DT-232

Dial-up Controller & Universal DTMF to RS-232 Translator
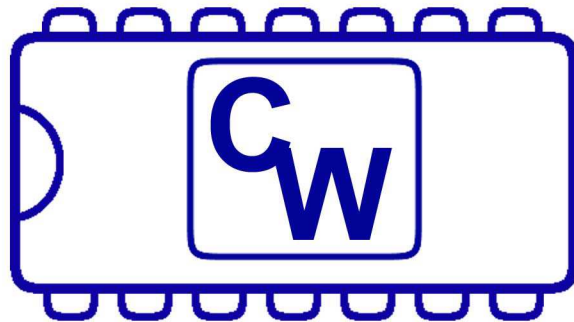
CircuitWerkes

Technical Manual

Notes:

The CircuitWerkes DT-232

Description

The DT-232 lets you interface DTMF control tones to any computer with a serial port and control devices using dry contact closures. The DT-232 receives DTMF tones from either its audio input connector or from its built-in telephone autocoupler. The DTMF tones are converted to ASCII and transmitted to the host computer.   DTMF control of four relays on the DT-232 makes it a powerful, yet inexpensive, dial-up remote control with audio pass-through capabilities.

The DT-232 has two main modes of operation: DTMF to ASCII conversion and DTMF to relay operation. Either mode can be used or both modes can be used simultaneously. When decoding DTMF tones, the DT-232 has a simple mode that outputs a preset ASCII sequence for every DTMF tone recieved. It also has a "sequence mode" in which it can decode up to nineteen DTMF sequences, ranging from 1 to 3 digits. Each sequence can output user-defined ASCII strings, and perform other functions, including operating the onboard relays. Free setup software is required to fully program the DT-232 and is included with your unit. It can also be downloaded from the support section of the www.circuitwerkes.com website.

Installation & Setup

To hook the DT-232 up to your system, connect the device up to your telephone system by plugging the telephone cord into the RJ-11 jack located on the right side of the device when looking at the back.   Connect the DT-232 to your PC using a male-to-female DB-9 cable. The cable should be connected to the DT-232's DB-9 jack, located on the left side of the device next to the power jack. The 1/4" TRS jack can be used as an audio input, as an alternative way to bring DTMF into the device, or as an audio output from the phone line. If either of these features are to be utilized, connect the appropriate piece of equipment to this jack. The audio input/output is unbalanced, with the sleeve connected to ground and the tip carrying the audio signal. Once the necessary connections have been made, plug the supplied CircuitWerkes 15-VDC, 200-mA power adapter into the wall. Then connect the barrel plug of the power adapter to the DT-232's power jack on the very left side of the circuit board. If you wish to use your own power supply, the power input for the DT-232 is 8V to 18V, a.c. or d.c.   When d.c. power is used, polarity is not important.

RS-232 outputs conform to the following standards: 9600, N, 8, 1. or 1200, N,8,1 depending on if J3c is "off" (9600) or "on" (1200).   The default is 9600baud. Be sure the host PC is also configured for 9600,N,8,1 or you will receive gibberish output.   You may select either a standard serial cable or a null modem cable by changing jumpers J1 and J2.

J4 disconnects the telephone coupler from the Audio in/out jack. When "OFF", the DT-232 has a high impedance (bridging) input at the audio jack but cannot send or receive audio from the telephone lone. This jumper must be "ON" for telephone operation.

When "ON" J8 delays detection of DTMF tones for a fraction of a second allowing greater immunity to false tripping when DTMF signalling is used over a noisy path, such as when program audio is mixed with the DTMF tones.

Default Output format

When the DT-232 is taken out of the box, it is set to operate in "simple mode". In this mode, it provides basic DTMF to ASCII conversion in the following format. The default prefix letter is "E" and the number represents the DTMF tone value received.   The prefix letter can be changed using the software.

| DTMF Input:	1	2	3	4	5	6	7	8	9	0	*	#	A	B	C	D
RS-232 Output	E1	E2	E3	E4	E5	E6	E7	E8	E9	E0	E*	E#	EA	EB	EC	ED

Software Setup & Advanced Configuration

The DT-232 includes client software that runs on your Windows based PC. The software can be used to both setup and control the DT-232. To run the software, you must first install it on your computer. To do so, double click on the DT-232 Software installer and follow the prompts.

Once the software is installed, you can run the main program. The next thing to do is select your com port and connect to the DT-232.   As soon as you connect, you should download the existing configuration, even if you plan to change it. Do *not* attempt to upload changes without download- ing first. If you have already made changes to your software configuration, just save them before downloading and then re-load them after the download.   Once you have downloaded from the DT-232, you can make your changes & upload. You can also save configurations to a local file.

The software is broken up into four main sections:

Com Port selector

DTMF sequence encoder.   Enter numbers that you want to send in here and push the "send" button

1. The top-left area is the sequence setup section Here you can set which DTMF tone, or tones will cause actions & You can also setup your actions.

2. The middle-left are the user toggles. Most of these can be set via a terminal program but are represented graphically to make them easier to use. Toggles with associated configuration settings, such as the DTMF password, inactivity timer, etc. are also presented here

3. The bottom left section is the terminal window. Serial data transmitted from the DT-232 will be visible here, including decoded DTMF tones & any responses to setup toggles.   Charac- ters entered here that match DTMF sequences will also cause that action to take place. In Serial-to-DTMF mode, digits entered will be transmitted as DTMF.
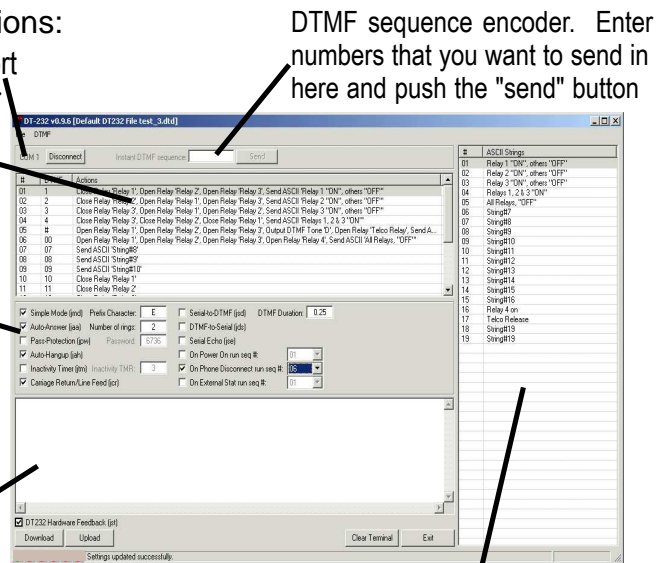
The right pane is your list of ASCII sequences. Clicking on any line lets you edit the sequence. Any ascii character can be added by entering its numeric value into the editor, even if it is not a typeable character.

User Toggles and Configuration:

The DT-232 has a number of advanced features that you can enable and/or program.
The basic setup toggles for the DT-232 can be configured using either the software or a common terminal program such as HyperTerminal. To toggle the status of the settings, a short ASCII string (case-sensitive) must be entered. The string is given below following the name of the setting. Some of the configuration switches have accompanying values, such as timers, passwords, etc. These must be set using the software. The DT-232 will remember the state of these settings even if the device is powered down:
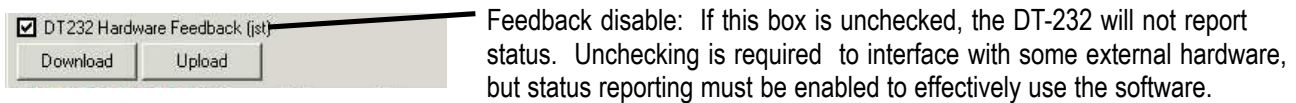
- Simple/Sequence Mode Enable/Disable - "jmd" (default: Simple mode)
  - The DT-232 ships from the factory in Simple mode. In Simple mode, the DT-232 does not monitor the received DTMF tones for predefined sequences. Every time a DTMF tone is received, an ASCII prefix ("E" by default) followed by the ASCII equivalent of the received DTMF tone is sent out on the RS-232 port.
  - Depending on the configuration of the CR/LF Insert setting as described below, Carriage-Return and Line-Feed characters may be sent out after the DTMF tone value.

  - Sequence mode is used to perform complex actions which are triggered by DTMF sequences and ASCII strings. For instance, the various commands described in the Basic Operation section are examples of these sequences and resulting actions.

- Carriage-Return/Line-Feed Insert Enable/Disable - "jcr" (default: Disabled)
  - Toggling this setting will enable or disable whether Carriage-Return and Line-Feed characters are sent out after the ASCII equivalent of the received DTMF tone, as described above.

- Inactivity Timer Enable/Disable - "jtm" (default: Disabled)
  - The inactivity timer is responsible for dropping the phone call if a DTMF tone is not received within a specified amount of time (2 minutes by default). Using the software, this value can be changed.

- Auto-Hangup Enable/Disable - "jah" (default: Enabled)
  - When this setting is enabled, the DT-232 monitors the phone line for an End-of-Call (CPC) signal from the telephone system. The DT-232 will automatically release the phone line when it sees the End-of-Call signal.
  - Some PBXs and telephone systems do not provide an End-of-Call battery reversal, which is required for auto-hangup. If this is the case for your system, you will need a CircuitWerkes CP-2 Call Progress Decoder, which generates an End-of-Call signal when a dial tone or busy signal is detected (most PBXs and telco systems will provide either a dial tone or busy signal at the end of a call if they do not provide the CPC signal). See our website for more details: www.circuitwerkes.com

- Auto-Answer Enable/Disable - "jaa" (default: Enabled)
  - This setting dictates whether the DT-232 will automatically answer the telephone after the specified number of rings (default: 1 ring).

- Status Reporting Enable/Disable - "jst" (default: Enabled)
  - With this setting enabled, changing any of the listed settings will cause the DT-232 to print a short message giving the current state of that setting. For instance, enabling the Auto-Hangup setting will cause the DT-232 to send "Auto-hangup enabled" out on the RS-232 port. If you turn off status reporting, neither a terminal nor the DT-232 software will report the current status when commands are issued. The software will state that the unit is in silent mode. Be aware thatyou can still toggle functions, even though they are not reported, so this mode is intended to only be used when connected to other serial hardware and should not be used during setup due to the risk of loosing track of what you have done.

- Serial Echo Enable/Disable - "jse" (defualt: Disabled)
  When this setting is enabled, the DT-232 will echo the incoming serial data back out on the serial connection. This mode is used with terminals without internal echo. It should be off for use with the software.

User Setup Toggles Continued:

▪ Password-Protection Enable/Disable - "jpw" (default: Disabled)
   As a security measure, the DT-232 can employ a password protection mechanism, which requires that the DTMF password be entered before any commands can be entered. When the DT-232 answers the telephone, this password must be entered. The password status will be cleared at the end of the call, so it must be entered at the beginning of every new call.
   By default, the password is "*6736*", but the DT-232 software lets you change the password.

▪ Serial-to-DTMF Enable/Disable - "jsd" (default: Disabled)
   ▪ When this setting is enabled, the DTMF will monitor the incoming serial data for valid DTMF characters, such as "1", "2", "A", "*", "#", etc. When a valid character is received, the DT-232 will generate a short DTMF tone corresponding to the received character. Please note that this is case-sensitive. For instance, to generate the "C" tone, the user could enter a capital "C" character using their favorite terminal program.

▪ DTMF-to-Serial Enable/Disable - "jds" (default: Disabled)
   ▪ This setting tells the DTMF whether to convert all received DTMF tones to their ASCII equivalents and send it to the PC through the RS-232 port. This is similar to the Simple mode, but DTMF sequences will still cause the appropriate actions. Also, a prefix will not be added, nor will the CR/LF insert.

Feedback disable: If this box is unchecked, the DT-232 will not report status. Unchecking is required to interface with some external hardware, but status reporting must be enabled to effectively use the software.

Using the DT-232 Software to set the toggles and enter setup values.

Simple Mode Prefix Character Selector

Number of incoming rings before answer

DTMF SEND duration: Sets DTMF on time for transmitted tones & spaces. Time is set in 50ms increments up to 12.75 seconds, max.

DTMF Password

DTMF Inactivity Timer: Sets inactivity delay before auto-hangup (in Minutes). Enter a zero (0) to disable the inactivity timer.

Special Functions: One sequence can be assigned to run whenever one of these special events occurs. The events that can trigger sequences are:
1. Telco disconnect. Very handy for releasing relays.
2. Power failure.
3. External status input

Sequence Mode Setup

DTMF Sequences from 1 to 3 characters each

All actions associated with each sequence

#	DTMF	Actions
01	#1#	Timed Closure '1' for '00.200' sec(s)
02	02	Send ASCII 'String#2'
03	03	Send ASCII 'String#3'
04	04	Send ASCII 'String#4'
05	05	Send ASCII 'String#5'
06	06	Send ASCII 'String#6'
07	07	Send ASCII 'String#7'
08	08	Send ASCII 'String#8'
09	09	Send ASCII 'String#9'
10	10	Send ASCII 'String#10'
11	11	Send ASCII 'String#11'

The DT-232 Sequence Editor lets you select the DTMF sequences & the actions that will be performed.

One of the great power functions of the DT-232 is its sequence mode. In sequence mode, you can define what DTMF tone, or tones, that the DT-232 will decode. There are 19 available DTMF sequences and each DTMF sequence will output a series of user-defined action steps. There can be up to seven action steps in each DTMF sequence. Actions can include the following functions:

Send ASCII - ASCII strings can be up to 32 characters long and can include any of the 255 standard ascii values.

Output DTMF Tone - Transmits a DTMF tone down the line. You can use this function to handshake with remote equipment or to control other peripheral devices. DTMF tones are only transmitted if the telco line is active.

Close Relay - Latches a relay on

Open Relay - Unlatches a relay (turns the relay "off").

Toggle Relay - Changes the current relay latch state
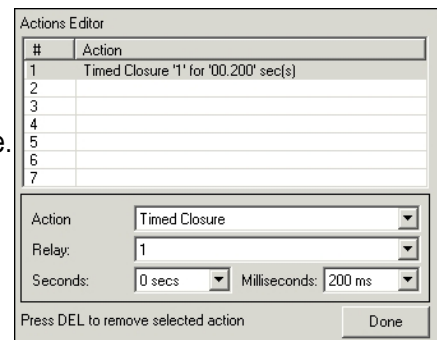
The Actions Editor

Momentary Relay - closes a relay for the duration of the last tone in the sequence

Timed Closure - Similar to momentary, this mode closes a relay for a defined period (see note).

Timed Open - When a relay is latched, this function opens it for a defined period (see note).

Pause - Do nothing for a specified period (seconds & milliseconds)

Jump Sequence - Jump to another action sequence & combine with the current one. It is possible to accidently end up in an endless loop by calling a sequence that calls the first. Be careful not to create an accidental endless loop with this function!!!!

NOTE: Timed closures & timed opens are handled differently than most other functions because they all start at the beginning of a sequence, regardless of where they are inside the sequence. For instance, a sequence comprised of: timed closure relay 1 for 2 seconds, pause 3 seconds, send ascii "relays closed", and timed closure of relay 5 for 4 seconds will actually result in relays 2 and 5 simultaneously closing at the beginning. Relay 2 will stay closed for 2 seconds, then at the 3rd second you'll get the ascii output followed by the opening of relay 5 another second later. What happened here is that the two timed closures and the pause function all started together. To create a sequential set of closures, you must use close relay#, pause, open relay#, pause, close relay ##, pause, open relay##. This second method will be executed in order. Alternatively, if the sequence starts with a closure that would be timed, you can use timed closure relay #, pause for the relay# time plus any additional time desired and then close relay##, pause, open relay##. This sequence will function the same as above but use two fewer sequense steps.

Creating ASCII Strings

There are 19 possible ASCII strings that can be stored on the DT-232.

Although there are 19 ASCII strings and there are 19 possible DTMF sequences, the two are not directly related because you are not required to assign one string to each DTMF sequence. Instead, you can assign multiple strings to one sequence if you like and none at all to another.

Each of these strings can be up to 32 characters in length. They can contain any of the 255 possible ascii characters. When entering custom strings, you simply type them directly on the line that you would like to use. When you are typing, you will also see a small box, called "Special Characters" below your current line. This is where you can enter the numeric values of characters that cannot normally be typed using a standard keyboard. Four of the most commonly used characters can be entered by using the buttons on the form.

#	ASCII Strings
01	String#1
02	String#2
03	String#3
04	String#4
05	String#5
06	String#6
07	String#7
08	String#8
09	String#9
10	String#10
11	String#11
12	String#12
13	String#13
14	String#14
15	String#15
16	String#16
17	String#17
18	String#18
19	String#19

Special Characters

ASCII Code: [   ]   Insert

Custom:

CR (13)   LF (10)

ESC (27)   Tab (8)   OK

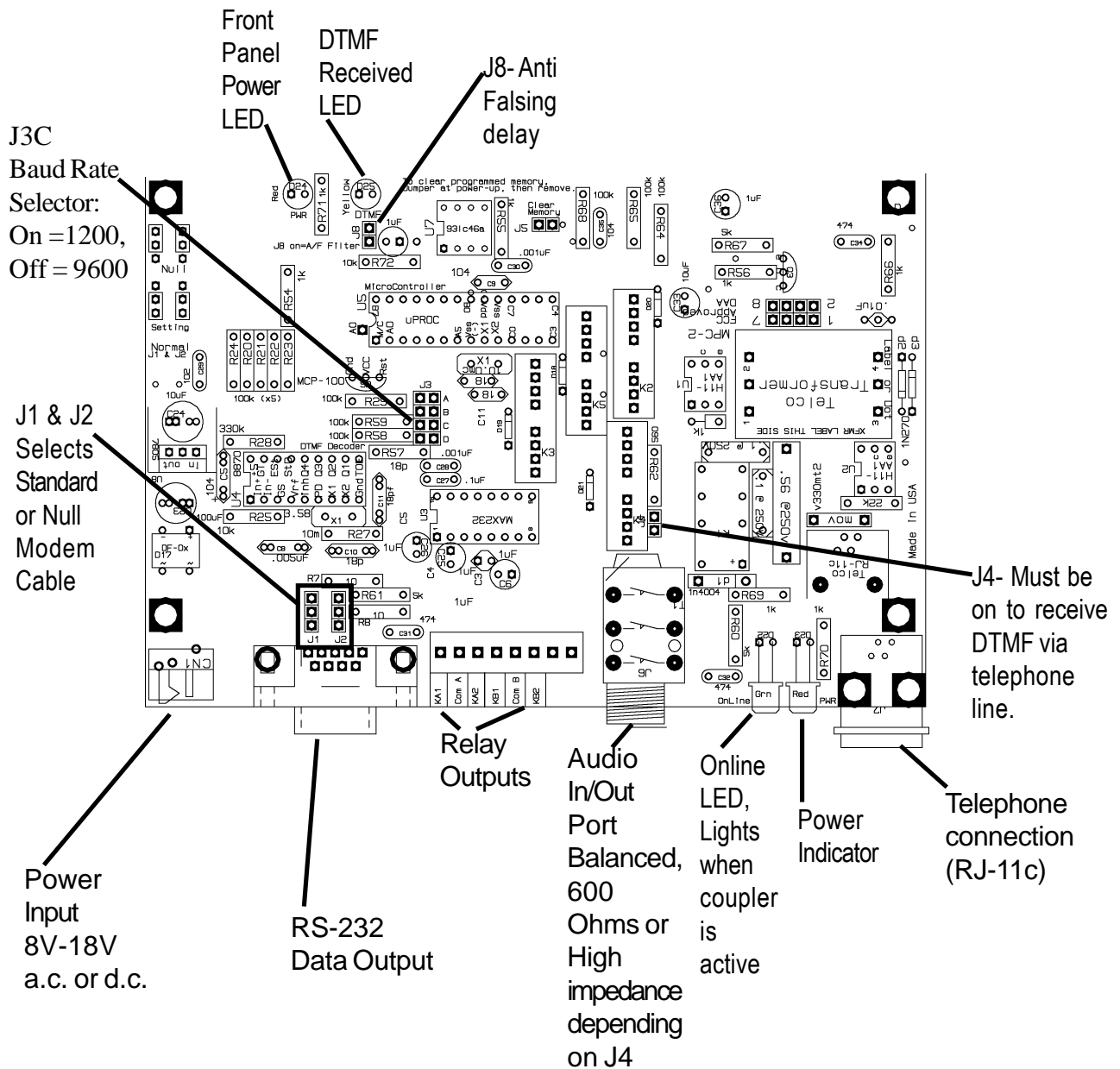## Sending DTMF Tones (Experimental Feature)

The DT-232 is capable of sending DTMF tones in two ways.   First, it can output them as part of an action sequence.   A second, experimental method is also available. You can enter DTMF values or strings of DTMF sequences into the DT-232 software play them out of the DT-232, on command, via the software. This function is experimental and is known to have bugs, particularly with DTMF sequences.

DT-232 v0.9.2 [Default DT23

File | Send DTMF

Edit DTMF Sequences

CO

Send: 1
Send: 2

#

To send instant DTMF tones, you must first enter tones, or sequences of tones into the DTMF string editor by selecting "Edit DTMF Sequences" from the "Send DTMF" drop-down menu. Once you have added DTMF tones/sequences using the editor, you can play them by clicking on the appropriate "Send" line.

The DTMF Strings are stored locally in the software. There is no preset limit on the number of DTMF strings that can be saved and played.

DTMF String Editor

#	DTMFString
1	1
2	2

Add   Done

Front Panel Power LED

DTMF Received LED

J8- Anti Falsing delay

J3C Baud Rate Selector: On =1200, Off = 9600

J1 & J2 Selects Standard or Null Modem Cable

J4- Must be on to receive DTMF via telephone line.

Telephone connection (RJ-11c)

Power Input 8V-18V a.c. or d.c.

RS-232 Data Output

Relay Outputs

Audio In/Out Port Balanced, 600 Ohms or High impedance depending on J4

Online LED, Lights when coupler is active

Power Indicator

Operation:

The telephone autocoupler will answer calls after one incoming ring. When the DT-232 answers, the caller will hear two short DTMF Tones (#,#) in succession. The DT-232 is now ready to receive DTMF inputs. ASCII output is transmitted via the serial port each time a DTMF tone is received. When the calling party hangs up, the DT-232 will also hang up and send "H", followed by a line-feed. Note: Some PaBXs and other telephone systems do not provide the necessary end-of-call battery signals that autocouplers need to disconnect. In that event, the autocoupler may answer normally, but not disconnect. If that happens, you can test the autocoupler for correct operation by disconnecting the DT-232 from the phone line. If removing the phone line from either the DT-232 or the wall jack causes the online LED to extinguish immediately, then the DT-232 is working correctly and the problem is with the phone line. One possible solution would be to add a CircuitWerkes CP-2 in front of the DT-232 to detect call progress audio tones such as busy or dial tones. Call CircuitWerkes for more information if you find yourself in this situation.

Special Circumstances - Power Failure:

There are several possible ways that a DT-232 can respond to power failures. Normally, the last relay state is saved and restored. When power is restored, the DT-232 will first restore all relays to their pre-power failure state. It will then execute any power failure sequence that you have set. Last, it will execute any sequence that you have put in place for telco disconnect, if applicable. If the power failure occurs while the unit is not on an active phone call, then the last relay state is recalled, followed only by any power up sequence that you have specified. If the unit was on an active call, then the telco disconnect sequence will usually execute unless you force the telco relay to be on as part of the power up sequence that executes prior to the telco disconnect sequence. If you do force the telco relay "ON", then the telco disconnect sequence will not run after a power failure because the line relay will be "ON" at the time its status is checked. Similarly, if the DT-232 was not on an active call at the time of the failure, the status of the telco relay would have been stored as off, so the DT-232 will not execute the hang-up sequence.

REPAIR OR SERVICE INFORMATION

In the event of the need for service or repair, call CircuitWerkes at (352) 335-6555 for a Return Merchandise Authorization number (RMA). Then carefully package the unit along with a note of the problem and send it to the address below. Clearly indicate the RMA number on the outside of the box. We cannot accept returns without an RMA. Be sure to include your address (not a PO box), telephone number and best time to call.

CircuitWerkes

ATTN: CUSTOMER SERVICE DEPT.
2805 NW 6th Street
GAINESVILLE, FL 32609

Note: Manuals are frequently updated in order to improve them. The latest version of this manual is available online at the CircuitWerkes internet web site. The address is: http://www.circuitwerkes.com/ E-mail may be sent to info@circuitwerkes.com.