



Auto Coupler

*Installation and
Operations Manual*

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Auto Coupler Installation and Operations Manual

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Introduction ≡

Congratulations on purchasing Auto Coupler. This manual explains how to install, set up and operate your Auto Coupler. It also provides instructions on how to resolve minor technical problems, should any arise.

If you need information on how to install, set up or operate your system, please contact Gentner Communications Corporation at the location noted below. We welcome and encourage your comments so we can continue to improve our products and serve your teleconferencing needs.

Gentner Communications Corporation

1825 Research Way
Salt Lake City, Utah 84119

TEL: Worldwide (801) 975-7200 In U.S.A. (800) 945-7730
FAX: Worldwide (801) 977-0087 In U.S.A. (800) 933-5107
Fax-On-Demand 24-Hour Information Service (800) 695-8110
Worldwide Web Page @ <http://www.gentner.com>

**Warranty
Registration** ≡

Please register your Auto Coupler by completing the self-addressed, postage prepaid warranty registration card and return it to Gentner Communications by mail. You may also FAX it to the above listed fax number or call Gentner Communications. When your product is properly registered, Gentner Communications will be able to serve you better should you require technical assistance or desire to receive upgrades, new product information, etc.

Unpacking ≡

Ensure that the following equipment (See Figure 1, below.) was received with your shipment:

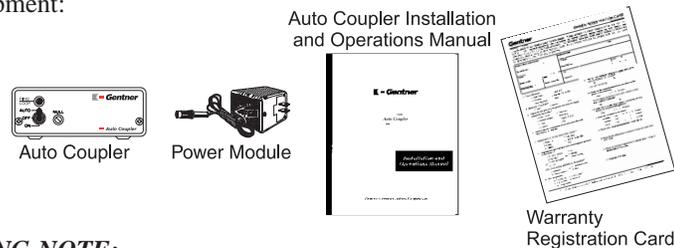


Figure 1. Equipment diagram.

SHIPPING NOTE:

Gentner Communications is not responsible for product damage incurred during shipment. You must make claims directly with the carrier. Inspect your shipment carefully for obvious signs of damage. If the shipment appears damaged, retain the original boxes and packing material for inspection by the carrier. Contact your carrier immediately.

**Product
Description** ≡**Auto Coupler and Auto Coupler CP**

The Auto Coupler is available in two versions: Auto Coupler and Auto Coupler CP. Both units are identical, *except* that the Auto Coupler CP has additional circuitry to provide call-progress decoding for auto-disconnect. The standard model detects loop continuity changes for auto-disconnect.

Both models are active devices that connect directly to the telephone line to be used with almost any analog or digital telephone system. They allow the user to simultaneously send and receive audio over a single telephone line.

Some telephone systems provide another means of line disconnect involving tone signaling. If your telephone system does not provide a standard “loop drop” on disconnect, you require the Auto Coupler CP with a built-in call-progress decoder.

Controls and Connectors

Null Trim Pot

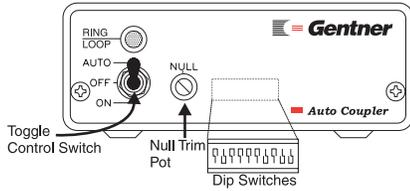


Figure 2. Auto Coupler front-panel controls

The telephone LINE and SET connectors are paralleled to an internal hybrid coil. This hybrid coil provides approximately 10dB of audio separation (i.e. null) between the incoming RECEIVE and outgoing SEND audio. The amount of separation can be adjusted slightly with the NULL trim pot (Figure 2, left).

Toggle Switch

When the switch on the front of the Auto Coupler is in the ON position, the internal hybrid is connected directly to the telephone line, which terminates the line. This allows the operator to hang up the telephone set and maintain an open telephone line.

With the switch in the AUTO position, the Auto Coupler will automatically answer and couple to the telephone line after the first ring. On “loop drop,” the unit will automatically disconnect from the telephone line.

Inputs

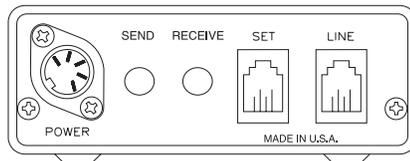


Figure 3. Auto Coupler back panel

The Auto Coupler’s input (See Figure 3, left.) consists of a single 1/4-inch modular phone jack. Any audio applied to this input will be sent to the caller. The level of send audio is determined by the level of the source and the position of the user options described in Installation (next page).

The unit’s input is balanced and has the electrical connections detailed in Table 1 (below).

Table 1. Input/Output Electrical Connections

Tip	(+) Audio
Ring	(-) Audio
Sleeve	Ground

This input is labeled SEND and appears on the rear panel of the unit. Any audio that is desired to be sent to the caller should be attached per the above connections to this input.

Outputs

The Auto Coupler’s output (See Figure 3, above, left.) consists of a single 1/4-inch modular phone jack. This output is active, balanced, and has the electrical connections detailed in Table 1 (above).

This output is labeled RECEIVE and appears on the rear panel of the unit. When online, the unit delivers caller audio to this connector. Any device used to monitor caller audio should be attached per the above connections to this output.

The output level is determined by the selection of user options described in Installation (next page).

OUTPUT NOTE:

The Auto Coupler’s receive output is never muted.

**Before You
Install** ≡**Power Requirements**

The Auto Coupler will accommodate 234Vac or 117Vac and should be specified by the user when the Auto Coupler is ordered. To make the Auto Coupler functional, the wall transformer must be plugged into the appropriate AC line and into the Auto Coupler's rear-panel connector.

Equipment Placement

The Auto Coupler should be placed within six feet of a standard electrical outlet.

Installation ≡**Step 1 — Make Connections**

Connect a telephone line to the LINE jack (See Figure 3, previous page.) on the back of the Auto Coupler by plugging in a modular cable terminated with an RJ11 connector, then inform all who may use it *which* line is connected. Connect the audio-feed output to the SEND jack on the back of the Auto Coupler. Also connect a telephone set to the SET jack for use in remotes and production feeds (Simple Remotes/Production Studio Feeds, Page 6).

Step 2 — Set Dip Switches

The Auto Coupler has 10 user-selectable dip switches. The switches are located behind the unit's front panel. To access these options, remove the two front-panel mounting screws and gently pull the internal assembly and end bezel from the rest of the enclosure.

These switches define the operation of the unit (Table 2, below).

Table 2. Auto Coupler Dip Switch Settings

<u>Switch #</u>	<u>Off/Open</u>	<u>On/Closed</u>
1	A lead closure NOT provided	A-lead closure provided*
2	DC-bypass OUT, auto-answer enabled*	DC-bypass IN, ring-detect bridge shorted
3	Receive limiter OUT	Receive limiter IN*
4	Unity receive	+20dB receive level*
5	-10dB send level*	Unity send
6	Send limiter OUT	Send limiter IN*
**7	Four call-progress units	No call-progress units*
**8	Two call-progress units*	No call-progress units
**9	One call-progress unit	No call-progress units*
**10	Call-progress level UNITY*	-6dB call-progress level

* Indicates factory-default setting.

** Auto Coupler CP only

These 10 option switches are defined as follows:

Switch 1

A-lead closure control, used to signal whether the user requires a relay closure on pins 2 and 5 of the line telephone modular jack when the Auto Coupler is online.

Switch 2

DC-bypass control, provided to allow use on the CO phone loops (i.e. no direct current to saturate the Auto Coupler's ring-detect bridge). If the Auto Coupler is used on a PBX line or other circuit not matching the unit's auto-

Installation
Continued ≡

answer specifications, this switch should be moved to the DOWN position for proper operation.

Switch 3

Receive limiter controls the maximum receive level. When ON, the Auto Coupler limits the receive signal to a 2.2 peak-to-peak voltage swing to approximately 0dBm.

Switch 4

Receive gain control allows the user to amplify the caller level 20dB only when ON. This places a typical local caller at 0dBm on the output jack.

Switch 5

Send gain control allows the user to attenuate the send signal by 10dB when selected. This equates into a -14dBm send level on a typical local loop.

Switch 6

Send limiter mirrors the function of the receive limiter except that it is send-audio signal path and, thus, controls the maximum transmit level.

Switches 7-9

Allow the user to select the number of call-progress decodings of the same call-progress event that must occur before the Auto Coupler disconnects from the phone line. These switches are configured as three binary bits of counting, which allow the user to select from one to seven counts before activation. With all of these switches ON, setting a count of zero, the Auto Coupler's CP option is disabled.

Switch 10

CP level control allows the user to adjust the input sensitivity of the call-progress decoder from either unity gain to -6dB of attenuation. This switch should be set to the -6dB setting if detection of the signals recorder of ring-back are required. Reorder is sometimes called "fast busy."

Adjusting Null

The Auto Coupler, being an analog device, must be adjusted to optimize its performance.

NULL SETTING NOTE:

The null setting is preset at the factory for most applications.

If null settings are inadequate, follow these step-by-step instructions:

Step 1 — Connect Test Audio

Although typical send audio can be any recorded message or test tone, Gentner Communications recommends a 400Hz, 0dBm test tone if critical null adjustments are required.

Step 2 — Call the Auto Coupler

From a separate line, call the telephone number where the Auto Coupler is hooked up, then move the Auto Coupler's front-panel switch to ON and place the caller handset down in a quiet environment to prevent caller audio from being detected as send-to-caller distortion.

Step 3 — Adjust Null Trim Pot

Using a small, flat-head screwdriver, adjust the front panel NULL trim pot (See Figure 4, left.) until the send source appears at the RECEIVE output at its lowest level.

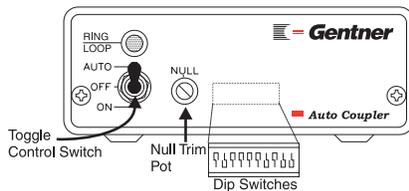


Figure 4. Front panel

NULL ADJUSTMENT NOTE:

A quick way to judge receive level is to attach an AC volt meter to the RECEIVE output jack between the sleeve and the tip.

Additional Circuit Connections

Gentner Communications also provides additional circuit connections to add additional resistive and capacitive components if the null adjustment needs further fine tuning.

By adding a small additional capacitor to the C11 posts (See Appendix B, Page 10; Appendix C, Page 13.), the null deepens by only 2–3dB at a single frequency.

These connections are screened C11 and R9 on the unit's printed circuit board assembly. Gentner Communications ships the Auto Coupler with quick solder-free clips for these connections. If it is desired to add additional components to these connections, please use wise techniques when making any modifications to prevent damage to the unit.

ADDITIONAL ADJUSTMENT NOTE:

Rarely will additional resistance be required besides the front panel 1Kohm null trim pot to optimize the Auto Coupler's hybrid performance.

Operation ≡

Controls

The hybrid coupler is easy to control. By positioning the toggle switch on the unit's front panel, the hybrid coupler can be either OFF, ON, or in AUTO position.

Table 3. Toggle Switch Postions

<u>Switch Position</u>	<u>Phone Circuit Connection</u>	<u>Description</u>
OFF	Not connected	N/A
ON	Connected	LINE connector terminated; SEND/RECEIVE jacks active
AUTO	Connected	Waiting for inbound calls before SEND/RECEIVE jacks become active

Auto-Answer Listen Lines

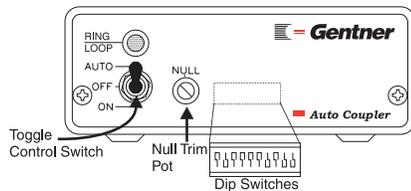


Figure 4a. Front panel

Since the Auto Coupler can be set to auto-answer an inbound call, it can be used to provide clients, employees, and the general public the capability of telephone calling the unit to receive audio feeds. To accomplish this, move the switch (See Figure 4a, left.) on the front of the Auto Coupler to the AUTO position.

The Auto Coupler is now ready to send the audio feed to the second party whenever the unit is called. When the caller hangs up, the Auto Coupler will disconnect the line and be ready for the next call.

Simple Remotes/Production Studio Feeds

The Auto Coupler can be used to provide fast connection to the telephone network for remote-audio feeds, news actualities, field reporting, etc. To accomplish this, follow these step-by-step instructions:

Step 1 — Place Telephone Call

Establish a phone connection by either dialing the second party or answering on ring with the telephone set.

Step 2 — Set Front Panel Switch

Move the switch on the front of the Auto Coupler to the ON position and hang up the telephone.

The Auto Coupler is now set up to send the audio feed down the telephone line to the second party. When the audio feed is complete, return the front-panel switch to the OFF position to hang up the telephone line.

Frequency Extended Remotes With EFT-100

A cost-effective way to improve the quality of a dial-up remote is to use the Auto Coupler with a Gentner EFT-100 Digital Frequency Extender. The EFT-100 dramatically improves telephone audio quality by extending the low-end frequency response and reducing the ambient noise level of a telephone loop.

Contact Gentner Communications for more information.

Specifications **Auto Coupler****Dimensions**

4.17"W x 1.61"H x 6.97"D

Weight

1 lb./.5kg (dry) 2 lbs./1kg (shipping)

Connectors

TELEPHONE: RJ11C

SEND AUDIO: 1/4" modular phone jack, -10dB nominal selectable, balanced, bridging, 20K ohms, internal limiter selectable

RECEIVE AUDIO: 1/4" modular phone jack, 0dBm/-20dB nominal selectable, balanced 600ohms, internal limiter selectable

Power Requirements

117/234Vac, 50/60Hz, 9W

Audio Performance**Frequency Response**

250Hz tp 3.2kHz, +.5dB

Signal-to-Noise Ratio

>60dB

Distortion

<.1% THD

Null

15dB nominal @ 1kHz, adjustable

Operating Temperature

32–106° F/0–50° C

All specifications are subject to change without notice.

Warranty

Gentner Communications Corporation (Manufacturer) warrants that this product is free of defects in both materials and workmanship. Should any part of this equipment be defective, the Manufacturer agrees, at its option, to:

A. Repair or replace any defective part free of charge (except transportation charges) for a period of one year from the date of the original purchase, provided the owner returns the equipment to the Manufacturer at the address set forth below. No charge will be made for parts of labor during this period;

B. Furnish replacement for any defective parts in the equipment for a period of one year from the date of original purchase. Replacement parts shall be furnished without charge, except labor and transportation.

This Warranty excludes assembled products not manufactured by the Manufacturer whether or not they are incorporated in a Manufacturer product or sold under a Manufacturer part or model number.

THIS WARRANTY IS VOID IF:

A. The equipment has been damaged by negligence, accident, act of God, or mishandling, or has not been operated in accordance with the procedures described in the operating and technical instructions; or,

B. The equipment has been altered or repaired by other than the Manufacturer or an authorized service representative of the Manufacturer; or,

C. Adaptations or accessories other than those manufactured or provided by the Manufacturer have been made or attached to the equipment which, in the determination of the Manufacturer, shall have affected the performance, safety or reliability of the equipment; or,

D. The equipments original serial number has been modified or removed.

NO OTHER WARRANTY, EXPRESS OR IMPLIED, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR USE, APPLIES TO THE EQUIPMENT, nor is any person or company authorized to assume any warranty for the Manufacturer or any other liability in connection with the sale of the Manufacturer's products.

Manufacturer does not assume any responsibility for consequential damages, expenses, or loss of revenue or property, inconvenience, or interruption in operation experienced by the customer due to a malfunction in the purchased equipment. No warranty service performed on any product shall extend the applicable warranty period.

In case of unsatisfactory operation, the purchaser shall promptly notify the Manufacturer at the address set forth below in writing, giving full particulars as to the defects or unsatisfactory operation. Upon receipt of such notice, the Manufacturer will give instructions respecting the shipment of the equipment, or such other matters as it elects to honor this warranty as above provided. This warranty does not cover damage to the equipment during shipping and the Manufacturer assumes no responsibility for such damage. All shipping costs shall be paid by the customer.

This warranty extends only to the original purchaser and is not assignable or transferable.

Gentner Communications Corporation, 1825 Research Way, Salt Lake City, Utah 84119

Safety **Information**

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electrical inspection authority, or electrician, as appropriate.

Appendix A: Telephone Theory

To fully understand the Auto Coupler, it is essential to first achieve a basic understanding of telephone systems.

The telephone company provides a single pair of wires for every telephone line within the service area of the Central Office (CO). The pair of wires is twisted to form a balanced transmission line. This twisting of the two identical wires (See Figure 5, below.) provides for the rejection of hum and noise on the telephone transmission of both send and receive audio, DC current to power the user's telephone, and ringing voltage to signal the user of an incoming call.

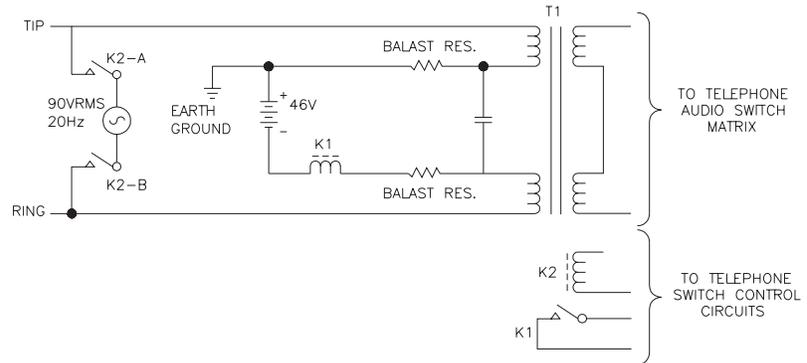


Figure 5. Subscriber-interface circuit

The two wires coming from the CO are called “tip” and “ring.” These names carry over from the days of the old manual switchboard, when an operator manually interconnected callers with patch cords. The tip and the ring terminals of the plug on the patch cord provided the connections to the caller's telephone.

It is very easy to identify tip and ring using a standard volt meter (Figure 6, below). The open circuit voltage on the telephone is 48V.

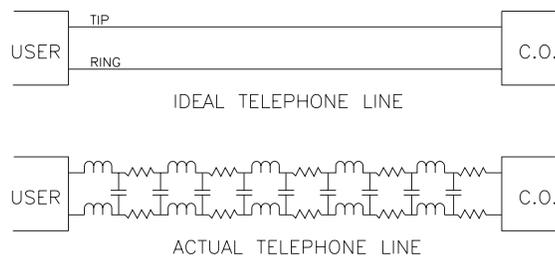


Figure 6. Ideal telephone line

Note: Tip is positive. Ring is negative.

When the telephone instrument is taken off hook, current is drawn from the CO battery, closing the contacts of the K1. These contacts tell the CO switching mechanism the user demands service. The switch then provides dial tone and waits for the user to dial a telephone number. If an incoming call is to be directed to a user, the CO switch will operate K2 and apply 90V (RMS) at 20Hz to tip and ring. This voltage now superimposed on the 48Vdc will cause the user's instrument to ring. When the called party takes the instrument off hook, K1 will close and the switch will interconnect the two parties.

Any wire conductor has a small amount of resistance and inductive resistance. When the length of this conductor is extended beyond 100 feet, the two impedances begin to have significant effects at audio frequencies. In addition, two of these conductors are twisted together, creating a significant amount of shunt capacities between the two wires. This distributed inductance, resistance and capacitance will cause a loss at the higher audio frequencies. The two deficiencies in tandem limit the frequency response of the telephone line to a band that extends from 300Hz to 3.4kHz. Since capacitive and inductive

Appendix A:
Continued 

resistance both change with frequency, the complex impedance of the telephone line will be different at every frequency in the voice band.

The purpose of a telephone hybrid is to separate the full-duplex audio of a balanced phone circuit into separate send and receive audio ports. This separation is very important to preserve the acoustic quality of the send audio. When audio is sent to a caller, it is transmitted on the telephone line. The acoustic of the audio become altered by the frequency response of the telephone line. If some of this altered send audio is mixed in with the caller audio, the audio will have a hollow sound.

The measurement of a telephone hybrid's performance is how well it isolates or attenuates the send-audio input port from the caller-audio output port. This isolation can be optimized by adjusting the hybrid's null controls. When the impedance of the null circuit matches the impedance of the telephone line connected to the hybrid, a perfect null or attenuation of the send audio will result. However, remember from the earlier discussion, that the impedance of the telephone line is different for every frequency in the voice band; thus, making the perfect null impossible to achieve. Even though a perfect null is impossible, very satisfactory results can be obtained using this method for most applications.

Appendix B: Technical Description

TECHNICAL DESCRIPTION NOTE:

Please refer to Appendix C (Page 14) for Auto Coupler schematics.

Power Supply

The Auto Coupler is powered by an external 34Vac wall transformer. This transformer is connected at J5. The full-wave bridge, DB2, along with C23 and C24 provide rectification and filtering for the bipolar supply. U3 and U8 provide voltage regulation to +/-15Vdc respectively. This bipolar supply is used to power all operational amplifiers and other analog circuitry.

The positive input supply is also regulated to +5Vdc by U9, which provides the necessary potential to operate the digital functions of the unit.

Telephone Line Interface

The telephone line is connected to the unit at J1, a USOC RJ11C modular telephone jack. J1 is wired in reverse parallel to J2, which allows a standard telephone instrument to be operated in parallel with the connected coupler. Telephone-line tip and ring appear at J1 pins 3 and 4. When the line relay, K1, is energized, pins 4 and 8 will be closed applying the telephone line to the primary winding of the hybrid coil T1. R1 and C1 are used to couple a sample amount of ringing current across the open relay contact when the Auto Coupler is on hook. This allows for ring detection for the auto-answer feature.

K1 provides an auxiliary contact closure that can be used for closing the A-lead and A-common of a key service unit. This closure will appear at J1 pins 2 and 5 when the first user option switch is ON.

The front panel three-position toggle switch, SW2, is implemented for controlling the three possible modes of operation. These are OFF, ON, and AUTO. When the switch is in the ON mode, the relay coil is connected to the auto-answer/auto-disconnect circuitry.

Diode bridge DB1, along with R1, U1, and diodes CR1, CR2, CR4 and CR5, implement a circuit which detects ringing voltage and loop current from the telephone line. The harsh environment of the telephone line is isolated from the auto-answer/auto-disconnect circuit by U2. The circuitry requires that at least 5V of direct current bias be applied to the primary of the T1 on non-biased or "dry" loops, the user option switch 2, when ON, shorts the ring-detect bridge, removing the load from the tip and ring audio.

The front-panel LED is also part of the ringing and loop-current detection circuit. The LED will flash rapidly when ring voltage is present and illuminate continuously when the Auto Coupler is off-hook.

Auto-Answer/Auto-Disconnect

The main function of this circuit is to discriminate between legitimate ringing on the line and ignore all other transients and dial pulses. This is done by implementing the following four sequential timers:

Timer 1

Made up of U4B, R33 and C35, timer 1 has a time constant of 33 milliseconds. It serves to discriminate that the voltage stimulus on the line is

Appendix B:
Continued ≡

greater than 15Hz. This prevents pulse dialing at 10 pulses per second to be falsely detected as ring signaling.

Timer 2

Implemented with CR10, R17 and C25, timer 2 requires that ringing be present for at least 250 milliseconds to be considered a legitimate ring.

Timer 3

Implemented with U4A, R20 and C26, timer 3 causes a wait of two seconds after detecting ringing before the coupler is allowed to answer. This extends the K1 relay life by not allowing the coupler to connect to the line during ring signaling.

Timer 4

Made up of C32, R29 and U5D, timer 4 disable the auto-disconnect feature until the Auto Coupler has been off-hook for two seconds. Many COs interrupt the DC loop current several times very rapidly when the loop is terminated. This timer prevents these pulses from being detected.

Auto-disconnect is performed by U5. If the coupler has been off-hook for the required two seconds, pin 1 will be HIGH. If the CO momentarily interrupt the SC loop current, test point A on the schematic will go HIGH. This logic level, coupled through R31, will enable the gate at U6A and the coupler will return on-hook.

U6B, U6C and set/reset flip-flop present the on-hook or off-hook condition to the line relay driver circuit composed of R32, Q1 and CR17.

Analog Circuitry

The secondaries of the hybrid coil are tied together at pins 8 and 11. These pins are then terminated in the nulling impedance of C9 and R35. R35 can be adjusted from the front panel and allows for the best separation of send audio from receive audio. If the Auto Coupler is to be used in a dedicated application, fixed nulling components may be installed at R9 and C11 to provide improved null performance.

Audio to be sent on the line is applied to pin 7 of the hybrid coil, while receive audio is available at pin 12. L1, L2, FB5, FB6, C6 and C13 provide RFI isolation between the hybrid coil and the analog circuitry.

Balanced audio to be sent on the line is connected to the send jack P1. Protection from RFI is offered at this input by FB2, FB4, C7 and C10. U2 and its associated components implement a balanced-to-unbalanced converter with unity gain. Unbalanced audio is fed to the hybrid coil driver amplifier. The gain of this amplifier is either unity or -10dB, as selected by the fifth user option dip switch. Resistors R7 and R8, along with diodes CR11, CR12, CR13 and CR14, implement a send limiter. When switched in via user option dip switch 6, this circuit will not allow a send level greater than 0dBm. This limiter also protects the send circuit from transients that may occur on a phone line.

Receive audio from the hybrid coil is limited in level by R6 and CR6, CR7, CR8 and CR9. This limiter can be removed by turning the user option dip switch 3 OFF. This limiter prevents damage to the receive circuitry from line transients. Receive audio is balanced by U2C and U2D. This amplifier

can be user programmed for unity gain or 20dB of gain via user option switch 4. FB1, FB3, C112 and C14 protect the balancing amplifier from RF interference. Balanced receive audio appears at the P2 rear panel phone jack.

Optional Call Progress Decoder (Auto Coupler CP)

The Auto Coupler and Auto Coupler CP use all of the same components with the exception of the CP option, which has the additional electronics to provide auto-disconnect by detecting CO call-progress codes. The CP option is required if auto-disconnect is desired when the Auto Coupler is used on CO or PBX units that supply a dial tone or busy signal in the event of disconnect, rather than an interruption in loop current.

Audio from the receive side of the hybrid coil is coupled through C28 and R28 to the input of U7. U7 and the Y1 crystal contain all the digital filters and timing circuitry necessary to decode all the standard call-progress signals. The audio input to U7 can be attenuated by 6dB via option switch 10. Depending on the audio level of the receive signal, this additional attenuation will help prevent false decoding.

The output of U7 is connected to U6, a programmable logic array. U6 and switch options 7–9 allow the user to format a counter from one to seven in three bits of binary code. The Auto Coupler CP option uses this count to control the auto-disconnect circuit. To auto-disconnect on call-progress tones, the identical code must be decoded the number of times consecutively as set by the counter. The output of U6 is connected to the U5 input that controls the set/reset flip-flop (See test point C.) reset function.

