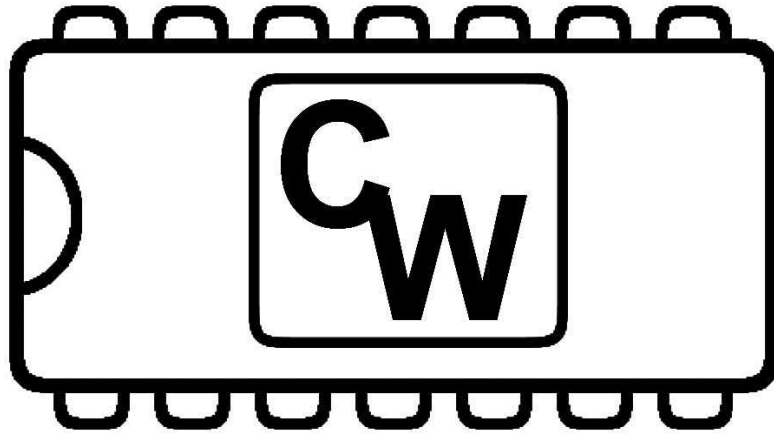


CircuitWerkes Technical Manual



TAC-5

Dial-up Remote Control and Audio Interface

CircuitWerkes

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v1.00 Firmware

Contents

OPERATIONAL OVERVIEW	3
GETTING STARTED QUICKLY	3
CONNECTIONS	4
DEFAULT SETTINGS	5
DEFAULT RELAY SETUP	6
STATUS INPUT	6
USING THE STATUS INPUT AS AN ALARM INPUT	6
OPERATION AND PROGRAMMING DETAILS	7
DIRECT ACCESS FUNCTIONS	8
SETUP MODE.	9
SETUP VARIABLES	10
ABOUT CODE SELECTION.	10
APPENDIX B	12
{ INFORMATION THE FCC MAKES US INCLUDE... }	12
CIRCUITWERKES LIMITED WARRANTY	13
REPAIR OR SERVICE INFORMATION	13

CP-1 INFORMATION (IF YOUR TAC-5 IS SO EQUIPPED) IS AT THE END OF THIS MANUAL.

Contacting CircuitWerkes

If you need technical assistance or product information for any of our products please feel free to call us at (352) 335-6555 from 10am to 6pm Eastern time Monday through Friday. You can also email us. Our email address is *info@circuitwerkes.com*. We ALWAYS value feedback from our customers!

You can download any of our current tech manuals from our Internet web site at *http://www.circuitwerkes.com/*. In addition to the manuals, current product information sheets can be found there as well.

The CircuitWerkes TAC-5 Dial-up Remote Control and Audio Interface

Thanks for buying the CircuitWerkes TAC-5 dial-up remote control and audio interface. The TAC-5 comes ready to plug in and start working; we've factory programmed it with default settings that will make it immediately useful for a large number of purposes. Of course, just about everything that has a default setting can be customized by the user if needed.

OPERATIONAL OVERVIEW

The TAC-5 is a microprocessor based remote control that lets you operate your station's equipment from anywhere there's a phone. It automatically answers the phone on a user set number of rings and waits for you to enter your password (from none to 8 digits). After entering your password, a dedicated relay closes that you can use as an external control or an unlocked indicator. Now you have complete control of the TAC-5's main relays. They can be individually programmed for momentary (leading edge or trailing edge), latching or interlocked operation. Each relay can be programmed to decode any of the 16 DTMF tones. Any relay can be tied to any other for modes such as latching and interlocked. Relays can return a beep acknowledge tone that tells you when you've activated an output. The TAC-5 allows one or two digit relay codes. Using two-digit codes prevent accidental contact closures when you're using it for remote broadcasts.

The TAC-5 has a logic level input that can be set up as a query-only status input or can be programmed to call your pager or other telephone number. The status/alarm input can dial up to 24 digits long including pauses.

The TAC-5 features an audio hybrid that allows you to control the unit while monitoring an external audio source. That makes the TAC-5 a great choice for EBS/EANS monitoring, remote controlled audio switcher, etc. Of course, an active, balanced telephone audio feed is brought out so that you can put the telephone audio on the air or into a recorder or for live remote broadcasting. Additional ground sink outputs occur when the TAC-5 seizes the phone line and when it hangs up. Programming is easily done from any DTMF telephone. The TAC-5 is compatible with the CP-1 call progress decoder option.

GETTING STARTED QUICKLY

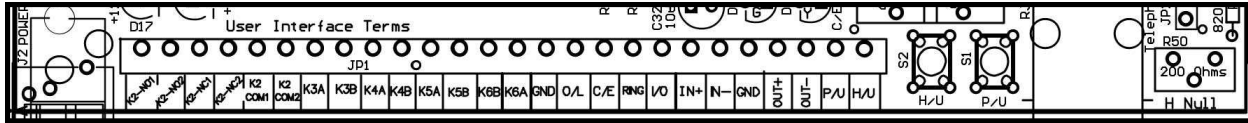
Your particular installation plans will dictate whether you want to wire or mount your TAC-5 first.

You can mount the TAC-5 in any position, just try to keep it away from high humidity or excessive heat.

The telco coupler in the TAC-5 is designed to take some abuse from phone line transients and the like, however, if you are in a lightning prone area we recommend installing a telephone line surge suppressor on the Telco Line jack of the TAC-5.

CONNECTIONS

The TAC-5 screw-terminal strip.



PWR. Connect the power supply here. If you choose to use a power supply other than the one we send with the TAC-5, be sure it can provide at least 200 mA continuously at 12 to 18 volts dc or ac. Polarity is not important.

The screw terminal connections are fairly straight-forward. From left to right:

Dual form "C" contacts from relay two. These contacts are somewhat tougher than those on relays 3 through 6; however, we do not recommend running AC line voltage, high current, or heavily inductive or capacitive loads through them. Contact a qualified electrician if you need to switch household line voltages. The contacts are marked NO1, NO2, NC1, NC2, COM1, and COM2. These markings correspond to the two sets of contacts for each relay normally open, normally closed, and common. K2's operation can be changed using jumper JP8 as follows: When JP8 "A" pins are jumpered the K2 will close anytime the TAC-5 is online. When the "B Pins" are jumpered (default) then the relay operates like the others and closes in response to DTMF commands. When JP8 is set to "C", K2 is disabled.

Normally Open contacts from relays 3-6. These contacts are rated at 10VA. If you need to switch beefy current or voltages, you will need to slave a beefy relay to any of these closures.

O/L= ONLINE. Open collector output, goes low (sinks to ground) when the TAC-5 is online

C/E = CALLEND. Open collector output, goes low (sinks to ground) momentarily when the TAC-5 hangs up.

RING. Open collector output, goes low (sinks to ground) when the TAC-5 senses an incoming ring.

I/O. TTL compatible input can be queried from your audio connection. Entering #1 will cause the unit to respond with the input's high or low status. Two beeps indicates an unchanged (internally pulled up) status, one beep indicates that the input is pulled low. Dial-out of alarms can be done using this input. Do not connect more than 5V to the input or you may damage your TAC-5.

IN + and -. Hook up the audio you want to send down the telco line here. ***If unbalanced, you can connect the (-) input to ground.*** This input is set up for a nominal 0dBm input level.

AUD OUT + and -. This is the balanced audio output of the TAC-5. It is normally incoming telco audio from the coupler/hybrid. The nominal level is factory set for peaks at around 0dBm. This level varies widely from one telco CO to another. Both outputs are active; ***do not attach either to ground.*** If your TAC-5 is equipped with a Silencer, your balanced Silencer audio comes out here.

P/U. Ground this terminal to seize the phone line. The TAC-5 will engage the line in the unlocked mode. Pushing the nearby button labelled P/U will perform the same task.

H/U. Ground this terminal to release the phone line. The TAC-5 will engage the line in the unlocked mode. Pushing the nearby button labelled H/U will perform the same task.

Telco Line Jack. This is the ONLY place to connect a phone line to your TAC-5. The line must be a standard dial-up line.

Hybrid Null pot. Use this to adjust your unit for minimum cross-talk between send audio and receive audio.

Hybrid Null Adjustment: The hybrid null adjustment potentiometer (vr1) is located just to the left of the Telco Line Jack. The purpose of nulling a phone line attached to the TAC-5 is to allow the TAC-5 to reliably receive dtmf tones from the caller while sending audio (cue return, listen line or whatever) down the line to the caller. The easiest way to set the null is to call up the TAC-5 enter the appropriate UNLOCK password and enter 66. The 66 command makes the TAC-5 generate a constant tone, for 30 seconds, which gets sent down the phone line. Listen to, or measure the audio voltage on, the AUD OUT port of the TAC-5 (not the calling telephone) while you adjust the NULL potentiometer for the lowest audio level.

DEFAULT SETTINGS

<u>Settings</u>	<u>Default value</u>	<u>User programmable options</u>
rings to answer	2	Can be set to answer on 1 to 8 rings
password checking	enabled	Sets whether the TAC-5 automatically locks at the beginning of each call and enables the 15-second hangup timer.
unlock password	6736#	Entering this password when the unit is locked will cause it to unlock which allows you to remain online and access TAC-5 functions. Entering the unlock password also clears any pending alarms. All TAC-5 passwords (lock, unlock, listen) can be up to eight characters from the phone pad. The only restriction is that # cannot be first character and must be used as the last.
lock password	5625	Places the unit in "locked" mode. While locked the TAC-5 will answer calls on the programmed ring but will not allow access to any of the command or status functions until after the UNLOCK password is entered. A locked TAC-5 will hang up on the caller if password checking (above) is enabled and if the correct unlock (or listen; see below) password is not entered within the first ten seconds of the call..
Listen password	5478#	This password merely allows the caller to remain on the line, "listening" to send audio. No control or status functions are available to a caller who enters the listen password.
Global beep enable	disabled	When this setting is enabled the individual programming of each relay determines whether a beep gets sent down the phone line after the relay fires. (two beeps on a relay OFF command) If this option is disabled no acknowledge beeps will be generated after any command.
AutoLock on hangup	enabled	When enabled the TAC-5 will automatically lock itself at the end of any call. When disabled, the TAC-5 can still be locked with the lock password.

Note: Unlock and listen passwords are always terminated by the pound (#) character.

DEFAULT RELAY SETUP

This table shows the default relay setup for the five output relays on the TAC-5.

Each relay has its own set of independently programmable parameters including one or two digit on and/or off codes, and operation mode: momentary, latching, or interlocked.

Mode 1=momentary, 2=latching, 3=interlocked-latch

Note: K1 is the line seize relay and is not a user-accessible relay.

relay #	mode	digits	oncode	offcode	beep or no beep
02	1	1	1	n/a	no beep
03	1	1	2	n/a	no beep
04	1	1	3	n/a	no beep
05	1	1	4	n/a	no beep
06	1	1	5	n/a	no beep

By default, relays do NOT beep when activated. It is very easy to change which relays beep, see setup toggles at the bottom of page 8.

By default, all Relays are momentary (mode 1), single digit activated with DTMF tones. Any relay can be programmed to respond to any DTMF tone (or sequence) and any relay can operate in any mode (latching, momentary, interlocked, etc). Changing the way relays behave is easily done by following the instructions on page 10.

Relay two is a DPDT (2 form C contacts). This relay, like all others can be latched on in one of several ways and can be used to switch balanced audio for live remotes, etc.

STATUS INPUT

The TAC-5 has one TTL compatible status input that you can "read" during your telephone call or from a programming phone. This input is pulled up on the TAC-5 (weak, 100k pullups) and accessed with code #1. If the status input is not triggered when you query it the TAC-5 will beep twice down the line. If the status input is pulled low by an external connection it will beep once.

USING THE STATUS INPUT AS AN ALARM INPUTS

The TAC-5 can dial out. If you program an alarm phone number for a status input the TAC-5 handles the input as an alarm input. It will dial out to the programmed phone number. The phone number can include pauses represented by the * character (2 seconds pause for each *). The pause character is included mainly for paging systems where you wish to dial a number, pause a few seconds for the system to answer, and then send a pager message. The unit will continue to dial out every three minutes up to 10 times (user programmable) until you enter the unlock code. You can enter the unlock code by calling the unit directly or when the unit calls you at the alarm phone number, if it is not a pager. You can also enter the unlock code with a phone attached to the programming port or with an audio feed into the aux audio input connections. See page 11 for instructions on programming an alarm dialout number for a status input.

OPERATION AND PROGRAMMING DETAILS

Your TAC-5 is controlled and programmed by DTMF tones. Control and programming functions are usually accessed by dialup phone connection

The following discussion of control and programming functions assumes you have successfully connected to the TAC-5 and have already entered the UNLOCK code (the green LED on the unit's front panel is on).

DIRECT ACCESS FUNCTIONS

These functions are available when the TAC-5 is UNLOCKED and has not been placed in SETUP mode with the SETUP code. In other words, just about anytime in normal operation, as long as the unit is unlocked.

DTMF Tone(s) Entered.				What happens
Relay Mode	ON /	Off		
02	1	n/a	M	entering '1' causes a momentary closure of relay two.
03	2	n/a	M	'2' causes a momentary closure of relay three.
04	3	n/a	M	'3' causes a momentary closure of relay four.
05	4	n/a	M	'4' causes a momentary closure of relay five.
06	5	n/a	M	'5' causes a momentary closure of relay six
				Modes: M=momentary, PM=momentary on trailing edge, I=Interlocked, L=Latching. The complete default relay table is on page 6.
		#1		"reads" status input one. Beeps twice if untriggered, once if triggered.
				Status inputs are internally pulled up (100k pullups). Pulling them low triggers them.
		66		Initiates a 30 second tone generator used for setting levels and hybrid null.
		00		Forces the TAC-5 to hang up immediately.
		9999		'9999' puts the TAC-5 in SETUP MODE. The unit will stay in setup mode until a valid setup entry is completed, or an invalid entry occurs, or if several seconds pass with no dtmf entry. A successful setup entry is followed by three quick beeps. A timeout or error ends in ten beeps.

SETUP MODE.

There are two distinct groups of setup functions: toggles, and variables. Toggles are simple software switches that generally enable or disable TAC-5 functions. Variables are storage items that you can change to make the TAC-5 better fit your needs. Dialout numbers and relay ON/Off codes are good examples.

To access SETUP functions you must first have the TAC-5 UNLOCKED and then enter the SETUP prefix, 9999. When you enter setup mode the TAC-5 beeps one long and two short beeps. A single beep follows each element of the setup sequence; and a series of three short beeps follows when the setup item is successfully stored. If you enter illegal values the unit will "error out" giving you a series of ten short beeps and exiting setup mode.

SETUP TOGGLES

prefix	toggle	
9999	20	Disables autolock of TAC-5 at pickup (see also code 32 & 33)
9999	21 (default)	Enables autolock of TAC-5 at pickup
9999	30	TAC-5 keeps relays in their last (pre-lock) states when unit gets locked.
9999	31 (default)	All relays are de-energized anytime the TAC-5 gets locked. Previously latched relays return to the "on" state when unlocked password is entered. <i>*Applies only to latched relays.</i>
9999	40 (default)	Globally turns off relay acknowledge beeps.
9999	41	Global enable of relay acknowledge beeps. Individual relay beeps can still be disabled or enabled with the 70/71 toggle below.
9999	70 <relay number>	Individually disables acknowledge beeps for relay.
9999	71 <relay number>	Individually enables acknowledge beeps for relay. Global acknowledge beep enable must be on (toggle 41) for this to work. See defaults on p6.

Resetting to Factory defaults:

If you make a critical mistake, such as programming a relay with a single digit 9 or double digit 99, you can lock yourself out of the TAC-5 because the relay will close on 9 which resets the input buffer. If that happens, you can restore factory defaults by unplugging the power, push and hold the pickup and hangup buttons together and, while holding those buttons, power the TAC-5 back on. This will erase any user programming that was previously entered.

SETUP VARIABLES

Just like the Toggles, already described, setup variables require the setup prefix. Setup variables are generally longer than toggles; we recommend that you write down your entire "setup string" before entering it. In the examples below, data between these bracket symbols <> will indicate a user-specified variable. In all setup operations relay numbers are two digits 01, 02, ..., 09, 10. For example, if a setup string includes <relay no.> you would replace that bracketed portion with 04 if you were setting up relay four.

Lock Password (default = 5625)	9999 91 <number of digits> <password> <password again> example: '9999 91 6 123456 123456' sets lock p/w to 123456
Unlock Password (default = 6736#)	9999 92 <number of digits> <password> <password again> example: '9999 92 3 505 505' sets the unlock password to 505
Listen Password (default = 5478)	9999 93 <number of digits> <password> <password again> example: '9999 93 4 90*# 90*#' sets the listen password to 90*#
Setup Password	9999 * <password> <password again>. Must be 4 digits & cannot start with #.
Answer Ring Count (default = 2)	9999 94 <rings> # sets the number of rings to answer on. '#' signifies end. example: '9999 94 6 #' sets the TAC-5 to answer after six rings
Special Functions	9999 95 <Sequence Number><Number of Digits><Sequence><Sequence again> Action Sequence is stored Sequence number indicates which action sequence is modified. Number of digits can be maximum 2. Two user programmable 2 digit functions are allowed Sequence 1: Unit hangs up on entering these sequence Default value: 00 Sequence 2: Unit produces a 1kHz Null tone for 15 secs. Default value: 66
Inactivity Hangup (default = 0)	9999 97 <minutes> # Hangs up the TAC-5 if there are no DTMF tones received in programmed number of minutes (up to 99). Set to 0 disables the feature.
Alarm Dial Number (default = none set)	9999 8 <status/alarm input number (always 1)> <number to dial> # Sets up a status input to dial the programmed number if the status/alarm input is pulled low. # ends the dial string; * in the dial string equals a 2 second pause. Up to 24 digits are allowed in the dial string. example: '9999 8 1 555 1234 #' would set status /alarm input one up to dial 555-1234 if the input is triggered. The unit would then send an alarm identifier string of dtmf tones (in case the unit is dialing a pager) that would effectively identify which status/alarms had been triggered. The format of the identifier string is two leading zeroes and the number(s) of the alarm(s) triggered. In this case '001' would be dialed by the TAC-5 a few seconds after the programmed number was completely dialed. The identifier string will repeat itself every six seconds until either the unlock code is entered (clearing all pending alarms) or the receiving end of the dialout hangs up.

See "USING THE STATUS
INPUTS AS ALARM INPUTS"
on page 6 for operational
details.

Setup Variables Continued

Changing Relay
Activation /
Deactivation codes

9999 <relay number> <mode> <1 or 2 digits> <On-code> <Off-code> <P/U action> <Lock Action>
This setup string will define how and when a particular relay acts. The setup string specifies five things:

1. <relay number> this is the two-digit number (02-06) of the desired relay.
2. <mode> this is how the relay acts. See NOTE A below.
 - '1' = momentary. The closure occurs at leading edge of detected tone & will last approximately 200 milliseconds or for the duration of the tone (whichever is longer). No OFF-code is required (or accepted) for relays with mode=1 or 4.
 - '2' = latching. The closure occurs when the ON-code is received and remains on until the OFF-code is received.
 - '3' = Interlocked. All relays that are set up as interlocked act much like latching relays except that only one interlocked relay will be allowed ON at any time. Activating an interlocked relay will turn off any other interlocked relay that was ON. The off code on an interlocked relay can also be used to turn it off.
 - '4' = Momentary on trailing edge of tone. 200 millisecond duration.
3. <1 or 2 digits> enter a '1' for setting up a single digit code or a '2' for a two digit code. This is the length for the Oncode and (if applicable) the Off-code.
4. <On-code> the one or two digit activation code for the relay. Can be any digit(s) on the standard telephone keypad including * and #. A-D in the extended dtmf set can also be used.
5. <Off-code> this dtmf digit or pair of digits deactivates the relay in question. This applies only to latching or interlocked relay modes. Just like the On-code, any valid dtmf tone (including A-D) can be in the Off-code. There is no Off-code for a momentary relay.
6. <P/U Action> This defines how the relay behaves at pick-up. Options are zero (0), one (1) and (2) two. Zero is take no action. One is activate relay. If the relay is a latching relay, it will then latch on. Two is on at unlock. Similar to 1, the relay energizes when the unlock code is entered rather than directly at pickup. Interlocked relays cannot turn on at pickup..
7. <Lock Action> Latching & Interlocked relays can behave in one of three ways on lock.
 0. Relays can unlatch and forget thier prior states. These relays will always be off at the start of every call and when latched on, will remain so only until the end of the call.
 1. They can unlatch (if on at lock) and remember their state. When the TAC-5 is unlocked the next time, they will return to the ON state if they were previously ON at hang-up.
 2. They can do nothing, remaining in their last state were already on when the last call ended.

Note: momentary relays (mode 1 & 4) have no action upon lock, only at pickup.

Please Read 'ABOUT
CODE SELECTION'
below.

IMPORTANT NOTE ABOUT CODE SELECTION (AKA CHOOSING WHICH DTMF TONES ACTIVATE YOUR RELAYS)

Relays can have one or two digit codes. Passwords can be up to eight digits in length. *Care must be taken to avoid conflicts between programmable passwords, programmable relay codes, and preset access codes for things like checking status inputs and generating a test tone.* The preset (non-programmable) features are grouped under a common first digit, the pound symbol <#>. You cannot start programmable codes or passwords with #. You must avoid selecting passwords and relay codes that conflict with each other. For example, the default relay code for relay one is simply <1>. If any of your programmable passwords are changed so that their first digit is a <1>, the unit will never "see" the password. The <1> will fire off relay one and the next digit will be considered the first digit of the next code.

APPENDIX B

{INFORMATION THE FCC MAKES US INCLUDE... }

NOTIFICATION TO THE TELEPHONE COMPANY

This equipment complies with Part 68 of the FCC Rules. You will find the label located on the solder side of the PCB, and/or on the bottom or back of the equipment enclosure if device is enclosed. This label contains the FCC Registration Number and Ringer Equivalence Number (REN) for this equipment. You must, upon request, provide this information to your telephone company. The REN is useful to determine the quantity of devices you may connect to your telephone line and still have all of those devices ring when your telephone number is called. In most, but not all areas, the sum of the RENs of all devices connected to one line should not exceed five (5.0). To be certain of the number of devices you may connect to your line, as determined by the REN, you should contact your local telephone company to determine the maximum REN for your calling area.

JACK TYPES NEEDED

Connection to the telephone network should be made by using standard modular telephone jack type RJ11C.

INCIDENCE OF HARM

If your telephone equipment causes harm to the telephone network, the telephone company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice is not practical, you will be notified as soon as possible. You will be informed of your right to file a complaint with the FCC.

RIGHTS OF THE TELEPHONE COMPANY

Your telephone company may make changes in its facilities, equipment, operations or procedures that could affect the proper functioning of your equipment. If they do, you will be notified in advance to give you an opportunity to maintain uninterrupted telephone service.

MALFUNCTION OF THE EQUIPMENT

In the event this equipment should fail to operate properly, disconnect the unit from the telephone line. Try using another FCC approved telephone in the same telephone jack. If the trouble persists, call the telephone company repair service bureau. If the trouble does not persist and appears to be with this unit, disconnect the unit from the telephone line and discontinue use of the unit until it is repaired. Please note that the telephone company may ask that you disconnect this equipment from the telephone network until the problem has been corrected or until you're sure that the equipment is not malfunctioning.

COIN SERVICE OR PARTY LINE USE

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

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 describing the problem and send it to the address below. Include your telephone number, address and e-mail, if available, on your note.*** 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

E-MAIL: info@circuitwerkes.com
WEB SITE: www.circuitwerkes.com

CIRCUITWERKES LIMITED WARRANTY

This product is warranted against defects for two years from date of purchase from CircuitWerkes and CircuitWerkes authorized distributors. Within this period, we will repair it without charge for parts and labor. Proof of purchase-date required. Warranty does not cover transportation costs, or a product subjected to misuse, accidental damage, alteration (except as authorized by CircuitWerkes), improper installation, or consequential damages.

Except as provided herein, CircuitWerkes makes no warranties, express or implied, including warranties of merchantability and fitness for a particular purpose. Some states do not permit limitation or exclusion of implied warranties; therefore, the aforesaid limitation(s) or exclusion(s) may not apply to the purchaser. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

Notes: