

CT-2 and CT-3 Channel Taggers

OPERATION MANUAL



TRILITHIC
INNOVATIVE ENGINEERING

Trilithic Company Profile

Trilithic is a privately held manufacturer founded in 1986 as an engineering and assembly company that built and designed customer-directed products for telecommunications, military and industrial customers. From its modest beginnings as a two-man engineering team, Trilithic grew over the years and broadened its offerings of RF and microwave components by adding broadband solutions to its product line. This was accomplished with the acquisition of components manufacturer Cir-Q-Tel and instruments manufacturer Texscan.

Today, Trilithic is an industry leader providing telecommunications solutions for major broadband, RF and microwave markets around the world. As an ISO 9000:2001 certified company with over 40 years of collective expertise in engineering and custom assembly, Trilithic is dedicated to providing quality products, services and communications solutions that exceed customer expectations.

Trilithic is comprised of three major divisions:

- **Broadband Instruments & Systems**
Offers test, analysis and quality management solutions for the major cable television systems worldwide.
- **RF Microwave Components**
Provides components and custom subsystems for companies specializing in cellular, military and other wireless applications.
- **Emergency Alert Systems**
Leading supplier of government-mandated emergency alert systems used by HFC service providers.

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General Information

Helpful Website

The following website contains general information which may be of interest to you:

<http://www.trilithic.com>

Trilithic's website contains product specifications and information, tips, release information, marketing information, Frequently Asked Questions (FAQs), bulletins and other technical information. You can also check this website for product updates.

Where to Get Technical Support

Trilithic technical support is available Monday through Friday from 8:00AM to 5:00PM EST. Callers in North America can dial 1-317-895-3600 or 1-800-344-2412 (toll free). International callers should dial 1-317-895-3600 or fax questions to 1-317-895-3613. You can also e-mail technical support at techsupport@trilithic.com.

For quicker support response when calling or sending e-mail, please provide the following information:

- Your name and your company name
- The technical point of contact (name, phone number, e-mail)
- The CT-2 or CT-3 serial number
- A detailed description of the problem you are having

How this Manual is Organized

This manual is divided into the following chapters:

- Chapter 1, “General Information” provides Trilithic contact information and describes how this Operation Manual is structured.
- Chapter 2, “CT-2 & CT-3 Introduction” describes what the CT-2 & CT-3 are and what they do. This chapter discusses the practical application of the CT-2 & CT-3. Finally, this chapter will also explain the connections and controls of the CT-2 & CT-3.
- Chapter 3, “CT-2 & CT-3 Installation” describes the steps needed to install the CT-2 & CT-3.
- Chapter 4, “CT-2 & CT-3 Setup” describes the steps needed to perform the initial configuration of the CT-2 & CT-3 and describes the steps needed to perform periodic calibration of the CT-2 & CT-3.
- Chapter 5, “Specifications” shows the technical specifications of the CT-2 & CT-3.

Conventions Used in this Manual

This manual has several standard conventions for presenting information.

- Connections, Menus, menu options, and user entered text and commands appear in **bold**.
- Web and email addresses appear in *italics*.



Note: A note is information that will be of assistance to you related to the current step or procedure.



CAUTION: A caution alerts you to any condition that could cause a mechanical failure, potential loss of data, or personal injury.

Precautions



CAUTION: Do not use the CT-2 or CT-3 in any manner not recommended by the manufacturer.



CAUTION: The CT-2 or CT-3 may not operate properly in the presence of an extremely high electromagnetic field.

CT-2 & CT-3 Introduction

This Chapter:

- Describes the purpose of the CT-2 and CT-3.
- Gives an overview of the features and operation modes of the CT-2 and CT-3
- Gives a guided tour of the CT-2 and CT-3

What are the CT-2 and CT-3 Channel Taggers?

The Trilithic CT-2 or CT-3 Channel Tagger is a headend-mounted instrument used with Trilithic's leakage receivers to help identify leakage sources in overbuilt areas and increase immunity to interference.

What do the CT-2 and CT-3 Channel Taggers do?

When several CATV systems operate in the same area, it is often difficult to determine which system is the source of a detected leak. The CT-2 or CT-3 is designed to deal with the problem of leakage identification in dual cable or overbuilt situations.

The CT-2 or CT-3 solves the problem of determining which cable is leaking by attaching a low frequency tag to the leakage carrier on the cable system.

Trilithic leakage receivers with tag detection including the Super Plus, Seeker, and Seeker Lite can be set to alarm only when the leakage signal has been tagged to insure the leak is from your system.

The tagged signal from the CT-2 or CT-3 also causes a distinctive audible response in all Trilithic leakage receivers. Trilithic leakage receivers generate an audible tone that varies in pitch depending on the leakage strength. When the CT-2 or CT-3 tags a leak, it causes this audible tone to rise and fall in pitch at a rate of 3 or 20 oscillations per second.

If you do not hear this fluctuating tone, you know that the leak did not originate in your system.

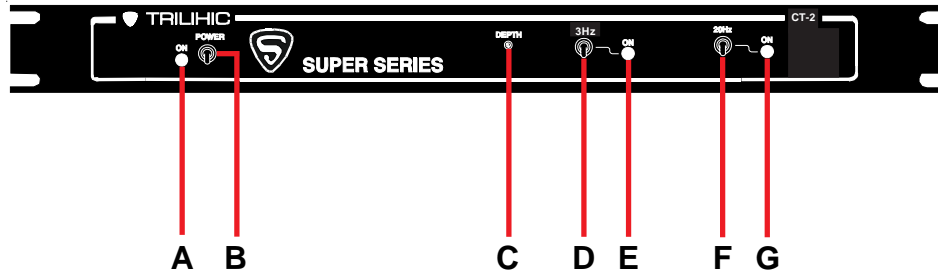
Application of the CT-2 and CT-3 Channel Taggers

Used as a system with a Trilithic leakage receiver, the CT-2 and CT-3 eliminates all “false alarm” triggers. The CT-2 and CT-3 provide the following features:

- Tags carrier used for leakage measurement for easy identification.
- Provides dual frequency *tags* of 3 Hz or 20 Hz
- Is compatible with Trilithic leakage receivers including Searcher Plus, Super Plus, Seeker, and Seeker Lite.
- The CT-2 is non interfering because its low frequency modulation is removed easily by the customer's TV automatic gain control.
- The CT-3 provides a built-in leakage carrier source.
- Is simple to install and operate.

Overview of the CT-2 Channel Tagger

Front Panel View



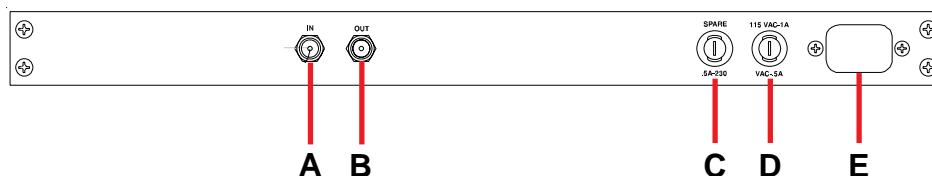
- A. **ON** - Power Indicator LED (Green)
This LED will illuminate when the unit is ON.
- B. **POWER** - Power Switch
This switch will turn the unit ON/OFF.
- C. **DEPTH** - 3 Hz Modulation Depth Adjustment
This adjustment is set at the factory with the proper setting for the 3 Hz modulation depth.
- D. **3 Hz** - 3 Hz Modulation ON/OFF switch
This switch is used to turn the 3 Hz modulation ON/OFF.
- E. **ON** - 3 Hz Modulation Indicator LED (Green)
This LED will illuminate when the 3 Hz modulation is ON.
- F. **20 Hz** - 20 Hz Modulation ON/OFF switch
This switch is used to turn the 20 Hz modulation ON/OFF.



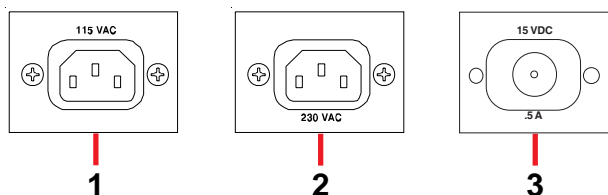
Note: 20Hz frequency is standard. Other frequencies are available. Contact factory for more information or see the Modulation Frequency Adjustment Section.

- G. **ON** - 20 Hz Modulation Indicator LED (Green)
This LED will illuminate when the 20 Hz modulation is ON.

Rear Panel View



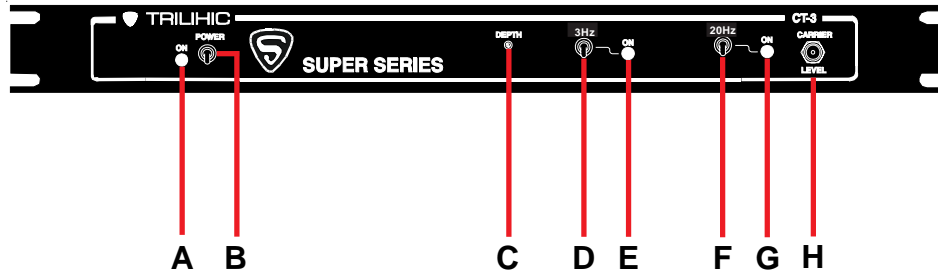
- A. **IN** - RF Input Connection
- B. **Out** - RF Output Connection
- C. **SPARE .5A-230** - Spare .5 Amp 230 VAC Fuse (**NOT INCLUDED** on European Models)
- D. **115 VAC-1A, VAC-.5A** - Either a 1 Amp 115 VAC Fuse or .5 Amp 230 VAC Fuse
The type of fuse will depend on the line voltage of the device (**NOT INCLUDED** on European Models)
- E. Power Supply - The CT-2 includes one of the following power connectors:



1. **115 VAC** - AC Power Connector using 115 VAC 1A line voltage. This option includes a built-in transformer which is set to the specified line voltage at the factory.
2. **230 VAC** - AC Power Connector using 230 VAC .5 A line voltage. This option includes a built-in transformer which is set to the specified line voltage at the factory.
3. **15 VDC .5A** - DC Power Connector using 15 VDC .5 A voltage. This option includes an external power cube that may be used with AC MAINS of 220 to 240 VAC 10% 50/60 Hz without needing to make any adjustments.

Overview of the CT-3 Channel Tagger

Front Panel View



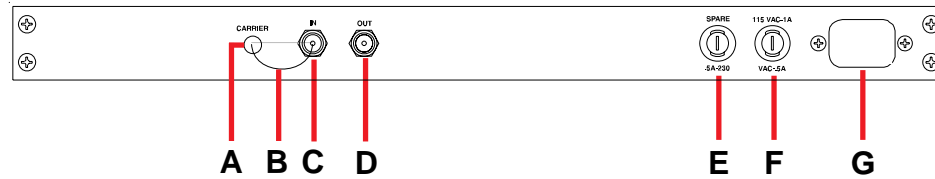
- A. **ON** - Power Indicator LED (Green)
This LED will illuminate when the unit is ON.
- B. **POWER** - Power Switch
This switch will turn the unit ON/OFF.
- C. **DEPTH** - 3 Hz Modulation Depth Adjustment
This adjustment is set at the factory with the proper setting for the 3 Hz modulation depth.
- D. **3 Hz** - 3 Hz Modulation ON/OFF switch
This switch is used to turn the 3 Hz modulation ON/OFF.
- E. **ON** - 3 Hz Modulation Indicator LED (Green)
This LED will illuminate when the 3 Hz modulation is ON.
- F. **20 Hz** - 20 Hz Modulation ON/OFF switch
This switch is used to turn the 20 Hz modulation ON/OFF.



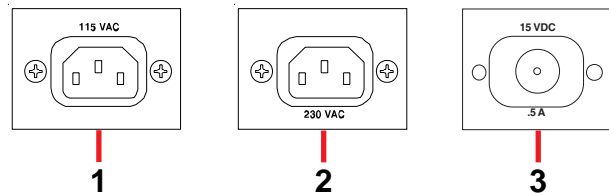
Note: 20Hz frequency is standard. Other frequencies are available. Contact factory for more information or see the Modulation Frequency Adjustment Section.

- G. **ON** - 20 Hz Modulation Indicator LED (Green)
This LED will illuminate when the 20 Hz modulation is ON.
- H. **CARRIER LEVEL** - Carrier Level Adjustment
This control is used to adjust the carrier output level.

Rear Panel View



- A. **CARRIER** - Carrier Output Connection
- B. Jumper Connection from **CARRIER** to **IN**
- C. **IN** - RF Input Connection
- D. **Out** - RF Output Connection
- E. **SPARE .5A-230** - Spare .5 Amp 230 VAC Fuse (**NOT INCLUDED** on European Models)
- F. **115 VAC-1A, VAC-.5A** - Either a 1 Amp 115 VAC Fuse or .5 Amp 230 VAC Fuse. The type of fuse will depend on the line voltage of the device (**NOT INCLUDED** on European Models)
- E. Power Supply - The CT-3 includes one of the following power connectors:



1. **115 VAC** - AC Power Connector using 115 VAC 1A line voltage. This option includes a built-in transformer which is set to the specified line voltage at the factory.
2. **230 VAC** - AC Power Connector using 230 VAC .5 A line voltage. This option includes a built-in transformer which is set to the specified line voltage at the factory.
3. **15 VDC .5A** - DC Power Connector using 15 VDC .5 A voltage. This option includes an external power cube that may be used with AC MAINS of 220 to 240 VAC 10% 50/60 Hz without needing to make any adjustments. MAINS of 220 to 240 VAC 10% 50/60 Hz without needing to make any adjustments.

CT-2 & CT-3 Installation 3

This chapter:

- Describes the installation of the CT-2 and CT-3

Installing the CT-2 or CT-3

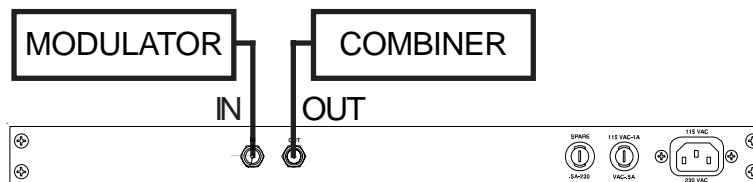
The following section explains the procedure used to install the CT-2 or CT-3. In order to properly setup the CT-2 or CT-3 the following steps must be completed in this order. Do not skip any steps.

1. Select a suitable rack panel location near the modulator for the desired leakage channel and mount the CT-2 or CT-3 in the rack using four retaining screws.
2. Connect the device to AC power.

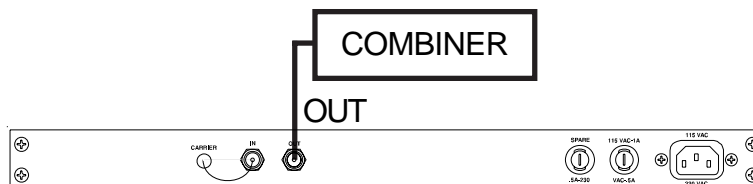


CAUTION: Be sure to verify whether the AC line voltage is correct for the device or damage may occur.

3. Connect the devices as shown.
 - A. For the CT-2, connect the device between the modulator and combiner as shown below.



- B. For the CT-3, connect the device to the combiner as shown below.



4. For the CT-3, adjust the CARRIER LEVEL to be +1.5 dB below the adjacent video carrier level.



Note: This 1.5 dB compensates for the leakage receiver video/cw peak detector efficiency.

CT-2 & CT-3 Setup

This chapter:

- Describes the setup of the CT-2 and CT-3

Setup Overview

The CT-2 and CT-3 are broadband devices that can “tag” any carrier in the aircraft band by placing it between the carrier source and the headend combiner.

If you are using a Trilithic leakage receiver with tag detection such as the Super Plus, Seeker, or Seeker Lite, you can use the 20 Hz setting to do special detection procedures. The 20 Hz internal adjustment has been set specifically for use with these receivers. If you are using a leakage receiver without tag detection, use the 3 Hz setting. You **CANNOT** use the 3 Hz and 20 Hz settings together when you are using a mix of leakage receivers.

Setup Procedure

Selecting Modulation Frequency

The unit comes from the factory ready to use, but the unit will need to be set to use a 3Hz or 20 Hz tagging frequency.

- If using a leakage detector without tag detection such as the Searcher or Searcher Plus, select 3 Hz. **DO NOT** use this setting with leakage receivers that have tag detection.
- If using a Trilithic leakage receiver with tag detection such as the Super Plus, Seeker, or Seeker Lite, select 20 Hz.



Note: Typically, receivers with tag detection will not be used with the 3 Hz frequency. The 20 Hz frequency is the setting which activates the features of these receivers.

- If using a leakage receiver with tag detection along with other types of leakage receivers, select 20 Hz.
- Select the proper modulation frequency by toggling the 3 Hz or 20 Hz switch on the front panel. The corresponding LED should be illuminated, indicating that the modulation is ON.

Adjusting 3 Hz Modulation Depth

The CT-2 and CT-3 should come from the factory with the proper setting for the 3 Hz modulation depth, but in some cases you may desire more or less 3 Hz modulation. You can use one of the following to achieve this:

- Spectrum analyzer and a leakage receiver
- Analog signal level meter

Spectrum Analyzer Method

Follow this procedure if using a spectrum analyzer and a leakage receiver.

1. Connect the analyzer to a system test point after the combiner.
2. Tune to the leakage carrier and set the analyzer to zero span.



Note: Use an IF bandwidth setting between 200 kHz and 300 kHz.

3. Observe the carrier amplitude, and slowly adjust the unit's 3 Hz **DEPTH** control. Start at the control's counterclockwise stop and adjust to a modulation depth of approximately 3 dB.



Note: If necessary, you can enhance the audibility of the tag by increasing the modulation depth with the 3 Hz **DEPTH** control.



Note: When the CT-2 is used with a video carrier, we recommend that you limit the maximum setting to a depth of 3 dB.

Analog Signal Level Meter Method

Follow this procedure if using an analog signal level meter.

1. Connect the analog signal level meter to a system test point after the combiner.
2. Tune to the leakage carrier.
3. Observe the carrier amplitude, and slowly adjust the unit's 3 Hz **DEPTH** control. Start at the control's counterclockwise stop and adjust to a modulation depth of approximately 3 dB, which will be indicated by the meter needle slowly varying by 3 dB.



Note: If necessary, you can enhance the audibility of the tag by increasing the modulation depth with the 3 Hz **DEPTH** control.



Note: When the CT-2 is used with a video carrier, we recommend that you limit the maximum setting to a depth of 3 dB.

Modulation Frequency Calibration

Trilithic's **CT-2** and **CT-3** channel tagging devices require periodic calibration. This ensures proper operation with Trilithic's signal leakage detectors which use tagged signals. Some leaks may not be detected if the CT-2 or CT-3 is mis-calibrated.

The CT-2 and CT-3 "tag" the signal used for leakage testing by adding one or two sub-audible modulations. The lower frequency modulation (about 3 Hz) is used with Trilithic's **Searcher Plus** and is not critical. However, the higher frequency modulation gives the **Super Plus, Search Lite, Seeker, and Seeker Lite** leakage detectors their immunity to "false alarms".

This higher tagging modulation can be set to any frequency between 10 and 20 Hz. The chosen frequency must closely match that of the leakage detector or leaks will not be detected properly. You should test the higher tagging frequency of the CT-2 and CT-3 at least once a year to ensure proper operation.

There are two ways to verify and adjust the modulation frequency. You can send the device to Trilithic or you can make the adjustment at the installation site.

Equipment Required

When adjusting the modulation frequency, the following equipment is needed:

- A frequency counter which can measure frequencies in the 10 to 20 Hz range with a resolution of 0.01 Hz.



Note: A frequency counter with a high input impedance of greater than or equal to 1 M Ω is recommended. However, you may also use a frequency counter with a 50 Ohm input provided that you use a 1x probe that has an internal series resistance of 0.5 to 10 K Ω and a sensitivity of -30 dBm or greater.

- Phillips screwdriver

Calibration Procedure

Use the following procedure to make the calibration adjustments:

1. Remove the nine (9) screws which secure the unit's top cover. Remove the cover.
2. Connect the power cord and turn the unit's power ON.



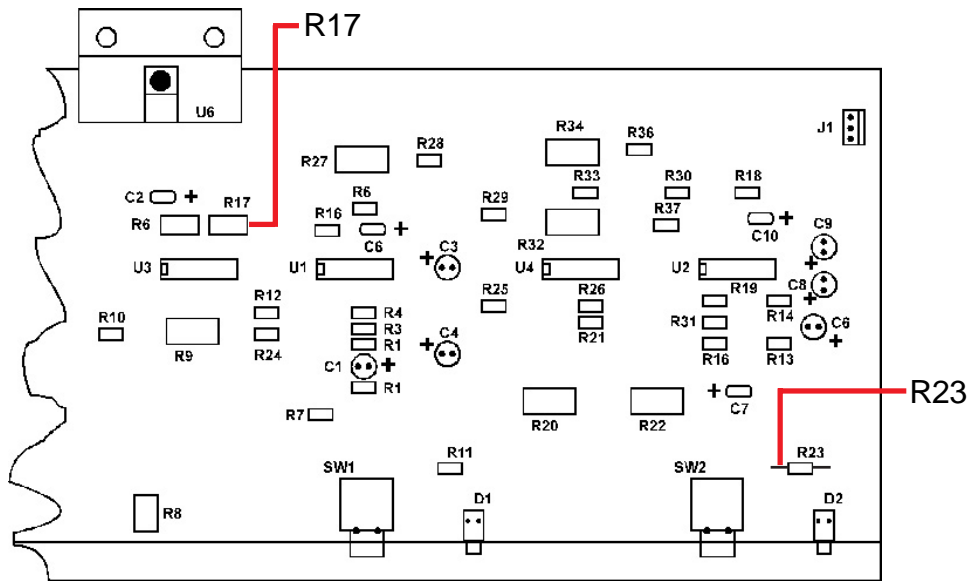
Note: Allow the unit to warm up for at least five minutes before proceeding with the modulation frequency adjustment.



CAUTION: Use proper care when working with active electronics or exposed line voltage.

3. Turn on the **20 Hz** switch.
4. Using a 1x probe, connect the Frequency Counter to the left end of R23. The frequency counter should indicate the proper modulation frequency within a tolerance of ± 0.05 Hz.

5. If necessary, tune R17 (the high frequency adjustment control) in small increments until the frequency counter indicates the proper frequency ± 0.05 Hz. (Turn clockwise to increase the frequency.)



6. Disconnect the frequency counter. Turn the unit's power off and disconnect the power cord.
7. Replace the top cover and install the cover screws.

CT-2 Specifications

Modulation:	Sine Wave
Modulation Rate:	Selectable 3 Hz or 20 Hz (Other frequencies available as an option)
Depth of Modulation:	Settable, 0.5 to 5 dB (3 Hz only) 20 Hz fixed at 3 dB
Input/Output Impedance:	75 Ohms, nominal
Power:	115 VAC, 230 VAC, or DC with 230 VAC charge cube (setup at the factory)
Mechanical Packaging:	1U (1.75 inch) rack enclosure

CT-3 Specifications

Modulation:	Sine Wave
Modulation Rate:	Selectable 3 Hz or 20 Hz (other frequencies available as an option)
Depth of Modulation:	Settable, 0.5 to 5 dB (3 Hz only) 20 Hz fixed at 3 dB
Input/Output Impedance:	75 Ohms, nominal
Carrier Frequency:	107 - 157.25 MHz; crystal controlled
Carrier Output:	+47 to +60 dBmV
Spurious:	-60 dBc
Power:	115 VAC, 230 VAC, or DC with 230 VAC charge cube (setup at the factory)
Mechanical Packaging:	1U (1.75 inch) rack enclosure

Warranty Information

Trilithic, Inc. warrants that each part of this product will be free from defects in materials and workmanship, under normal use, operating conditions and service for a period of two (2) years from date of delivery. Trilithic, Inc.'s obligation under this Warranty shall be limited, at Trilithic, Inc.'s sole option, to replacing the product, or to replacing or repairing any defective part, F.O.B. Indianapolis, Indiana; provided that the Buyer shall give Trilithic, Inc. written notice.

Batteries are not included or covered by this Warranty.

The remedy set forth herein shall be the only remedy available to the Buyer under this Warranty and in no event shall Trilithic, Inc. be liable for incidental or consequential damages for any alleged breach of this Warranty. This Warranty shall not apply to any part of the product which, without fault of Trilithic, Inc., has been subject to alteration, failure caused by a part not supplied by Trilithic, Inc., accident, fire or other casualty, negligence or misuse, or to any cause whatsoever other than as a result of a defect.

Except for the warranty and exclusions set forth above, and the warranties, if any, available to the Buyer from those who supply Trilithic, Inc., there are no warranties, expressed or implied (including without limitation, any implied warranties of merchantability of fitness), with respect to the condition of the product or its suitability for any use intended for it by the Buyer or by the purchaser from the Buyer.



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