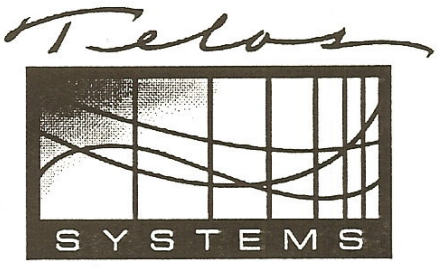
Telos DT100

Teleconference System

User's Manual



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Overview

The DT100

DT100 Teleconference System brings superb technology to applications where performance is an important consideration. It embodies a state-of-the-art approach to interfacing telephone lines for teleconferencing use. The very fast and precise digital automatic nulling allows smooth, natural simultaneous conversation without the usual speakerphone blocking effect or the audio distortion and feedback problems often experienced with hybrid-type interface devices.

A powerful digital signal processor with proprietary software is used in this unit for excellent performance. The DT100 is a *true digital* second-generation telephone interface.

Purpose

The purpose of the DT100 Teleconference System is to separate the distant[1] and local signals and to deliver pure distant audio to the speakers with as little of the local signal as possible mixed in, while at the same time sending the local signal to the telephone lines without mixing in any of the distant audio. Since the signals in both directions travel on the same pair of telephone wires, this is not an easy task. Until digital signal processing techniques were applied to the telephone interface problem, there were two choices:

Switching

The distant and local paths were separated by having only one talk direction active at a time. The common "speakerphones" use this approach. The disadvantage is that natural conversation is impossible, since the distant is cut off when a local talks, and vice-versa.

Analog Hybrid Interfaces

These were, on most phone lines, *very* poor at removing the local signal from the distant's audio. This meant that the local signal could become quite distorted as the phone audio was mixed in. It also exacerbated audio feedback problems.

The DT100 uses state-of-the-art digital techniques to perform this telephone hybrid function – the separation of the local and the distant audio. These audio signals are converted to digital bits and processed to separate the signals while maintaining natural, simultaneous, full-duplex conversation. The digital approach assures consistently good signal separation regardless of varying phone line impedance.

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[1] In the context of this manual "distant" will be used to refer to the party at the other end of the telephone line.

Special Features

DT100 Teleconference System incorporates sophisticated audio processing *in the digital domain* for gain control and filtering.

- A digital high-pass filter is used to reduce hum and other low frequency interference. High frequency noise above the telephone frequency range is also attenuated.
- A digital automatic gain control smooths input and output levels. A noise-gate/ downward expander is provided in the receive path to reduce phone line noise during distant pauses.
- An automatic override function is provided to allow ducking of the distant audio while a local is speaking. The override function includes an acoustic ducker which dynamically reduces send audio when distant audio is present in order to reduce feedback and aid in natural conversation.
- A unique feature is a special feedback reduction function using a pitch-shifting approach. The local (send) audio is shifted downward in frequency by 4 Hz to help prevent feedback buildup.
- Front panel metering is provided by an LED display for input level.
- Automatic disconnect when distant disconnects. The feature can be defeated internally if automatic disconnect is not desired.
- Automatic answering is available as an extra-cost option.

Operation

When a call is initially established, a brief mute/adapt period provides an opportunity for the system to adjust to the line before the connection is made to the conference speaker(s). The distant hears a brief "hiss" (noise burst), which is not heard over the conference speaker(s) because the output is muted during this time. This noise burst is the signal that the digital signal processor uses to initially adapt the system to the telephone line impedance. Adaptation to the telephone line characteristic continues throughout the conference as the conversation proceeds, using the voice as the driving signal.

This initial adaptation period has the incidental benefit of removing the line switching "clunk."

Installation

Telephone Line

There are two modular RJ11 telephone connectors on the rear of the DT100. The incoming telephone line is connected to the connector marked "LINE." A telephone set can be connected to the one marked "SET." When the DT100 is in the "CONFERENCE ON" mode of operation, the "SET" is disconnected. When the DT100 is in the "CONFERENCE OFF" mode of operation, the telephone line is simply passed through from the "LINE" connector to the "SET" connector.

Input Audio Connections

Audio is input via one of three connectors:

Microphone connector

This is a TB3M connector with DC bias, designed to connect directly to Audio-Technica UniPoint® condenser microphones. Pin #1 is ground; Pin #2 is signal and Pin #3 is DC bias. The sensitivity of the microphone used should be no less than 4 mV/Pa (−48 dBV). Gain is controlled by the "MICROPHONE" level control on the front panel.

The Audio-Technica AT851a UniPlate® condenser microphone is ideally suited for table-top conference applications. It provides frontal pickup angles of 120° horizontal and 60° vertical, which is ideal for most conference situations. Should the situation warrant, the pickup angle in the AT851a may be changed to an acceptance angle of 170° (subcardioid) by replacing the element with an AT853SC-ELE or to an acceptance angle of 110° using an AT853H-ELE hypercardioid element.

For hemispherical pickup (360° horizontal and 180° vertical) use the AT841a UniPlate microphone. Or, if you prefer the AT851a microphone, you can use the AT853O-ELE omnidirectional element with it. Note that as the horizontal acceptance angle is increased, so is unwanted background noise.

Line connector

This is an XLRF-type connector providing access to a balanced, line-level input. The input impedance is approximately 2000 ohms. The input requirements are 600 ohm line output; −20 dBV to +10 dBV. Pin #1 is the ground; Pin #2 is the non-inverting input and Pin #3 is the inverting input. The gain of this input is also controlled by the "MICROPHONE" level control on the front panel.

Remote connector

Line-level input is also included on a pin of the "REMOTE" connector on the rear panel. This connector is intended for interface with accessory modules to the DT100.

Note that when using the Audio-Technica CP8510 SmartMixer™ the audio connection is made through the remote connector, and the Line connector is not used. However, both the Line input connector and the microphone connector are available for use in connecting additional equipment to the system.

Output Connections

There are three separate audio output connections: "LINE LEVEL OUT", "SPEAKER" and "REC" (record). Two of these carry distant audio only. "REC" can be either distant or local or a mix, depending on the setting of the "RECORD" control on the front panel.

Line Level Out

This is an XLRM-type connector providing an active balanced output. Pin #1 is ground. The output level will vary from approximately −20 dBm to +10 dBm depending on the distant level. This output can be used to drive the line input of a mixer or mixer/power amplifier as might be used for a multi-speaker installation.

Speaker

This is a 1/4" phone jack. The signal delivered to this circuit is the same as that to "LINE LEVEL OUT." However, the signal now goes through a power amplifier of sufficient size to drive several speakers. Depending upon the size of the external power supply used with the DT100, this amplifier can deliver as much as 40 watts into 4 ohms.

REC (Record) output

This is a 1/8" mini-jack intended to feed a tape recorder. The output is a mixture of distant and local audio with the ratio of mix controlled by the "RECORD" control on the front panel. It is also useful to feeding to auxiliary PA equipment when both sides of the teleconference need to be amplified.

Connection To The Telephone Line

Telephone connections are made via the standard modular jacks on the rear panel.

The incoming telephone line should be connected to the modular jack marked "LINE."

The modular jack marked "SET" is a loop-through connection which passes the telephone line through when the DT100 is not active. It is normally used for the connection of a desk set telephone. The telephone will be disconnected during conference operation.

Both modular jacks use the center two pins (red & green) for the audio connection.

Set-up Adjustments

Set-up adjustments of the DT100 Teleconferencing System are very simple. There are only two adjustments to make. Both require an assistant at a telephone at the distant location with whom to talk.

Note that the quality of the distant telephone makes a significant difference in the quality of sound that you will experience. A good quality electronic telephone will sound much better than a standard dial or push-button telephone that uses an old-style carbon microphone.

1. With an initial setting of the "MICROPHONE" and "SPEAKER" controls on the front panel of the DT100 at ¼ to ⅓ rotation (so you can communicate with your assistant), have your assistant speak while you adjust the "SPEAKER" control to a comfortable level for the location.
2. While sitting at a normal conference position in front of the microphone, adjust the "MICROPHONE" control so that your assistant hears you properly.
3. If you are installing a system or setting up a portable system that uses multiple microphones and speakers, it is recommended that directional microphones be used and that you try to place the speakers *behind* the microphones in their rejection zone.
4. In adjusting the relative speaker gains and microphone sensitivities, do not attempt to set them too high and assume that the digital signal processor will handle the situation. The result will be that the local and distant acoustic ducking circuits will be working too hard and you will lose full duplex operation.

   If you are using a CP8510 SmartMixer, or some other extended microphone or speaker distribution system, there will be gains of the individual components to adjust. The procedure will be generally similar and must be adapted to the situation.

   In most situations, this is all that will be required as the DT100 feedback control system will handle most problems. If the system sounds like it is hunting for control (you will recognize this situation), that means that there is an exceptionally strong acoustic coupling that needs to be corrected.

   Normal troubleshooting techniques should be employed. Gains may have to be readjusted, or balanced differently. Maybe there is a reflective surface that can be angled differently, or a speaker or microphone that can be aimed slightly differently. These are the types of things to look for.

Power Supply

In order to keep hum away from the sensitive circuitry, the DT100 uses a special, separate power supply with a center-tapped 24-volt transformer. In order to get sufficient output from the speaker amplifier, a transformer rated at least 1.5 amps should be used. This will supply about 10 watts of audio power to a 4 ohm speaker. A 1.5 amp supply is provided with the DT100.

Remote Control

The DT100 may be activated from a remote control switcher which duplicates the functions of the "CONFERENCE ON" and "CONFERENCE OFF" push-button on the front panel of the DT100. In addition, provisions are made for a "MUTE" function. At the "REMOTE" connector there is power for LEDs to indicate the "CONFERENCE ON" mode and the activation of the "MUTE" function. When the "MUTE" function is activated, **all** of the microphones connected in the system are disabled. This enables you to carry on a private conversation without it being heard at the distant end of the telephone line. To re-activate the microphones, simply push the "MUTE" push-button again.

Connections for the "REMOTE" connector on the rear of the DT100 and a schematic diagram for a remote switcher are given at the end of this manual.

When your system is configured with the Audio-Technica CP8510 SmartMixer, which plugs into the "REMOTE" connector, *remote switching* is available in a connector on the back of the SmartMixer. If you are chaining multiple SmartMixers together, the connector will be available on the last SmartMixer in the chain. The remote switching is accomplished as described above.

Operation

The DT100 is very simple to operate. In a permanent installation where the gains of the microphone and speaker circuits have been previously set, the operation can truly be called "one-button-operation." When the DT100 is used as a portable system, or one that is taken down and set up again when needed, the "MICROPHONE" and "SPEAKER" controls may have to be adjusted for optimum operation.

It is easier and less confusing to operate the DT100 system if a telephone is connected to the "SET" connector on the rear panel. Otherwise, there is no ringing indication or call-out capability.

Answering an incoming call

The telephone set will ring as in normal operation. It can be answered normally to verify that the incoming call is indeed the expected conference call. The "CONFERENCE ON" push-button is then pressed and the phone line is seized by the DT100. The system sends a short burst (less than ½ second) of white noise down the line to cause adaptation to be accomplished prior to the start of conversation. The caller will hear this short burst, but the local end of the call will not because the outputs are muted.

The incoming call may also be answered by pushing the "CONFERENCE ON" push-button, placing the conference system in operation immediately.

In order to disconnect the call, simply press the "CONFERENCE OFF" push-button. The line will be released.

The DT100 can be set to automatically disconnect from the telephone line when the distant hangs up. This is accomplished by moving two internal jumpers. Located about 1¼" behind the front panel and between the "SPEAKER" control and the "CONFERENCE OFF" LED is a contact block labelled "LOOP DET." One end is labelled "ON" and the other "OFF." The DT100 is normally shipped with both jumpers in the "OFF" position. In order to enable the auto-disconnect, move BOTH jumpers to the "ON" position.

Originating the call

Using the telephone connected to the rear of the DT100, make the telephone call to initiate the conference. Once it is verified that the other end of the conference is ready, press the "CONFERENCE ON" push-button. The system will adapt to the line as above and the conference can proceed.

As above, the phone line is released when the "CONFERENCE OFF" push-button is pressed. Or, alternatively, the DT100 will disconnect automatically when the distant hangs up.

Feedback control

The DT100 system provides large immunity to acoustic feedback within the room as well as superior cancellation of echo conditions occurring within the telephone system and/or at the other end of the conference call. This is accomplished with the acoustic ducking and override signal processing in the digital domain using a proprietary signal processing algorithm.

Regardless of the efficiency of a feedback control system, the acoustic environment of the conference location is very important to the ease and comfort with which a teleconference can be conducted. An acoustically "soft" environment, with carpeting, drapes and other soft, non-reflecting surfaces, will aid the feedback control system in the DT100. Any time that such a system can be aided and not have to "work" as hard will produce results more pleasing to the ear.

The use of directional (cardioid) microphones is highly recommended. Such microphones will tend to reduce the pickup of distracting ambient noise within the room and improve the signal-to-noise ratio at the other end of the telephone line. In addition, positioning the speakers behind the microphones, in their low sensitivity zone, will reduce the possibility of acoustic feedback.

DT100 Rear Panel Connectors

Microphone Input

Designed to accept Audio-Technica UniPoint® microphones.

TB3M receptacle; mating plug is TA3F (standard on UniPoint® and UniPlate® microphones)

Pin #1 - Ground
Pin #2 - Signal
Pin #3 - +5 VDC

Line Level Input

Standard XLR 3-pin female receptacle; mating plug is standard XLR 3-pin male plug.

Pin #1 - Ground
Pin #2 & Pin #3 - Active balanced input

Line Level Output

Standard XLR 3-pin male receptacle; mating plug is standard 3-pin female plug.

Pin #1 - Ground
Pin #2 & Pin #3 - Active balanced output

Speaker Output

Standard ¼", 2-circuit phone jack; mating plug is standard ¼", 2-circuit phone plug.

Tip - Signal
Sleeve - Ground

REC (Record) Output

Standard ⅛", 2-circuit phone jack; mating plug is standard ⅛", 2-circuit phone plug.

Tip - Signal
Sleeve - Ground

Telephone Set And Line

Standard RJ type modular telephone receptacles; mating plug is standard RJ11 or RJ14 modular telephone plug.

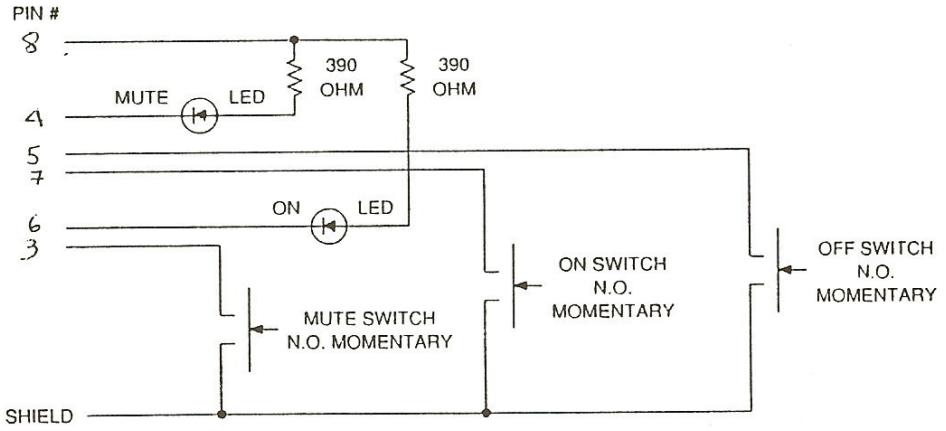
Center two leads (red and green) - Telephone signal

Remote Connector

8-pin female mini-DIN receptace. Hirose type HR212; mating plug is 8-pin male mini-DIN, Hirose type HR212-10P8PCAC300. See schematic for connector pin-out.

Pin #1 - No connection
Pin #2 - Auxiliary line level audio input - unbalanced
Pin #3 - "MUTE" switch
Pin #4 - Mute LED indicator
Pin #5 - Conference mode "OFF" switch
Pin #6 - Conference mode "ON" LED indicator
Pin #7 - Conference "ON" switch
Pin #8 - +8 VDC
Shield ring - Ground

Remote Controller Schematic Diagram



Power

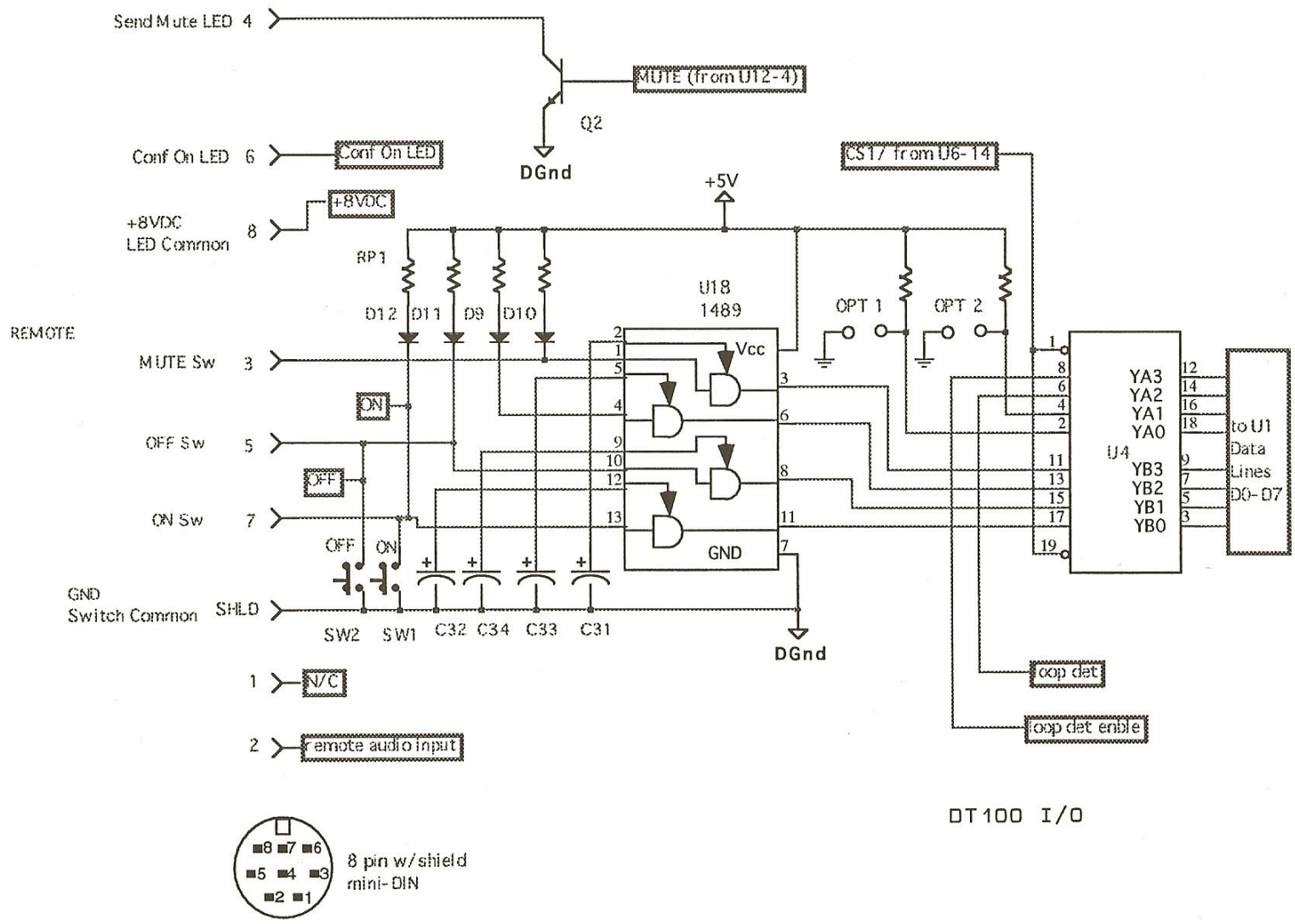
Standard DIN receptacle, female, 5-pin, 180° pattern; mating plug - standard 5-pin DIN male, 180° pattern.

Pins #1 & #3 - 24 volts AC
Pin #2 & Center tap and ground
Pins #4 & #5 - Not used

The included 1.5 amp power supply provides about 10 watts of audio power into 4 ohms.

A 2.8 amp power supply provides about 40 watts of audio power into 4 ohms.

Power supply used must be 24V center tapped, AC.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DGnd
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+8VDC
+8VDC LED Common 8
+5V
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RP1
D12 D11 D9 D10
U18
1489
OPT 1
OPT 2
REMOTE
MUTE Sw 3
ON
OFF Sw 5
OFF
ON Sw 7
OFF ON
Vcc
GND
YA3 YA2 YA1 YA0
U4
YB3 YB2 YB1 YB0
to U1 Data Lines D0-D7
GND Switch Common SHLD
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2 remote audio input
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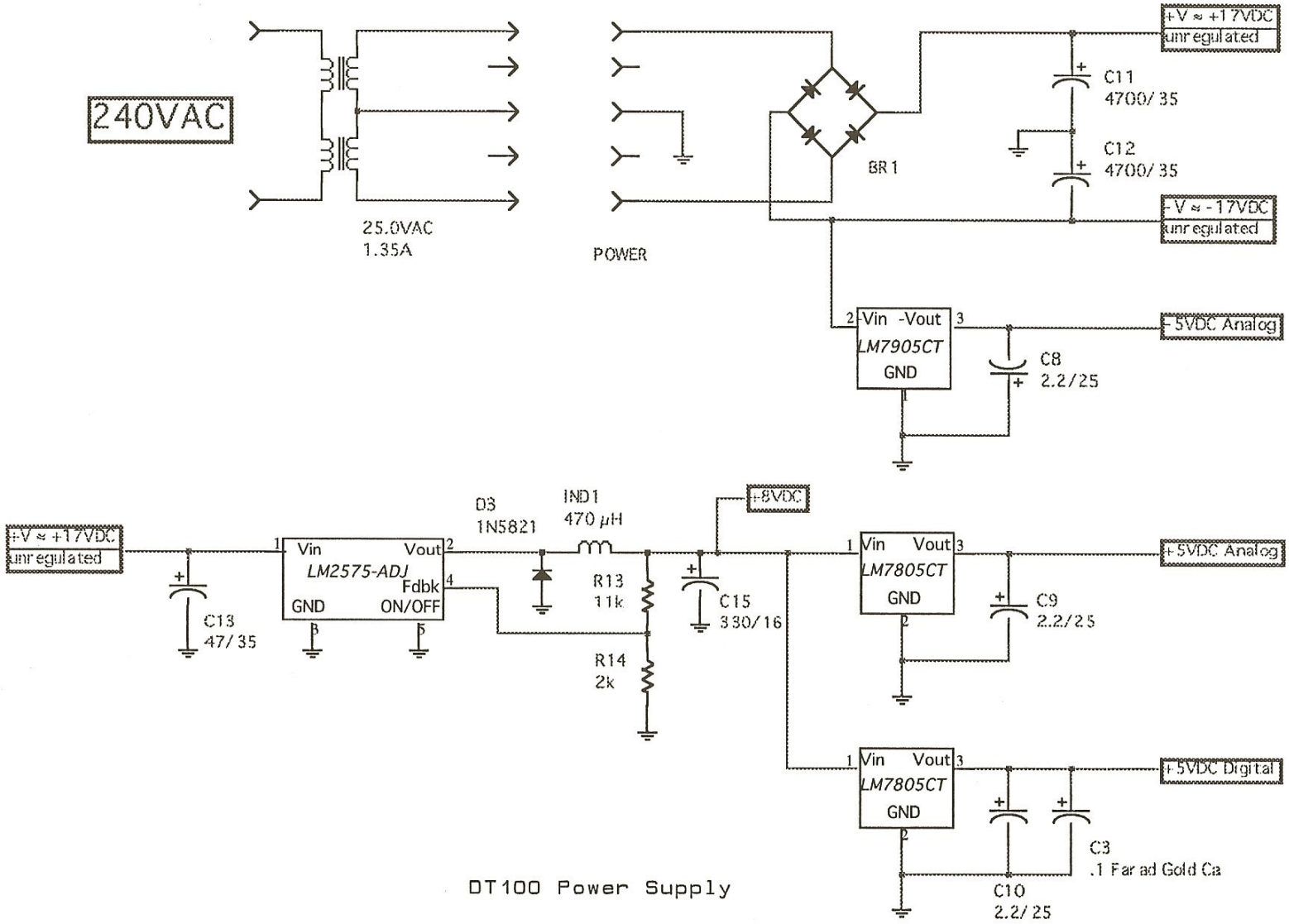
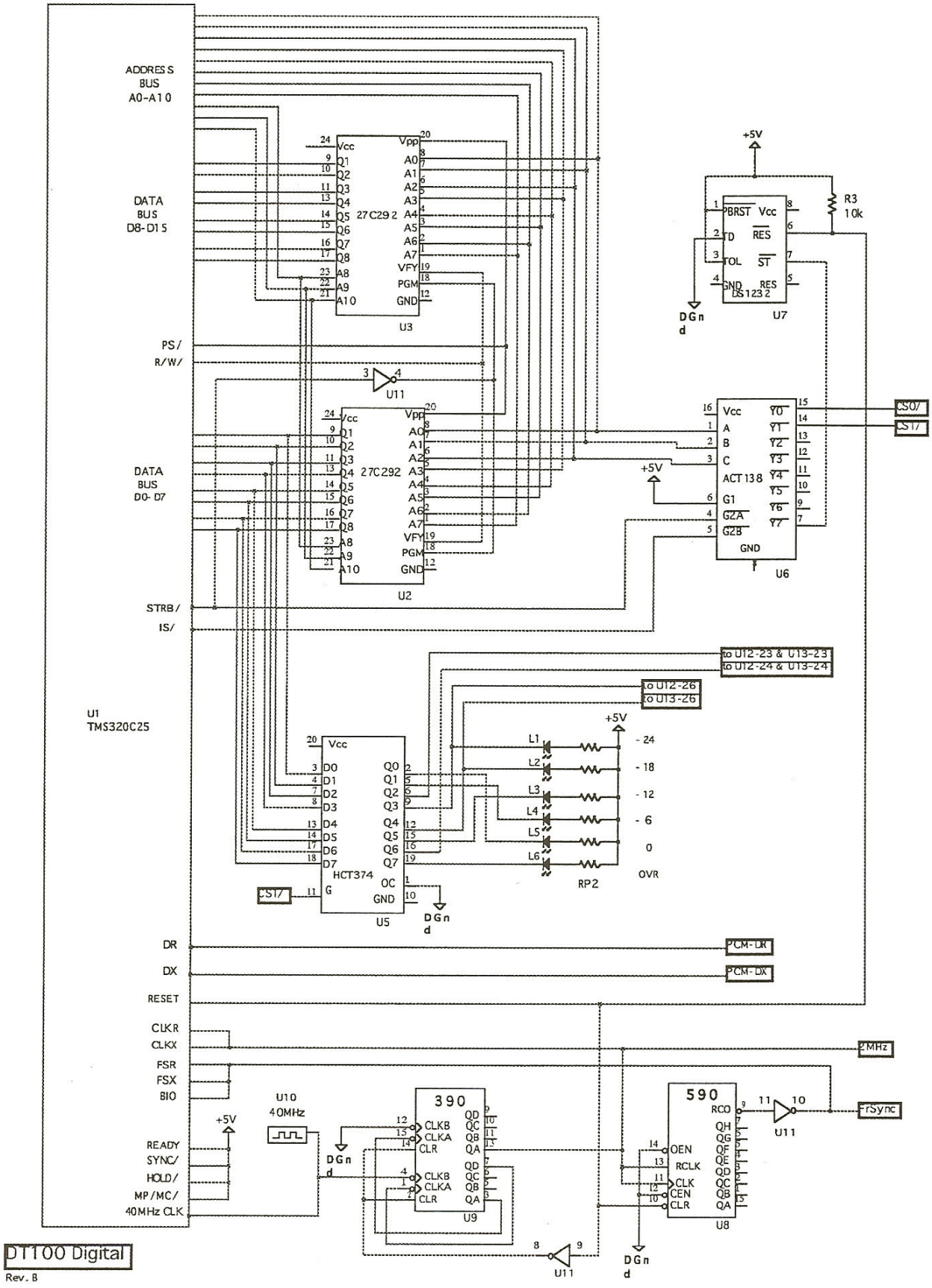
DT100 I/O



DT100 Power Supply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DT100 Digital
Rev. B