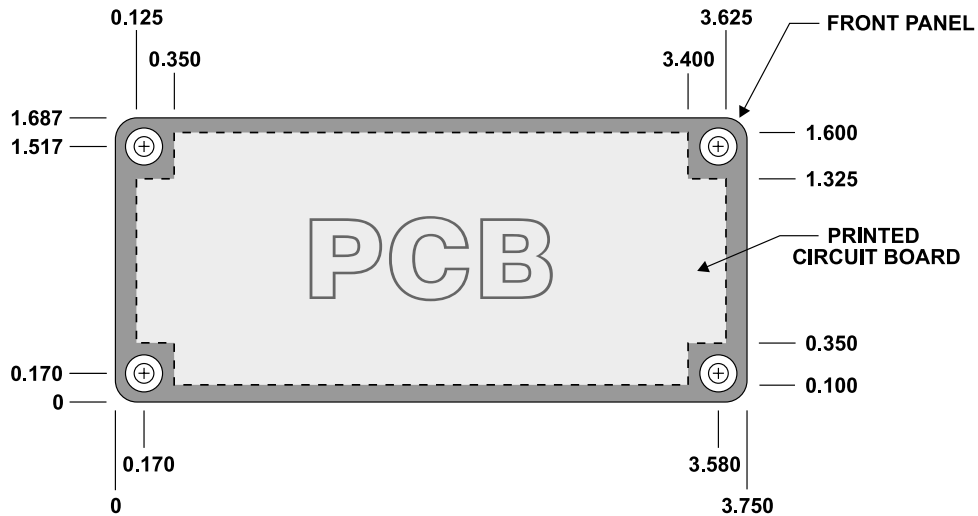
Headers on the Printed Circuit Board

The actual part numbers of the header connectors that are soldered into the Model 5132'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 5132! We are providing these details only so that interested technical personnel can have the full background on the Model 5132'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!)**

Appendix B—Model 5132 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.