Technical Practice

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Model 272 Telecom Interface with Smart Disconnect

3. Installation

3.1 Installation Overview

In this section you will be installing and interconnecting the Model 272. The unit will be mounted onto a wall surface. Telephone circuit connections will be made by way of a 25-pair connector. Earth ground and power connections will be made using either the 25-pair connector or a 3-position screw terminal strip.

3.2 Caution

As with any product, installing the Model 272 requires a safety-first approach.

Warning: Never install telephone wiring during a lightning storm. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations. Never touch non-insulated telephone wires or terminals unless the telephone line has been disconnected at the network interface. Use caution when installing or modifying telephone lines.

3.3 Installation Kit

Included in each Model 272 shipping carton is an installation kit. Each kit contains four #8 pan-head screws and two nylon cable ties.

3.4 Mounting

The Model 272 wall mounts using four #8 screws appropriate for the wall material. If suitable, use the four #8 pan-head screws that are contained in the installation kit. The unit's mounting holes are in the four corners of the enclosure. They are accessible from the inside, requiring that the cover be

removed. The cover is secured to the base using two clamp screws which are located on the top and bottom of the unit. Using a Phillips screwdriver, loosen the screws until the cover can be easily removed.

3.5 Connections

All connections to and from the Model 272 can be made by way of a 25-pair plug labeled P1. The installer must provide a 25-pair cable-mounted female connector to mate with P1. Alternately, ground and power connections can be made using a 3-position terminal strip labeled TS1. Figure X, located at the end of this practice, provides detailed connection information.

3.6 Installing and Terminating the 25-Pair Connector

Insert the 25-pair cable-mounted female connector into plug P1. Once it is firmly mated with the plug it should be secured using the Velcro® fastener strap assembly. Terminate the cable end as required for the specific application. In most cases the cable will be "punched down" into a 66-type or the newer and much-preferred 110-type block.

3.7 Connecting Earth Ground

For correct operation the Model 272's circuitry an earth ground connection must be made. Connect earth ground to the violet-brown pair of P1 or pin 1 of terminal strip TS1. It's important to note that when powering the Model 272 from –48 volts DC two separate ground connections are necessary: one for power supply ground and one for earth ground. Even if the power supply ground is electrically at earth ground potential, it must still be connected to both the power supply ground and the earth ground connection points on the Model 272.

3.8 Connecting Power

The Model 272 requires an external source of nominal 24 volt AC or –48 volt DC power for operation. The unit isn't particular; an AC power source in the range of 22 to 30 volts can be directly connected. A DC power source in the range of –42 to –56 volts can also be connected. For installer convenience, power can be connected to either the violet-slate pair of P1 or pins 2 and 3 of terminal strip TS1.

Powering with 24 volts AC: When powering the unit with 24 volts AC it's recommended that both sides of the power source be floating (isolated) from earth ground. If the source is a plug-in-the-wall device it needs to be a Class 2 type. The 24 volt AC source must be able to provide a minimum of 155 milliamperes of current. A transformer with a rating of 6 VA would be appropriate. Connect one lead of the 24 volt AC power source to the violet-slate wire of P1 or to pin 2 of TS1. Connect the other lead of the 24 volt AC supply to the slate-violet wire or pin 3 or TS1. Note that if you are using a transformer provided by Gordon Kapes, Inc. you might need to make your connections to the transformer's terminals that are marked LOAD.

Powering with –48 Vdc: Connect power supply ground to the violet-slate wire of P1 or pin 2 of TS1. The –48 volt DC connection should be connected to the slate-violet wire of P1 or pin 3 or TS1. The power supply must be capable of supplying a minimum current of 80 milliamperes.

3.9 Model 272 Kit—Earth Ground and Power

A configuration is available from Gordon Kapes, Inc. that provides, in a single carton, a Model 272, a 24 volt AC transformer, and a 3-conductor earth/power interconnecting cable. The leads on the interconnecting cable provide a simple means of connecting earth ground and 24 volts AC power to the Model 272's 3-position terminal strip. The green wire should link the transformer's ground terminal to pin 1 of the terminal strip TS1. The other two wires should be connected to the transformer's load terminals as well as pins 2 and 3 of TS1.

3.10 Interface Circuit Connections

Two pairs, each consisting of a tip lead and a ring lead, are associated with each of the Model 272's four interface circuits. The first pair of each interface, e.g., the white-blue pair, is connected to a loop start trunk circuit or a loop start station port. The second pair of each interface circuit, e.g., white-orange, is connected to the loop start or ground start connection on the associated customer premise equipment (CPE). Also, be certain that the correct tip and ring polarity is maintained. It may be useful to confirm the polarity using a digital volt meter. With a loop start trunk port or loop start station port the tip lead should measure positive with respect to the ring lead. Refer to Figure X, located at the end of this technical practice, for detailed connection information.

3.11 External Tip Ground Connections

In rare cases a loop start trunk circuit or loop start station port that is connected to a Model 272 interface circuit may have its tip lead floating (isolated) from earth ground. This condition can lead to incorrect operation of the unit's conversion circuitry. To overcome this obstacle the Model 272 allows a tip ground connection to be made using pairs on plug P1. To make the connection simply requires adding a strap across one pair of wires for each interface circuit. Refer to Figure X for details. Note that when the optional tip ground is implemented the Model 272's circuitry applies earth ground only when the associated circuitry is in its idle state. Once a call has been correctly "set up" using the conversion circuitry the tip ground is automatically removed. This ensures that hum, noise, or other extraneous signals won't be induced into the audio path.

3.12 Securing the Connecting Wires

It's recommended to use one of the cable ties provided in the installation kit to secure the 25-pair cable to the mounting point molded into the Model 272's base. If connections have been made to the 3-position screw terminal strip the other cable tie should be used for its associated wires. To allow access to the configuration switches please do not replace the cover at this time.

4. Configuration

4.1 Configuration Overview

The Model 272's interface circuits are capable of being configured for a wide range of operating modes. How they perform depends on the settings made using an 8-position DIP-type switch assembly. It is located on the lower left of the Model 272's circuit board and is labeled SW1. The individual switches are labeled SW1-1 through SW1-8. Correct operation of the Model 272 in a specific installation depends on understanding the operating modes and then carefully setting the switches to achieve the desired result. Note that all four of the Model 272's interface circuits will follow the same selected configuration. They cannot be configured to have unique operating modes.

4.2 Overall Operating Mode

Switch SW1-1 is used to set the Model 272's overall operating mode. As was previously discussed this setting controls the operation of all four of the interface circuits. The overall operating mode can be set to either ground start or loop start. When selected to the ground start mode the interface circuits will allow customer premise equipment intended for use with ground start trunk port circuits to be used with loop start trunk circuits or loop start station ports. When selected to the loop start mode the Model 272's interface circuits will enhance the ability of customer premise equipment to work correctly with loop start trunk ports or loop start station ports.

To select the overall operating mode for ground start set SW1-1 to the off (down) position. To select loop start mode set SW1-1 to the on (up) position. It's worth again reviewing the selected operating mode to ensure that it meets the needs of the specific installation. An incorrect setting may lead to some very strange results!

4.3 Progress Tone Detection—Overview

Using a combination of hardware and software, the presence of dial tone, busy tone, and reorder progress tones on the interface circuits can be detected. Three switches allow each detection function to be enabled or disabled as desired. Upon detection of a specific progress tone a number of actions may take place. These can include causing a break in loop current and extending the duration of a loop current break.

Progress tone detection is accomplished using time ("cadence") measurements, rather than detecting precise pairs of frequencies. The Model 272's microcontroller integrated circuit, under software control, is "watching" for the presence of audio signals over the 305 to 640 hertz call progress tone audio band. Time measurements are continually made to determine which, if any, progress tones are active on the four interface circuits. A configuration switch is used to set the detection time for the three progress tone detection functions. Another switch is used to specify a time period that tone detection will be ignored at the beginning of each new call. This prevents normal progress tones, such as a dial tone at the beginning of a call, from being detected and causing the call to terminate.

In most applications it's recommended that the dial tone detection function be enabled. This will help to minimize the chance that an unrecognized disconnect signal will cause a line or trunk to become "hung" in an off-hook state. The requirements of a specific application will dictate whether the busy tone or reorder tone detection function will be enabled.

4.4 Dial Tone Detection

Switch SW1-2 is used to select the enabled or disabled status of the dial tone detection function. When SW1-2 is in the on (up) position the function is enabled.

The function "looks" for the continuous presence of audio within the detection band. Dial tone, or any other continuous signal, must be present over the configured detection period (4 or 8 seconds as set by switch SW1-5) for a valid dial tone condition to be recognized. Note that after the start of any new call the dial tone detection function will become active only after a fixed time interval has elapsed (6 or 20 seconds as set by switch SW1-8).

4.5. Busy Tone Detection

Switch SW1-3 is used to select the enabled or disabled status of the busy progress tone detection function. When switch SW1-3 is in the on (up) position the function is enabled. This function looks for the presence of audio within the detection band that has a repeating cadence of 500 milliseconds (0.5 seconds) on and 500 milliseconds (0.5 seconds) off. Busy tone must be present over the configured detection period (4 or 8 seconds as set by switch SW1-5) for a valid busy tone condition to be recognized. Note that after the start of any new call the busy tone detection function will become active only after a fixed time interval has elapsed (6 or 20 seconds as set by switch SW1-8).

4.6 Reorder Tone Detection

Switch SW1-4 is used to select the enabled or disabled status of the reorder progress tone detection function. In telephone lingo reorder may also be known as a "fast busy" progress tone. When switch SW1-4 is in the on (up) position the function is enabled. This function looks for the presence of audio within the detection band that has a repeating cadence of 250 milliseconds (0.25 seconds) on and 250 milliseconds (0.25 seconds) off. Busy tone must be present over the configured detection period (4 or 8 seconds as set by switch SW1-5) for a valid reorder condition to be recognized. Note that after the start of any new call the reorder tone detection function will become active only after a fixed time interval has elapsed (6 or 20 seconds as set by switch SW1-8).

4.7 Progress Tone Detection Time

Switch SW1-5 is used to select the progress tone detection time period. The progress tone detection time choices are 4 or 8 seconds. When switch SW1-5 is in the off (down) position 4 seconds is selected; on (up) indicates that 8 seconds is selected. This setting impacts the dial tone, busy tone, and reorder tone detection functions, defining the time length over which a signal must be continuously present for it to be recognized as being valid. In almost every case selecting 4 seconds is appropriate. It's long enough minimize the chance of incorrectly detecting a signal as a valid progress tone, but still fast enough to provide a reasonable detection time. The choice of an 8-second detection time was included for those rare applications where the chance of incorrectly recognizing a progress tone must be minimized. Selecting an 8-second detection time will almost guarantee that "false positives" won't occur. Of course nothing is prefect, but with the 8-second setting detecting a voice, modem, hum, or other signal as a valid progress tone will be highly unlikely. The downside is that a minimum of 8 seconds will be required for detecting any valid progress done. This can reduce the number of unique calls that can be carried on each interface circuit.

4.8 Loop Current Detection Functions—Overview

The Model 272's hardware and software continually monitors for the presence or absence of loop current in the interface circuits. The "makes and breaks" in the loop current are interpreted to provide information about the status of the connected lines or circuits. How the loop current status is acted upon in software depends on whether the main operating mode has been selected for ground start or loop start and how the loop current detection function is configured. It's important to understand the characteristics of these operating modes and the associated "rules" that apply.

4.9 Loop Current Detection Function—Ground Start Mode

Switch SW1-6 is used to select the way in which the loop current detection function will operate. As previously discussed, the available choices depend on whether the main operating mode has been selected for ground start or loop start. When the operating mode is set for ground start (SW1-1 off), the loop current detection function allows a break timer to be set for 375 milliseconds (0.375 seconds) or 1.5 seconds. When switch SW1-6 is in its off (down) position, 375 milliseconds is selected; on (up) indicates that 1.5 seconds is selected. The selected time is the minimum time period that loop current must stop flowing for the interface circuits to recognize that a loop disconnect has taken place. In most applications the 375 millisecond setting is appropriate. It will detect a normal user "hang up" or loop disconnect signal while ignoring random short-duration breaks. The 1.5 second setting is provided specifically for those applications where breaks in loop current due to switch-hook-flash functions are going to take place. "Flash" signals are used by some central office and PBX telephone systems to initiate various call functions. These include call hold, call transfer, and 3-way calling. The published technical standards for a "flash" signal specifies a break in loop current of between up to 300 milliseconds (0.3 seconds) and 1.0 seconds, so selecting the 1.5-second setting will ensure that a "flash" will not be recognized as a loop disconnect.

4.10 Loop Current Detection Function—Loop Start Mode

When the Model 272's main operating mode is set for loop start (SW1-1 on) the loop current detection function can be either disabled, or set to have a detection time interval of 375 milliseconds (0.375 seconds) and provide an extension of the break interval. When SW1-6 is set to the off (down) position the function is disabled and the interface circuits will ignore any breaks in loop current. This is an appropriate setting when the loop start lines or trunks and the connected devices are successfully providing loop disconnect signaling.

When SW1-6 is set to the on (up) position the loop current detection function is configured to provide a break extender feature. In this mode a 375 millisecond loop current break timer is active. At the end of any call (break in loop current of 375 milliseconds) the interface circuits will extend the loop

current break time by the forced disconnect time (2 or 4 seconds as configured by SW1-7). This feature is provided to assist systems that require a break in loop current that exceeds that provided by the line or trunk or the connected equipment. This function can be thought of as a "hang up" extender or "stretcher," ensuring that all breaks in loop current are at least 2.375 or 4.375 seconds. (375 millisecond minimum detect time combined with a 2- or 4-second forced disconnect time).

4.11 Forced Break Time

Several Model 272 functions, including progress tone detection, can initiate a forced disconnect. This is performed by breaking loop current, signaling to connected equipment that a call-in-progress should terminate. This break in loop current is also known in the telecom industry as calling-party-control (CPC) or calling-party-disconnect. Switch SW1-7 is used to set the break time, the choices being 2 or 4 seconds. When SW1-7 is in the off (down) position the forced disconnect time is 2 seconds; in the on (up) position the time is 4 seconds. In most cases 2 seconds is more than sufficient to signal to connected devices that a call should be terminated. The 4-second setting is provided for those special applications that require an extra-long break in loop current, indicating that the current call should be terminated and the equipment prepared for the next.

4.12 Ignore Progress Tone Time

The ignore progress tone function was included so that normal progress tones that are present at the beginning of a call, especially dial tone, will not cause the call to be erroneously "broken down" (disconnected). Switch SW1-8 sets the ignore progress tone time period to be either 6 or 20 seconds. When SW1-8 is set to the off (down) position the ignore time period is 6 seconds; in the on (up) position the time is 20 seconds. In most cases the 6-second setting is appropriate. This is more than adequate to allow the dialing process to begin, an action that causes the dial tone present at the beginning of a call to stop. Only special circumstances should require the 20-second setting.

5. Testing and Operation

6. Incorrect Operation

7. Repair and Replacement

8. Specifications

Model 272 Telecom Interface Connection Diagrams

25-Pair Plug P1

Pin	Wire Color		Description	
26	WHT-BLU	T	Loop Start Trunk	Circuit 1
1	BLU-WHT	R	or Station Port	
27	WHT-ORN	T	Ground Start/Loop Start	
2	ORN-WHT	R	CPE Equipment	
28	WHT-GRN	T	Loop Start Trunk	Circuit 2
3	GRN-WHT	R	or Station Port	
29	WHT-BRN	T	Ground Start/Loop Start	
4	BRN-WHT	R	CPE Equipment	
30	WHT-SLT	T	Loop Start Trunk	Circuit 3
5	SLT-WHT	R	or Station Port	
31	RED-BLU	T	Ground Start/Loop Start	
6	BLU-RED	R	CPE Equipment	
32	RED-ORN	T	Loop Start Trunk	Circuit 4
7	ORN-RED	R	or Station Port	
33	RED-GRN	T	Ground Start/Loop Start	
8	GRN-RED	R	CPE Equipment	
34	RED-BRN	T		
9	BRN-RED	R		
35	RED-SLT	T		
10	SLT-RED	R		
36	BLK-BLU	T		
11	BLU-BLK	R		
37	BLK-ORN	T		
12	ORN-BLK	R		
38	BLK-GRN	T		
13	GRN-BLK	R		
39	BLK-BRN	T		
14	BRN-BLK	R		
40	BLK-SLT	T		
15	SLT-BLK	R		
41	YEL-BLU	T		
16	BLU-YEL	R		
42	YEL-ORN	T		
17	ORN-YEL	R		
43	YEL-GRN	T		
18	GRN-YEL	R		
44	YEL-BRN	T		
19	BRN-YEL	R		
45	YEL-SLT	T	Ext. Tip Ground - Circuit 1	
20	SLT-YEL	R	Earth Ground	
46	VIO-BLU	T	Ext. Tip Ground - Circuit 2	
21	BLU-VIO	R	Earth Ground	
47	VIO-ORN	T	Ext. Tip Ground - Circuit 3	
22	ORN-VIO	R	Earth Ground	
48	VIO-GRN	T	Ext. Tip Ground - Circuit 4	
23	GRN-VIO	R	Earth Ground	
49	VIO-BRN	T	Earth Ground	
24	BRN-VIO	R	Earth Ground	
50	VIO-SLT	T	AC Common/Ground	
25	SLT-VIO	R	24Vac/–48Vdc	

Terminal Strip TS1

Pin	Description
1	Earth Ground
2	AC Common/Ground
3	24Vac/–48Vdc