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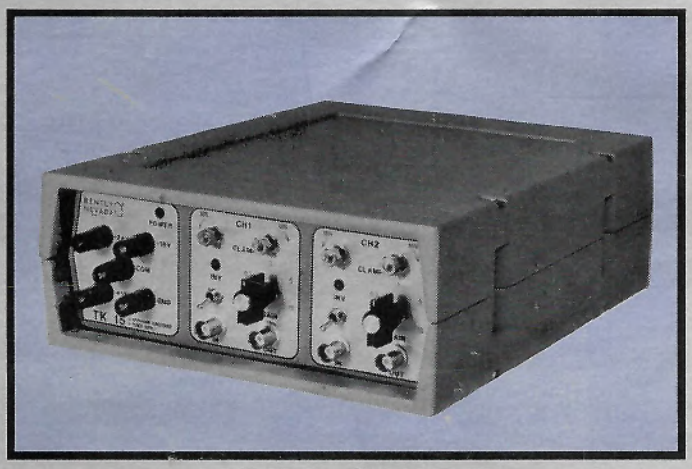
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TK15 Keyphasor® Conditioner and Power Supply



USER GUIDE

BENTLY NEVADA®

User Guide

Manual No. 82469-01 • First Printing July 1988

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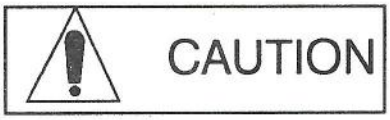
Bently Nevada Corporation
Post Office Box 157
Minden, Nevada 89423 USA
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Telex: 7400983 BNC UC

NOTICE

READ THE FOLLOWING BEFORE INSTALLING OR OPERATING EQUIPMENT.

Bently Nevada Corporation has attempted to identify areas of risk created by improper installation and/or operation of this product. These areas of information are noted as WARNING or CAUTION for your protection and for the safe and effective operation of this equipment. Read all instructions before installing or operating this product. Take particular attention to those areas designated by the following symbols:





The following WARNING notice appears on the TK15 rear panel



WARNING, "SEVERE SHOCK" DISCONNECT SUPPLY BEFORE SERVICING

Note:

In this document procedures are given only for channel 1. Procedures for channel 2 are similar except for the obvious substitution of corresponding switches, terminals and indicators.

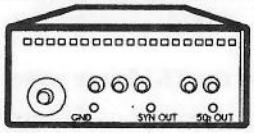
Symbols Used



2469A36

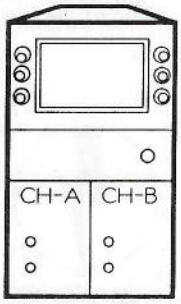
Recommended Test Equipment For TK15 Checkout

FUNCTION GENERATOR



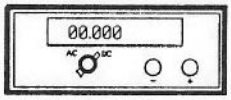
- 50 Ohm and Sync outputs
- 0.1 to 100 KHz minimum frequency range
- -10 to +10 Vdc offset range
- 0.1 to 10 Volts peak to peak minimum output amplitude
- Variable symmetry

OSCILLOSCOPE



- General purpose,
- Dual channel,

DIGITAL MULTIMETER



- 3 1/2 Digit Display or better
- 0 TO 500 Vac/Vdc or greater
- 0 TO 10 megohms resistance measurement range

2469A37

Preface

The TK15 is a portable instrument that provides power for transducers, and conditions transducer output signals. These signals are then usable by diagnostic instruments

Note:

The signal conditioning ciruitry is AC coupled and will not pass DC gap voltages.

This manual describes the TK15 and its applications for machine diagnostics. The intended audience comprises maintenance and engineering personnel who have been trained in the fundamentals of machine diagnostics.

Related Bently Nevada Corporation Documents

- Application note, "The Keyphasor: A Necessity for Machinery Diagnosis," literature No. AN016

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APPENDIX C, OPTICAL PICKUP INFORMATION

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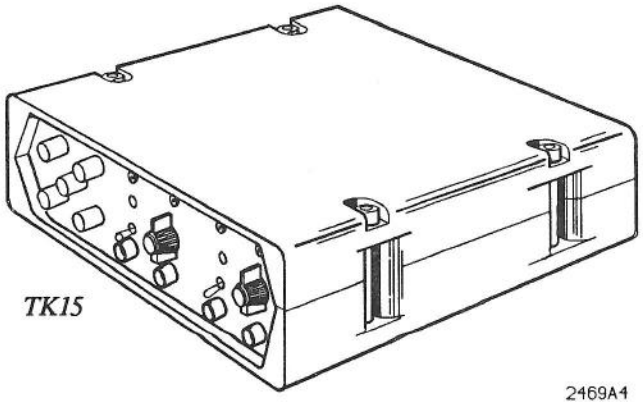
APPENDIX E, PROBLEM RESOLUTION

SECTION I
INTRODUCTION

The TK15 Keyphasor Conditioner and Power Supply, a 115/230 Vac powered portable instrument, is primarily used to power and condition Keyphasor transducers. (For Keyphasor applications refer to Bently Nevada Corporation Applications Note, "The Keyphasor: A Neccessity for Machinery Diagnosis," literature No. AN016.)

The TK15:

- Receives and conditions signals from proximity, velocity, acceleration, and optical pickup transducers.
- Receives and conditions pre-recorded transducer signals.
- Creates a temporary Keyphasor signal with an optical pickup package and accessories.
- Creates a temporary Keyphasor signal from a radially mounted transducer (may not always be possible).
- Supplies power for transducers, including proximity, velocity, acceleration, and optical pickup types.
- Supplies power for Bently Nevada Corporation Keyphasor Multiplier/Dividers.



TK15

2469A4

TRANSDUCER POWER

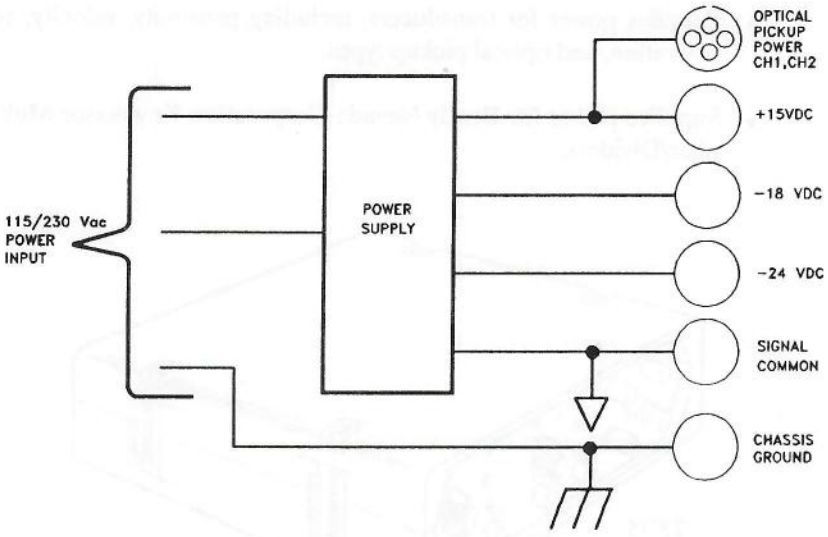
See front panel view for connector type and location of the dc power outputs. Refer to Appendix A for output specifications, and to determine the maximum number of transducers that can be powered.

−24 Vdc and −18 Vdc Outputs

Two dc outputs are available for powering standard Bently Nevada Corporation transducers. Other transducers and accessories can be powered if they require −24 Vdc or −18 Vdc.

+15 Vdc Output

A +15 Vdc output is available to power transducers and accessories. This output also supplies drive current to the optical pickup transducers.



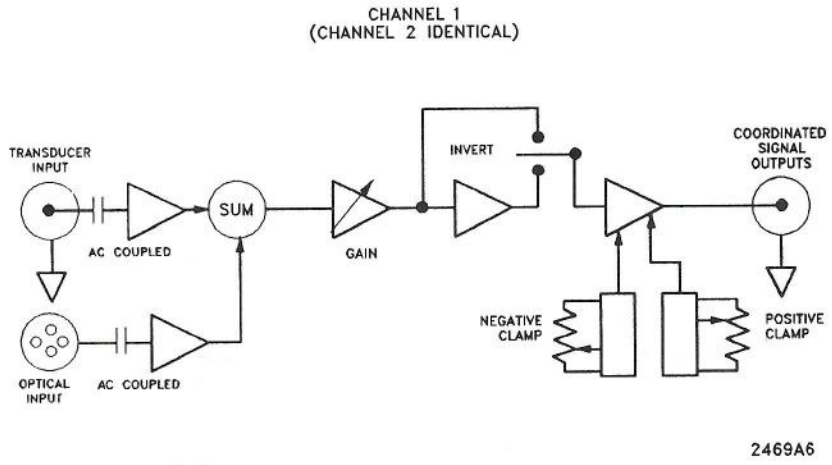
TK15 Transducer Power Supply Flow Diagram 2469A5

TRANSDUCER SIGNAL CONDITIONING

The TK15 has two independent channels for conditioning transducer signals. This conditioning can include changing amplitude, polarity, and noise level. These signals are then usable by diagnostic instruments.

Note:

The signal conditioning circuitry is AC coupled and will not pass DC gap voltage.



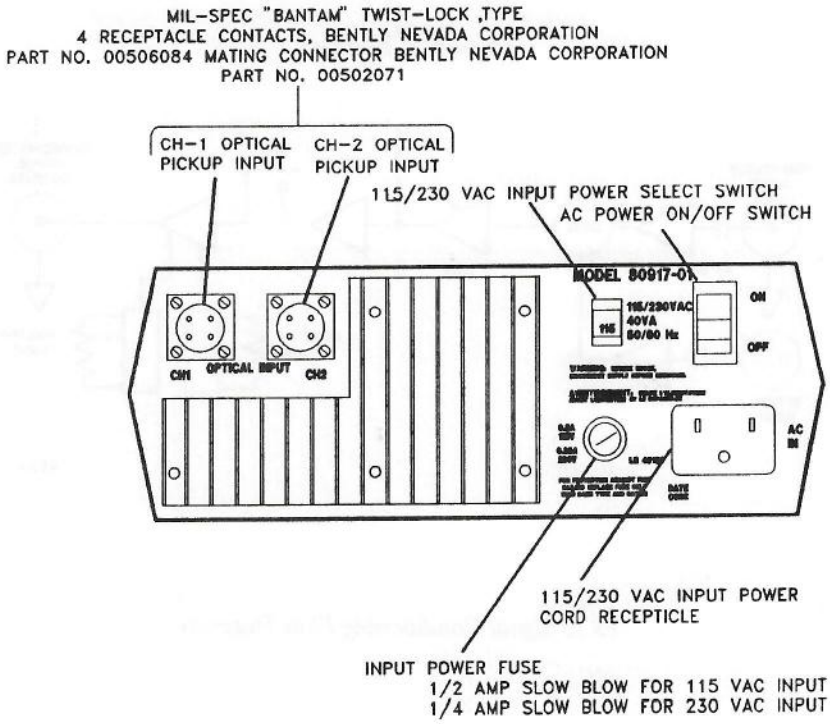
TK15 Signal Conditioning Flow Diagram

Signal Input

TK15 has two independent channels, each with two input connectors. Two front panel connectors accommodate most proximity, velocity, and acceleration transducers. Two rear panel connectors are provided for optical pickup transducers. Any dc voltage on the input signal is filtered out. See front and rear panel views for type and location of signal input connectors. Refer to Appendix A for TK15 input specifications.

Note:

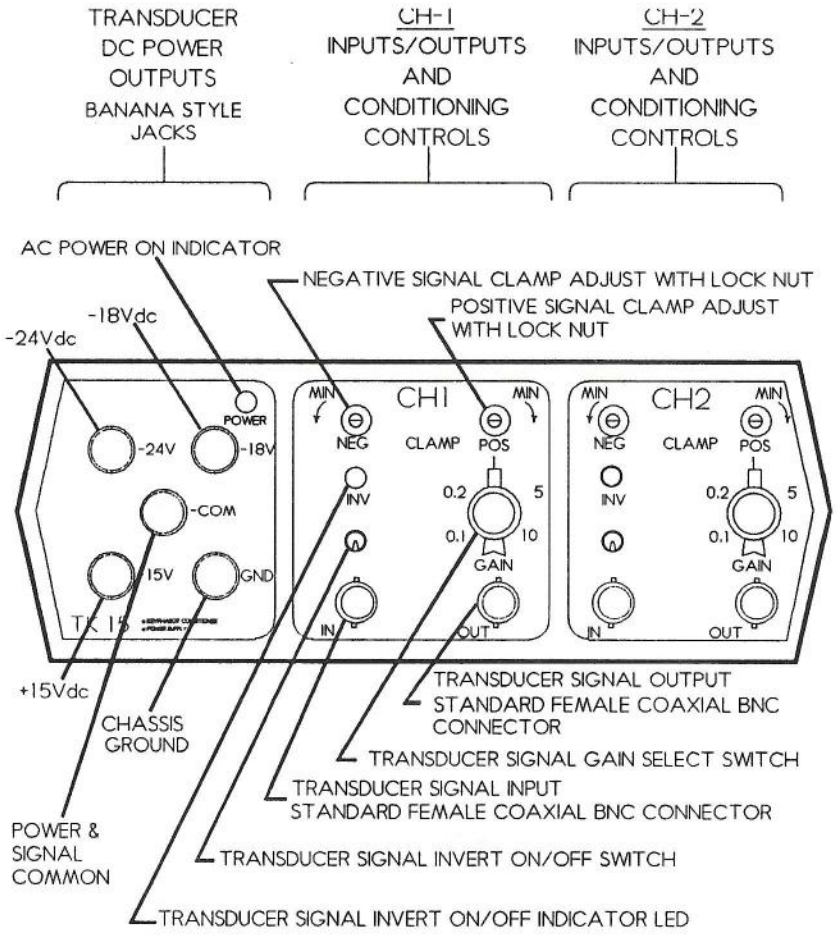
If both inputs to a given channel are used simultaneously they will be summed with equal weighting.



TK15 Rear Panel

Signal Output

The conditioned output signal of each channel is available at a front panel connector. See the front panel view for connector type and location. Refer to Appendix A for TK15 output specifications.



TK15 Front Panel

Signal Amplitude

The amplitude of the input signal on each channel can be independently increased or decreased with the front panel GAIN switch. The following amplification factors are provided:

- 0.1 x signal input
- 0.2 x signal input
- 1 x signal input
- 5 x signal input
- 10 x signal input

Signal Polarity

The input signal on each channel can be inverted with the front panel INV switch. A green LED (light emitting diode) near each channel's INV switch indicates its status (LED ON indicates signal output is inverted).

Signal Clamping

The positive or negative excursion of each channel's input signal can be clamped by adjusting the front panel POS or NEG CLAMP potentiometers. Both potentiometers are variable over the entire signal amplitude range, and can be locked.

Improving A Low Quality Signal

A low quality or noisy transducer signal can usually be improved by adjusting the signal gain and clamping controls for optimum output quality.

Creating A Temporary Keyphasor Signal

TK15 can often convert a radially mounted vibration transducer into a temporary Keyphasor signal by amplifying and clamping a once-per-turn event signal such as a scratch or dent on the monitored shaft.

An optical pickup can also be installed, signal conditioned by TK15, and then used as a temporary Keyphasor transducer. Refer to Appendix C for optical pickup information and references.

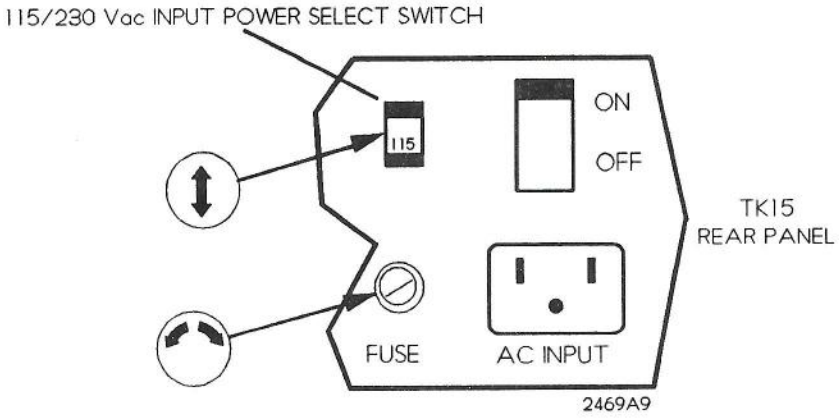
SECTION II
PREPARATION FOR USE

SELECTING AC LINE INPUT POWER FOR TK15

WARNING

Setting Power Select Switch incorrectly, or using incorrect fuse, could overheat components and cause an equipment fire

TK15 is powered by either 115 Vac or 230 Vac, 47 to 63 Hz. However, the rear panel fuse type, and the AC INPUT power select switch setting, must correspond to the input used (refer to instructions on following page). For power input specifications refer to Appendix A.



TK15 Rear Panel



WARNING

"Severe Shock" disconnect power before changing fuse.

115 Vac 47-63 Hz operation:

- **Install** a 0.5 A slow blow fuse (Part No. 01710102) in rear panel FUSE holder. (Note that TK15 is shipped with this fuse installed.)
- **Set** rear panel AC INPUT power select switch to 115. (Note that TK15 is shipped with switch set to 115 position.)

230 Vac 47-63 Hz operation

- **Install** a 0.25 A slow blow fuse (Part No. 01700250) in rear panel FUSE holder.
- **Set** rear panel AC INPUT power select switch to 230.

TK15 CHECKOUT

Ensure that rear panel AC INPUT power switch is set to OFF.

Note

Performance of the TK15 checkout procedure is optional. As a minimum, Bently Nevada Corporation recommends that this procedure be performed the first time TK15 is used.

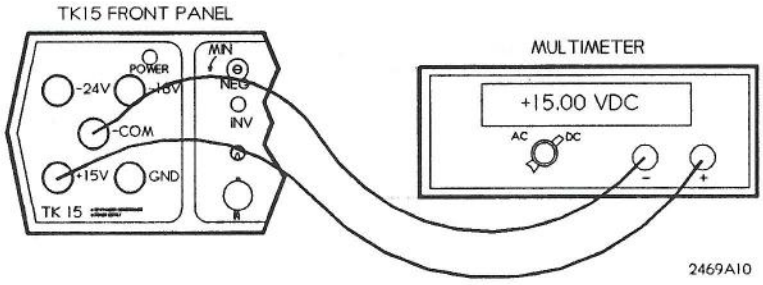
Connect power cord between TK15 rear panel AC INPUT connector and the appropriate power source.

Transducer Power Supply Checkout

Set TK15 rear panel AC INPUT power switch to ON.

- **Observe** that TK15 front panel POWER LED is ON.
- **Measure** DC output voltages at TK15 front panel with a multimeter. Connect meter negative (−) input to TK15 COM jack for all readings. Outputs should be within following limits:

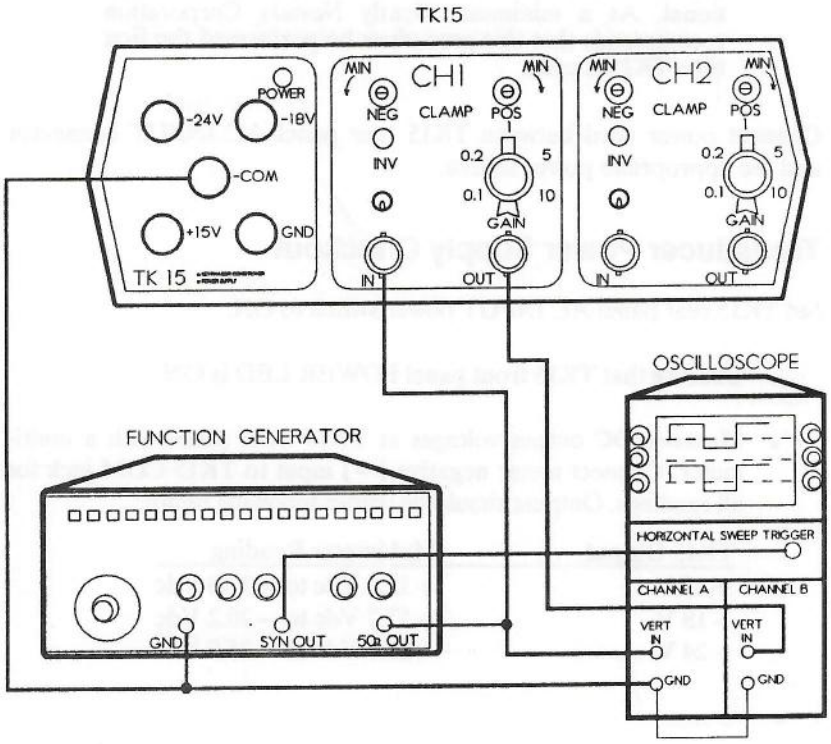
TK15 Output	Multimeter Reading
+15 V	+15.0 Vdc to +17.3 Vdc
−18 V	−17.7 Vdc to −20.2 Vdc
−24 V	−22.7 Vdc to −25.9 Vdc



Measuring TK15 Output Voltages

Signal Path Checkout

The following procedure is for TK15 channel 1, and should be repeated for channel 2.



Signal Path Checkout Equipment Interconnections 2469A11

Set function generator as follows:

FUNCTION	Square wave
FREQUENCY	1000 ±100 Hz
AMPLITUDE	1.0 ±0.2 V peak to peak
DC OFFSET	0.0 ±0.5 Vdc
SYMMETRY	50 ±10 % Duty Cycle

Connect function generator SYNC out (TTL out) to oscilloscope sweep trigger input connector.

Connect function generator 50 OHM output to TK15 front panel CH1 signal IN connector **and** to oscilloscope Channel A vertical input.

Connect oscilloscope Channel B vertical input to TK15 front panel CH1 signal OUT connector.

Connect function generator and oscilloscope signal common terminals to TK15 front panel COM jack.

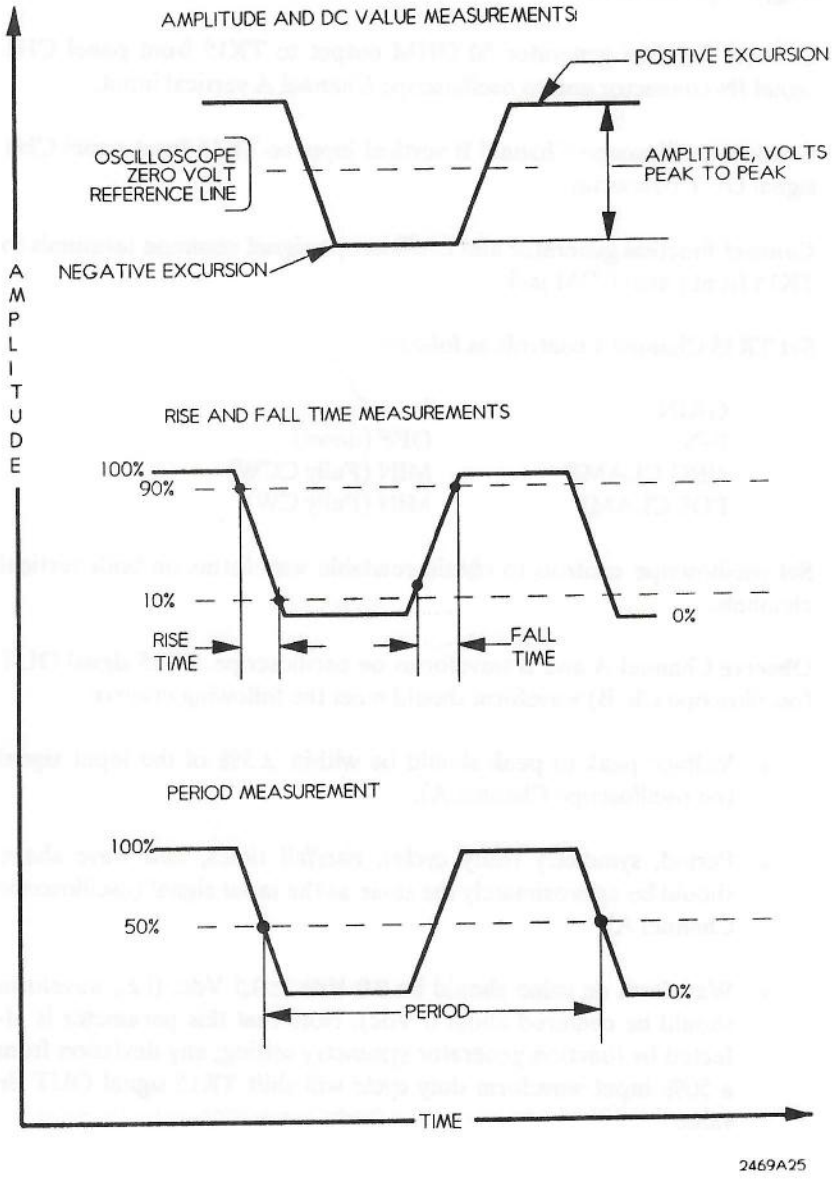
Set TK15 Channel 1 controls as follows:

GAIN	1
INV	OFF (down)
NEG CLAMP	MIN (Fully CCW)
POS CLAMP	MIN (Fully CW)

Set oscilloscope controls to obtain readable waveforms on both vertical channels.

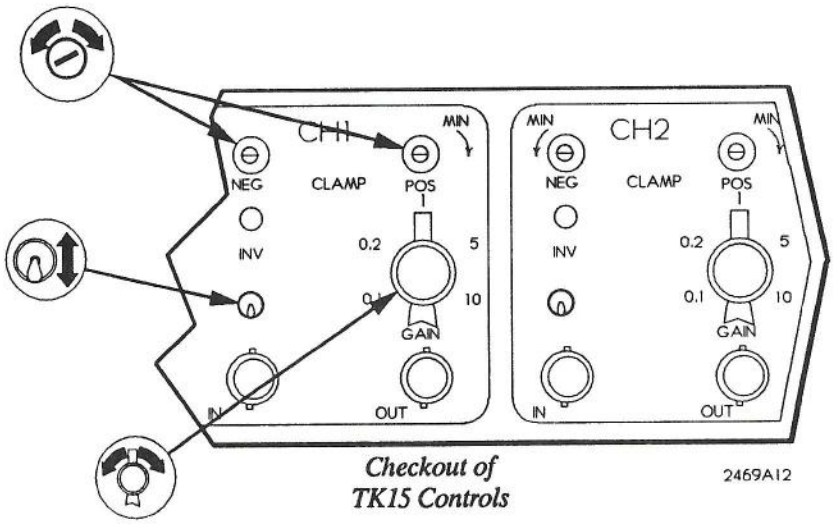
Observe Channel A and B waveforms on oscilloscope. TK15 signal OUT (oscilloscope Ch. B) waveform should meet the following criteria:

- Voltage peak to peak should be within ±5% of the input signal (on oscilloscope Channel A).
- Period, symmetry (duty cycle), rise/fall times, and wave shape should be approximately the same as the input signal (oscilloscope Channel A).
- Waveform dc value should be 0.0 Vdc ±0.5 Vdc. (i.e., waveform should be centered about 0 Vdc). Note that this parameter is affected by function generator symmetry setting; any deviation from a 50% input waveform duty cycle will shift TK15 signal OUT dc value.



Signal Path Checkout Waveforms

Vary following TK15 Channel 1 controls while observing oscilloscope Channel B waveform:



Checkout of TK15 Controls

2469A12

TK15 GAIN switch:

Signal OUT voltage peak to peak should reflect GAIN switch setting times input signal amplitude ±5%, at all settings of GAIN switch.

TK15 INV switch:

With INV switch UP (ON) TK15 OUT waveform should be approximately 180 degrees out of phase with input waveform. TK15 INV LED indicator should be ON.

TK15 POS CLAMP adjustment:

TK15 OUT waveform positive excursion is progressively reduced as the POS CLAMP adjustment is rotated CCW.

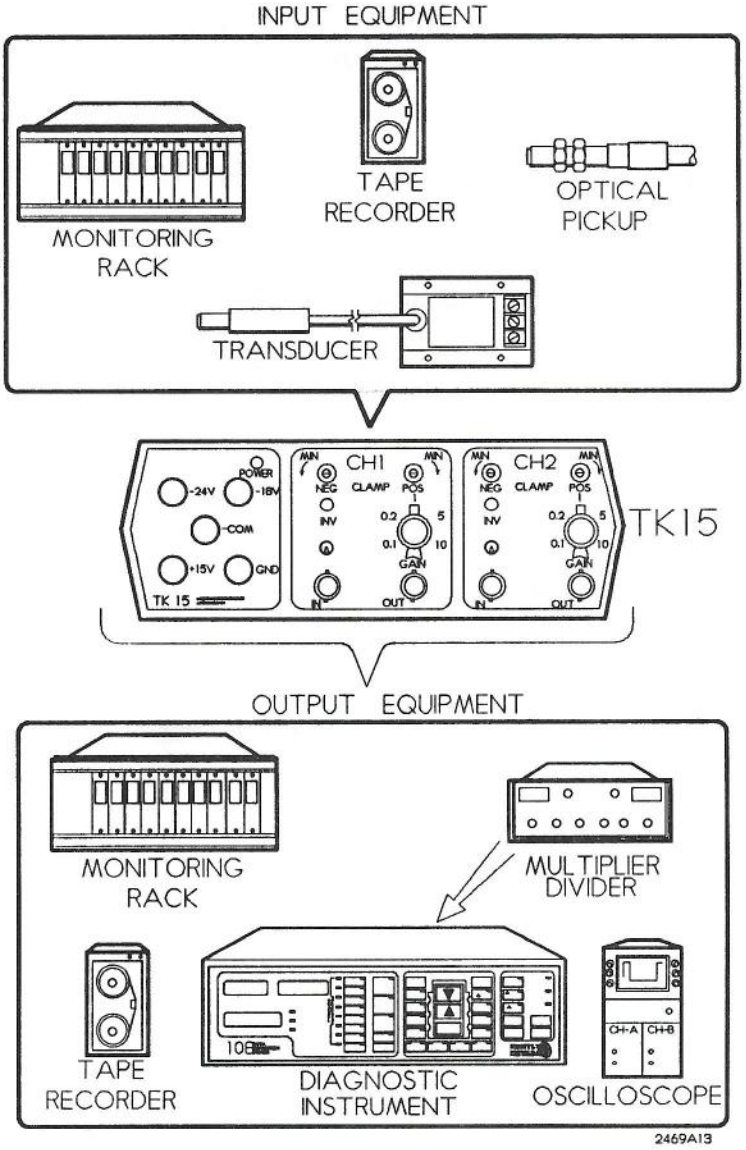
TK15 NEG CLAMP adjustment:

TK15 OUT waveform negative excursion is progressively reduced as the NEG CLAMP adjustment is rotated CW.

Disconnect all test equipment from TK15 and set rear panel AC INPUT power switch to OFF.

SECTION III
OPERATING INSTRUCTIONS WITH APPLICATIONS

The following diagram shows typical equipment to interface with TK15.



CONNECTING TRANSDUCERS TO TK15

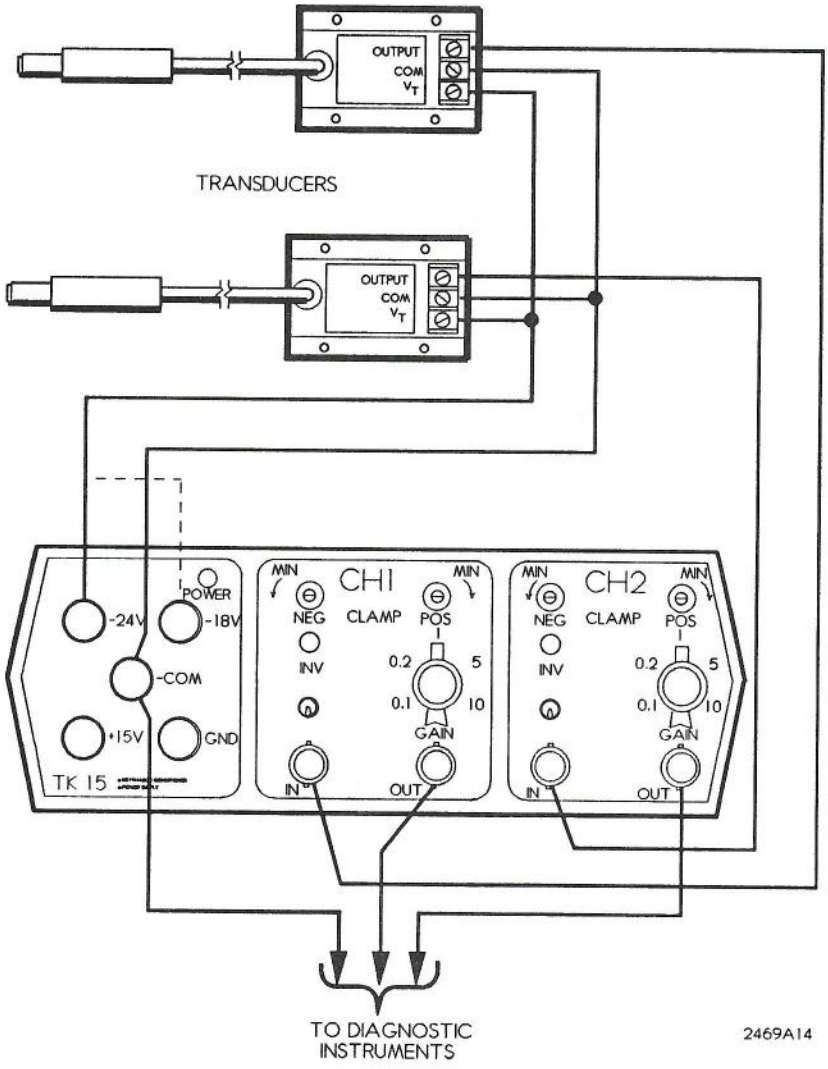
Note

A transducer is normally connected to either the front or the rear TK15 input connector, not both. If a transducer is connected to both front and rear signal input connectors, the signal OUT for that channel will be the sum of the two input signals.

Proximity, Velocity, and Acceleration Transducers

1. Determine the power requirements for the transducer.
   - **Ensure** that TK15 rear panel AC INPUT switch is set to OFF.
   - **Connect** appropriate TK15 dc power OUT connector to transducer power terminal.
   - **Connect** TK15 COM to transducer common terminal.
   - **Repeat** above connections for all transducers powered by TK15.
2. One or two transducer signals can be input directly to TK15 front panel connectors as follows:
   - **Connect** TK15 CH1 IN to first transducer output terminal.
   - **Connect** TK15 CH2 IN to second transducer output terminal (if required).
   - **Connect** TK15 COM to transducer common terminal (this connection may have already been made in step 1 above).
3. TK15 Channel 1 (and Channel 2 if being used) signal output can now be connected to desired diagnostic instruments as follows:
   - **Connect** TK15 front panel CH1 (and CH2 if required) OUT to instrument signal input connector.
   - **Connect** TK15 COM to instrument signal common connector. Refer to Appendix D for good grounding practices.

4. Apply power by setting TK15 rear panel AC INPUT switch to ON.



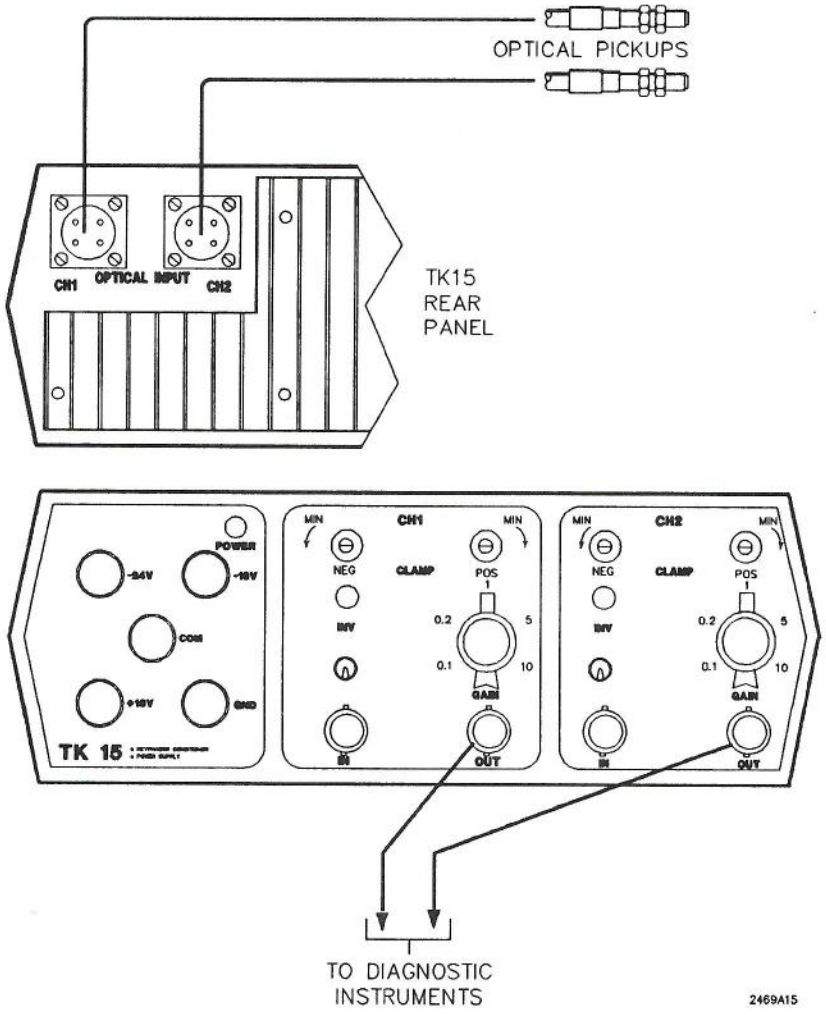
Connecting Proximity, Velocity, or Acceleration Transducers

Optical Pickup Transducers

1. Optical pickup transducer power and signal wires are all within a single cable; therefore, separate power connections are not necessary if proper cabling is used. Refer to Appendix C for optical pickup information.
2. One or two optical pickup transducers can be input directly to TK15 rear panel connectors as follows:
   - **Connect** first optical pickup cable to TK15 rear panel OPTICAL INPUT CH1 connector. An appropriate extension cable may be used. Refer to Appendix C for cable and connector type.
   - **Connect** second optical pickup cable to TK15 OPTICAL INPUT CH2 (if required).
3. TK15 channel 1 (and channel 2 if being used) signal output can now be connected to desired instruments as follows:
   - **Connect** TK15 front panel CH1 (and CH2 if required) OUT to instrument signal input connector.
   - **Connect** TK15 COM to instrument signal common connector. Refer to Appendix D for good grounding practices.
4. Apply power by setting TK15 rear panel AC INPUT switch to ON.

Note

TK15 will generate a negative going pulse when a reflective surface is passed by the optical pickup transducer. The amplitude of this pulse is determined by the distance of the pickup from the reflective surface, and by the area of the reflective surface. The TK15 OUT pulse amplitude and polarity can be changed by the GAIN and INV controls.



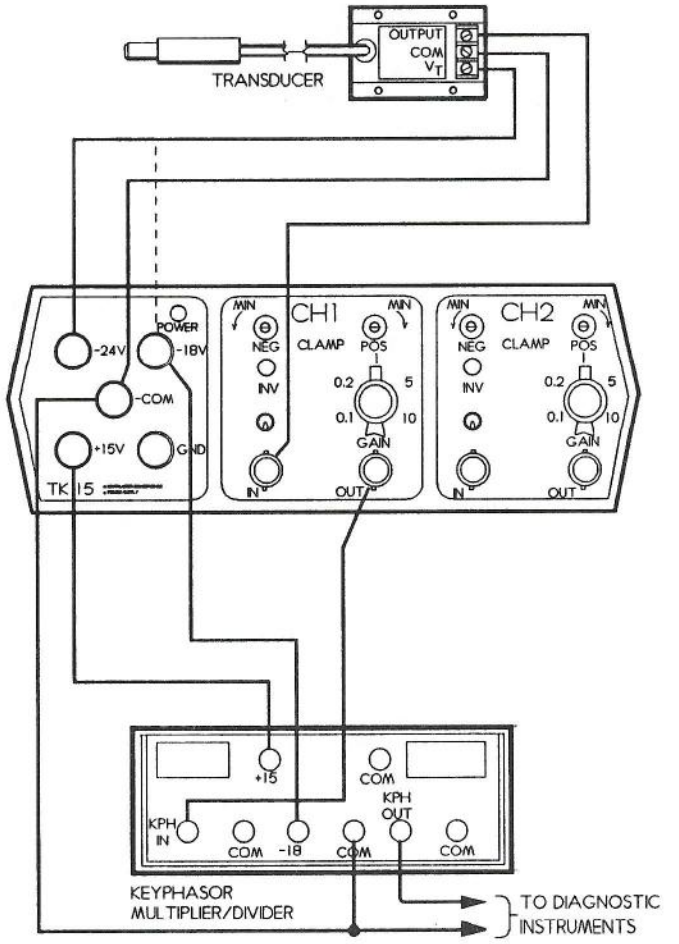
Connecting Optical Pickup Transducers

Keyphasor Multiplier/Divider (or other similar Keyphasor accessory)

1. Determine the power requirements of the accessory. These should be obtained from labeling on the accessory front panel, or from its specifications. (Bently Nevada Corporation Keyphasor Multiplier/Divider requires -18 Vdc and +15 Vdc).
   - **Ensure** that TK15 rear panel AC INPUT switch is set to OFF.
   - **Connect** TK15 front panel COM to signal common of accessory.
   - **Connect** TK15 dc OUT connectors to appropriate accessory power terminals.
   - **Repeat** above connections for all accessories powered by TK15.
2. One or two transducer signals can be input directly to TK15 front panel connectors as follows:
   - **Connect** TK15 CH1 IN to first transducer output connector.
   - **Connect** TK15 CH2 IN to second transducer output connector (if required).
3. TK15 front panel signal output can now be connected to a Keyphasor accessory, and the accessory to a diagnostic instrument, as follows:
   - **Connect** TK15 front panel CH1 (or CH2) OUT connector to Keyphasor input connector of Keyphasor accessory.
   - **Connect** Keyphasor output connector of Keyphasor accessory to desired instrument for diagnostic use.
   - **Connect** signal common connector of Keyphasor accessory to TK15 COM (this connection may have been made in step 1 above) and to diagnostic instrument common. Refer to Appendix D for good grounding practices.
   - **Repeat** above connections for another accessory if required.
4. Apply power by setting TK15 rear panel AC INPUT switch to ON.

Note

If a transducer signal is of sufficient amplitude and quality, it can be input directly to a Keyphasor Multiplier/Divider (KPH M/D). The KPH M/D output can then either drive the required diagnostic instruments, or TK15 (for further signal conditioning). If the transducer signal is not sufficient to drive a KPH M/D, than it must be connected as shown below.



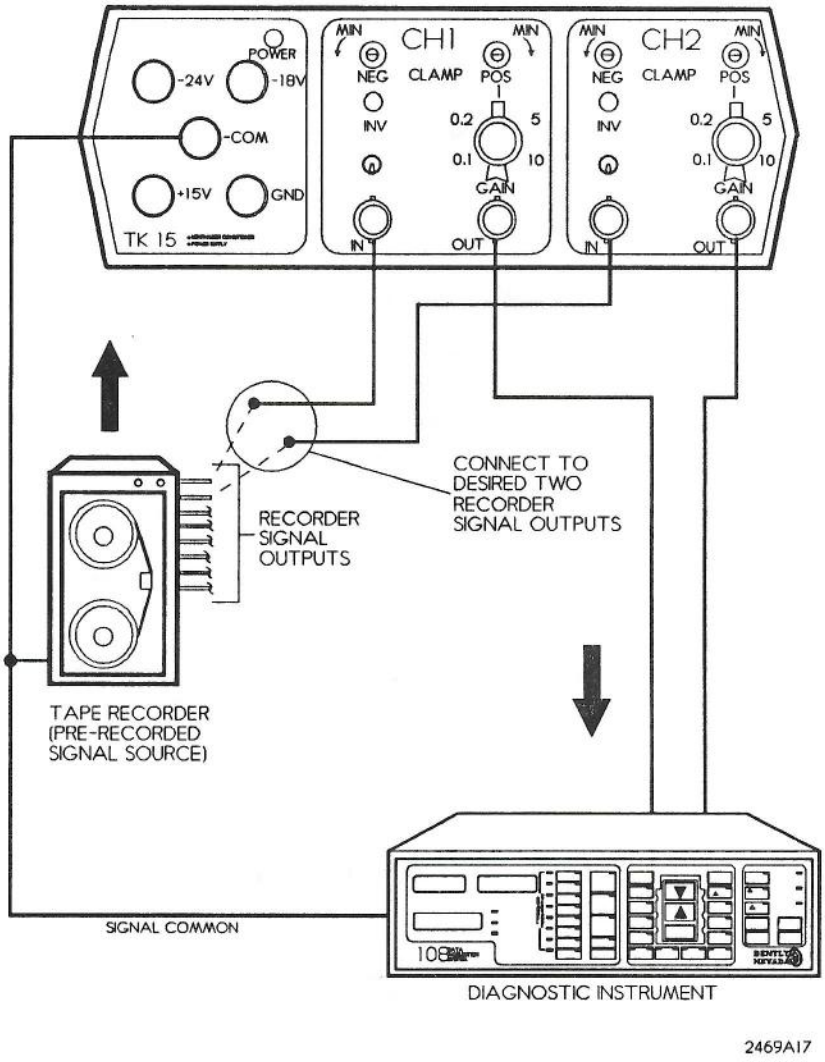
Connecting Keyphasor Accessories

Pre-Recorded Transducer Signals

Note

TK15 can condition previously recorded transducer signals (as described below), or it can precondition signals before they are recorded on tape. (Typically with a frequency modulated tape recorder.) Any DC voltage on the input signal is filtered out. When preconditioning, the signal may be reduced in amplitude (by setting TK15 GAIN control to x 0.1 or x 0.2) to avoid overdriving the tape recorder. On playback, the signal can be restored to its original amplitude by setting TK15 GAIN control to x 10 or x 5.

1. One or two previously recorded transducer signals can be input to TK15 from a tape recorder as follows:
   - **Connect** TK15 front panel COM to tape recorder signal common.
   - **Connect** TK15 front panel CH1 IN to the desired signal output channel of the tape recorder.
   - **Connect** TK15 front panel CH2 IN to the next desired signal output channel of the tape recorder (if required).
2. TK15 front panel Channel 1 (and Channel 2, if required) signal OUT connectors may now be connected to instruments for diagnostic use, as follows:
   - **Connect** TK15 CH1 OUT (and CH2 if required) to instrument signal input connector.
   - **Connect** TK15 COM to instrument signal common. Refer to appendix D for good grounding practices.
3. Apply power by setting TK15 rear panel AC INPUT switch to ON.



Connecting Pre-Recorded Signals from FM Tape Recorder

USING TK15 CONDITIONING CONTROLS

NOTE

Before attempting to condition a transducer signal, set TK15 channel 1 and 2 CLAMP potentiometers to their MIN position. This will ensure that the transducer signal is displayed in its original (before conditioning) state.

Any DC voltage on the input signal is filtered out.

TK15 conditioning can convert an initially unsuitable transducer signal into one usable by diagnostic instruments. This is accomplished by altering the **amplitude, polarity,** and **noise** content of the signal. The following considerations are helpful when determining conditioning requirements:

- **Determine** the input requirements of the instrument to be driven.
- **Observe** the conditioned signal's effect upon the instrument and its output while adjusting conditioning controls.
- **Use** a dual channel oscilloscope while conditioning the transducer signal. The transducer signal and the conditioned signal (TK15 OUT connector) should be viewed simultaneously while adjusting TK15 controls.



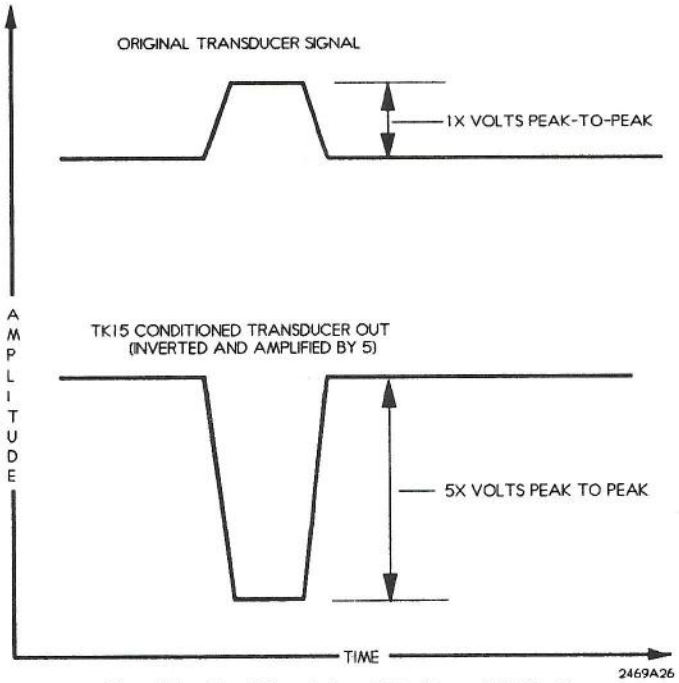
TK15 INV switch setting will affect the data generated by a diagnostic instrument connected to TK15 OUT. Therefore, this switch setting should remain unchanged while taking data which may be related or compared. The INV switch setting should also be recorded with all data taken using TK15. (The magnitude of the data comparsion error caused by changing the INV switch setting is directly proporational to the Keyphasor pulse duty cycle.)

Signals with Incompatible Amplitude or Polarity

- **Change** the peak to peak voltage of the transducer signal with the TK15 GAIN control. Signal amplitude can be decreased or increased by the following amplification factors: 0.1, 0.2, 1, 5, 10. Select the gain setting which results in a voltage within the input range, or triggering requirements, of the instrument to receive the conditioned transducer signal.

- **Invert** the polarity of the transducer signal with the TK15 INV switch if required, i.e., a positive going pulse can be converted to a negative going pulse (or a negative going to a positive going). The signal peak to peak voltage will not be effected by inverting the polarity.

- **Record** the TK15 GAIN and INV switch settings with the data taken by diagnostic instruments connected to TK15.

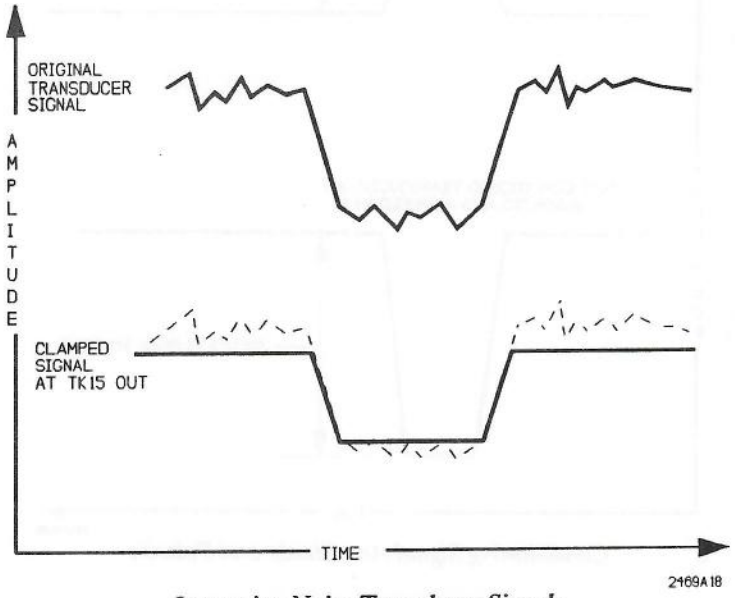


Conditioning Signal Ampilitude and Polarity

Signals with Low Quality or Excessive Noise

A noisy transducer signal can cause false triggering from the instruments using it. TK15 can prevent this by clipping noise off the positive or negative extreme of the transducer signal.

- **Set** the TK15 GAIN switch to obtain a peak to peak output voltage greater than that required by the instrument to receive it.
- **Remove** noise from the positive excursion of the transducer signal by adjusting TK15 POS CLAMP counterclockwise while observing TK15 OUT. Stop when noise has been clipped off the signal.
- **Remove** noise from the negative excursion of the transducer signal by adjusting TK15 NEG CLAMP clockwise while observing TK15 OUT. Stop when noise has been clipped off the signal.
- **Lock** the above adjustments with the locking nuts around each CLAMP control (to prevent accidental setting change).
- **Record** the TK15 Gain and INV switch settings with data taken.



Improving Noisy Transducer Signals

CREATING TEMPORARY KEYPHASOR SIGNAL

TK15 can generate a temporary Keyphasor signal for a machine component which does not have a fixed Keyphasor transducer installed. Two methods for doing this are described below.

Using Optical Pickup as a Temporary Keyphasor

Mount an optical pickup and use its output to generate a once-per-turn event signal. This method can only be used if the machine rotating component is accessible and has (or allows the installation of) a suitable target. Proceed as follows:

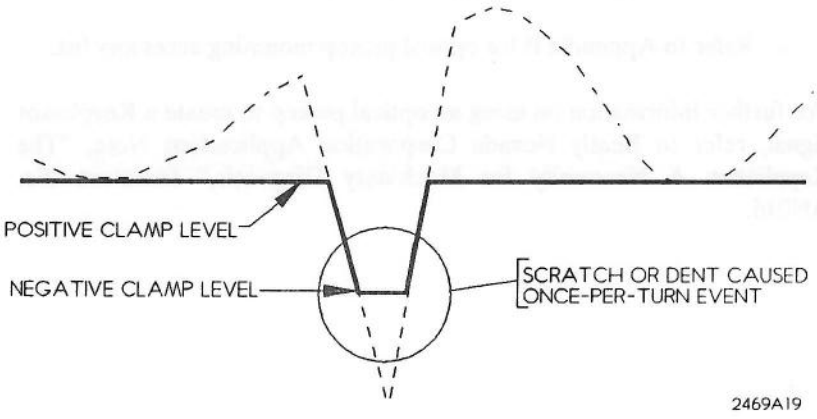
- **Locate** or install optical target on machine rotating component.
- **Install** optical pickup transducer and connect to TK15 rear panel optical pickup connector.
- **Connect** appropriate TK15 channel OUT connector to the instrument requiring a Keyphasor signal.
- **Adjust** TK15 conditioning controls as required to meet input and triggering requirements of instrument.
- **Refer to** Appendix C for optical pickup information.
- **Refer to** Appendix B for optical pickup mounting accessory list.

For further information on using an optical pickup to create a Keyphasor signal, refer to Bently Nevada Corporation Applications Note, "The Keyphasor: A Neccessity for Machinery Diagnosis," literature No. AN016.

Converting Radially Mounted Transducer to a Temporary Keyphasor

If a radially mounted vibration transducer is located on the machine rotating component it can sometimes be converted to a temporary Keyphasor transducer by TK15 conditioning.

- **Observe** the output signal of the radially mounted transducer; look for a once-per-turn event signal. This event may be from a scratch or dent; it must not be subject to changing phase such as a vibration signal.
- **Connect** the above transducer output to TK15 Channel 1 or 2 IN.
- **Condition** the once-per-turn event with TK15 GAIN and CLAMP controls to create a waveform that approaches a Keyphasor transducer signal.
- **Connect** the temporary Keyphasor signal from TK15 OUT to the instruments or equipment requiring a Keyphasor transducer.

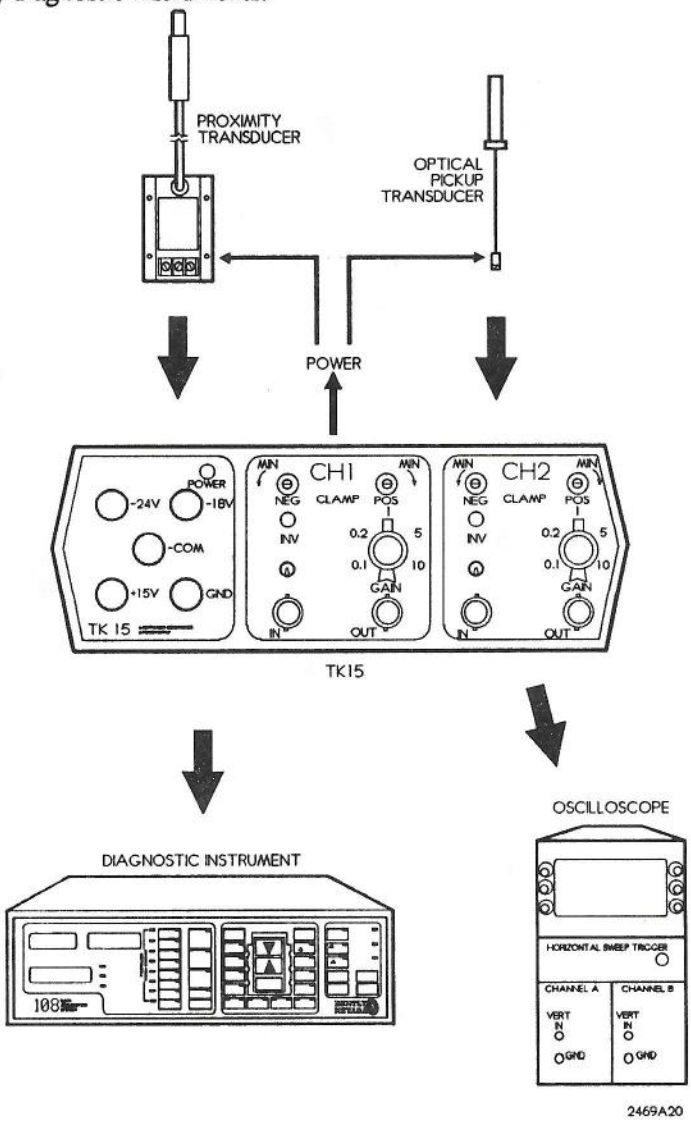


Creating Temporary Keyphasor Transducer

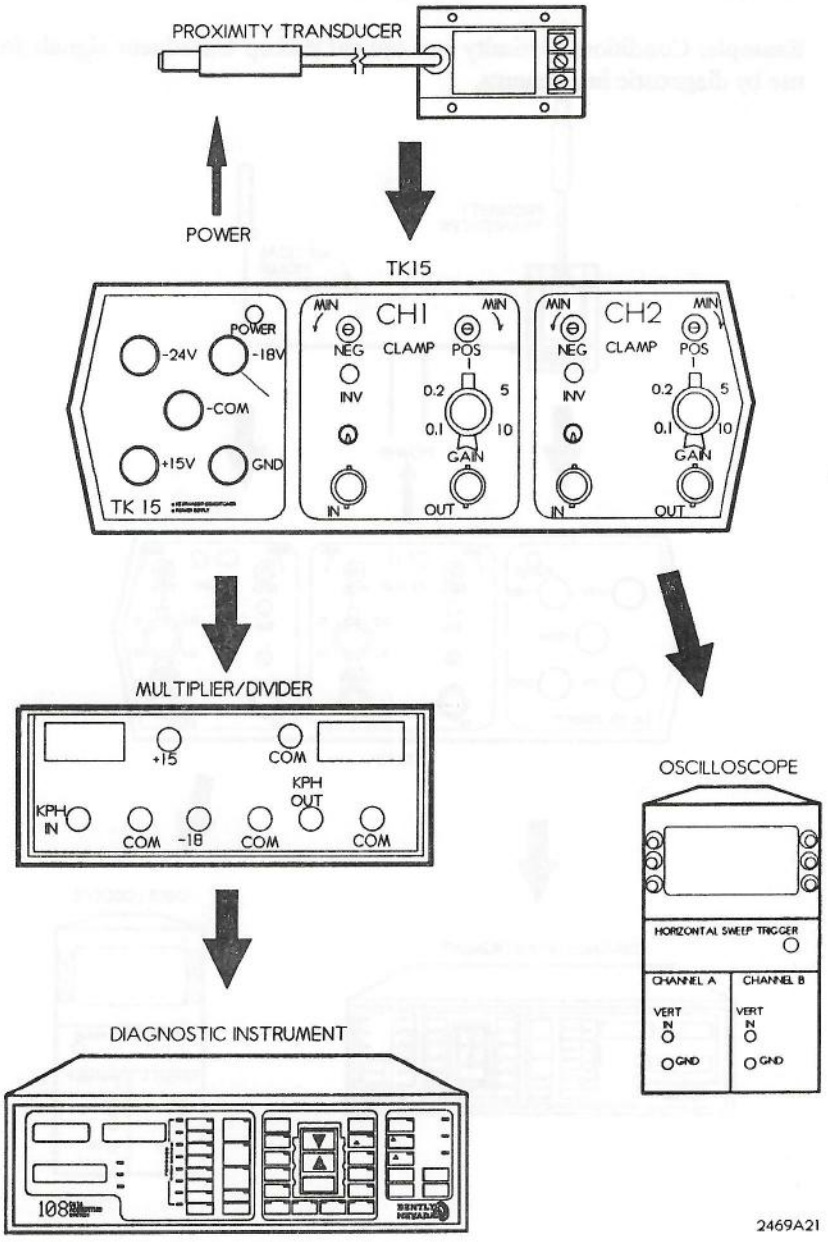
TYPICAL APPLICATIONS USING TK15

See previous paragraphs for detailed connection and conditioning information.

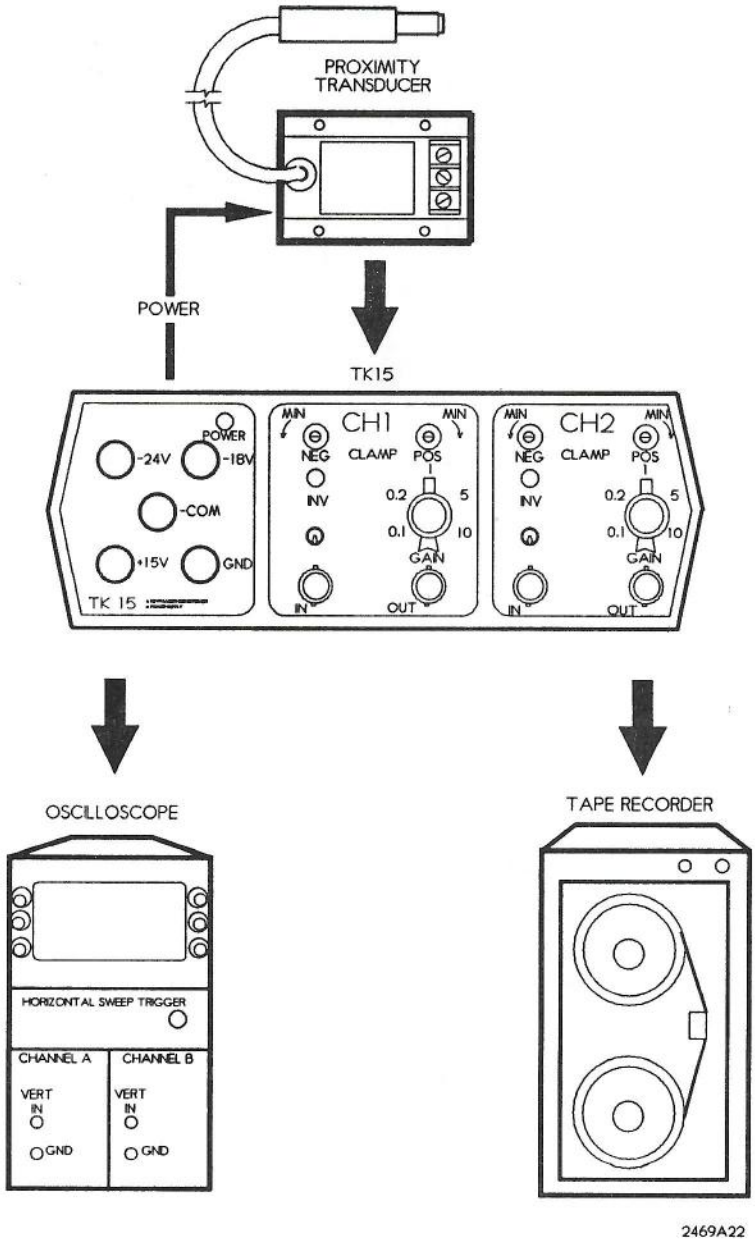
Example: Condition proximity and optical pickup transducer signals for use by diagnostic instruments.



Example: Condition proximity transducer signal for use by a Keyphasor Multiplier/Divider and diagnostic instruments.

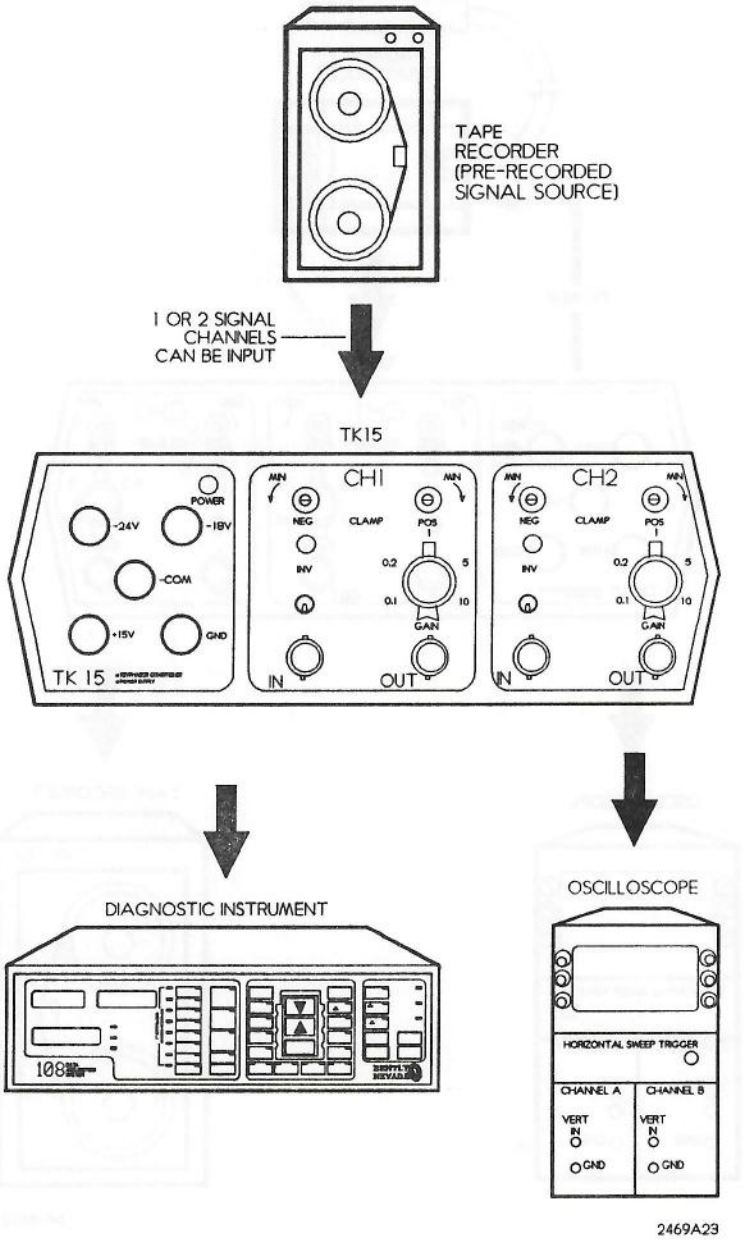


Example: Condition proximity transducer signal for storage by frequency modulated tape recorder. To avoid overdriving the tape recorder, reduce signal amplitude with TK15.

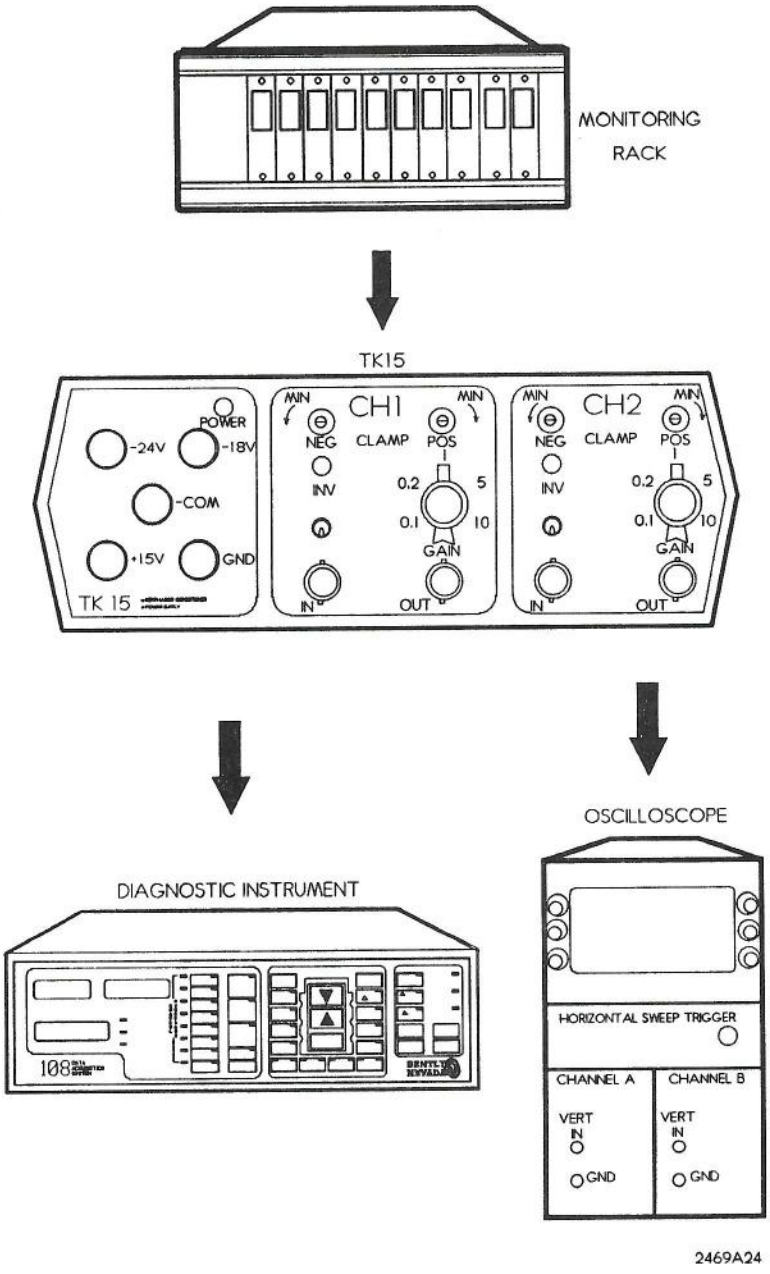


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Example: Condition pre-recorded signals for use by diagnostic instruments. If signal amplitude was reduced for recording, it should now be restored to its orginal value.



Example: Condition monitoring system signals for use by diagnostic instruments.



APPENDIX A
TK15 SPECIFICATIONS

POWER SUPPLY OUTPUT SPECIFICATIONS

+15 Vdc Supply

Nominal voltage	+16.2 Vdc ±1.2 Vdc
Maximum current	150 mA with no optical pickups 100 mA with one optical pickup connected 50 mA with two optical pickups connected
Maximum ripple	1 mV peak to peak
Typical noise level	0.5 mV rms

−18 Vdc Supply

Nominal voltage	−18.9 Vdc ±1.2 Vdc
Maximum current	300 mA *
Maximum ripple	1 mV peak to peak
Typical noise	0.6 mV rms

−24 Vdc Supply

Nominal voltage	−24.2 Vdc ±1.5 Vdc
Maximum current	350 mA *
Maximum ripple	1 mV peak to peak
Typical noise	0.7 mV rms

*** The sum of −18 Vdc supply current and −24 Vdc supply current is not to exceed 350 mA.**

DETERMINING MAXIMUM NUMBER OF TRANSDUCERS WHICH CAN BE POWERED

+ 15 Vdc Supply

1. Determine the number of optical pickups to be connected to TK15. Obtain the available current value for this number of pickups from the power supply specifications.
2. Determine the current requirements of all transducers and accessories to be powered by TK15 +15 Vdc supply. The sum of these must not exceed the value determined in step 1. above.

For example: If one optical pickup is to be connected to TK15, 100 mA is the maximum current available for other items. Therefore the sum of all transducer and accessory (other than the optical pickup) current drawn from +15 Vdc supply must not exceed 100 mA.

– 18 Vdc and –24 Vdc Supply

1. Determine the current requirements of all transducers and accessories to be powered by TK15 –18 Vdc supply.
2. Determine the current requirements of all transducers and accessories to be powered by TK15 –24 Vdc supply.
3. The sum of the current determined in step 1. plus step 2. above must not exceed 350 mA.

For example: If the following are to be powered by TK15:

Five Bently Nevada 7200 Series 5mm Proximitors, 13 mA each,
5 x 13 mA = 65 mA total from –24 Vdc.
Two Bently Nevada Multiplier/Dividers, 10 mA each,
2 x 10 mA = 20 mA total from –18 Vdc.
Seven Bently Nevada Velocity to Displacement Converters, 20 mA each, 7 x 20 mA = 140 mA total .from –24 Vdc.

Determine total current drawn from –18 Vdc and –24 Vdc:
65 mA + 20 mA + 140 mA = 225 mA.
This value must not exceed 350 mA maximum.

SIGNAL CONDITIONING SPECIFICATIONS

Transducer Input

Input impedance	100 k Ohms
Configuration	Single ended Referenced to signal common
Ac Coupling	Time Constant = 0.2 seconds Filter lower corner = 0.8 Hz

Optical Pickup Input

Optical pickup type	Bently Nevada part No. 10798-03 or equivalent
Typical LED current	50 mA
Maximum Photo-detector operating voltage	20 Vdc

Conditioned Signal Output

Output impedance	249 Ohms, short circuit protected
Offset Offset Drift	±300 mVdc maximum over temperature ±4.3 mVdc per degree C maximum (±2.4 mVdc per degree F maximum)
Output Dynamic Range	±10 volts minimum over temperature
Clamp range Clamp Drift	±10 volts minimum over temperature ±13 mVdc per degree C maximum (±7.2 mVdc per degree F maximum)

Input to Output Specifications

Gain error Gain drift	±3 % maximum over temperature ±0.02 % per degree C maximum (±0.011 % per degree F maximum)
Slew rate	1.5 V per μs minimum over temperature
Bandwidth	0.8 Hz to 30 k Hz minimum over temperature

AC INPUT SPECIFICATIONS

Input voltage	95 to 125 Vac 190 to 250 Vac rear panel selectable
Input frequency	47 to 63 Hz, single phase
Maximum power required	40 VA
Fuse ratings, 115 Vac 230 Vac	0.5 A, 250 V, slow blow 0.25 A, 250 V, slow blow
Input receptacle and power on/off switch	Located on rear panel

MECHANICAL SPECIFICATIONS

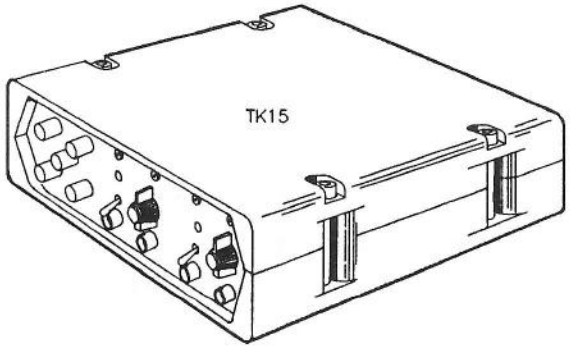
Width	8.7 inches (221 mm)
Depth	11.6 inches (295 mm)
Height	3.5 inches (89 mm)
Weight	6.8 pounds (3.1 kg)

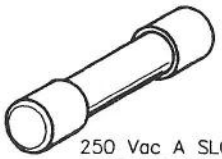
ENVIRONMENTAL SPECIFICATIONS

Operating temperature	0 to +50 degrees C (+32 to +122 degrees F)
Storage temperature	-40 to +85 degrees C (-40 to +185 degrees F)
Relative humidity	to 95 %, noncondensing
Electrostatic discharge (ESD)	No harm will result to the unit from induced ESD of up to 12 kV

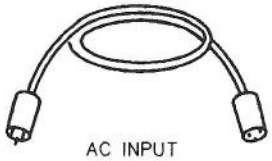
APPENDIX B
ORDERING INFORMATION

Item Description	Bently Nevada Part No.
TK15 Keyphasor Conditioner and Power Supply	80917-01
With	
User Guide, Power Cord, and fuse for 230 Vac operation (Unit shipped with fuse for 115 Vac operation installed)	





250 Vac A SLOW BLOW
FUSE FOR 230 Vac USE



AC INPUT
POWER CORD



TK15 USER GUIDE

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ACCESSORY ORDERING INFORMATION

Item Description	Bently Nevada Part No.
Keyphasor Multiplier/Divider	73783-01
Optical pickup with integral cable and manual	10798-03
Extension cable, (for optical pickup) XX = cable length in 1 foot increments (for example a 15-foot cable would be: 20545-15) Minimum length is 10 feet (3 meters) Maximum length is 99 feet (30 meters)	20545-XX
1/4-20 magnetic base with flexible gooseneck and holder	20211-01
1/4-20 vice grip pliers with flexible gooseneck and holder	20211-02
M8 x 1.25 magnetic base with flexible gooseneck and holder	20211-03
M8 x 1.25 vice grip pliers with flexible gooseneck and holder	20211-04
1/4-20 magnetic base and vice grip pliers with flexible gooseneck and holder	20211-05
M8 x 1.25 magnetic base and vice grip pliers with flexible gooseneck and holder	20211-06
Reflective tape, 150 foot (46 meter) rolls (used to install optical pickup targets)	02290050
Adapter, coaxial BNC receptacle to double banana plug	01609140
Adapter, binding posts to coaxial BNC plug	01609296
Adapter, single binding post to coaxial BNC plug	01619250
Adapter, coaxial BNC "T" jack-plug-jack	00510700
Adapter, coaxial BNC receptacle to single banana plug	01609180
Cable assembly, 50 ohm, 72 inchs long, coaxial BNC connectors	40971-01

Note: Refer to Bently Nevada Catalog to order transducers.

APPENDIX C
OPTICAL PICKUP INFORMATION

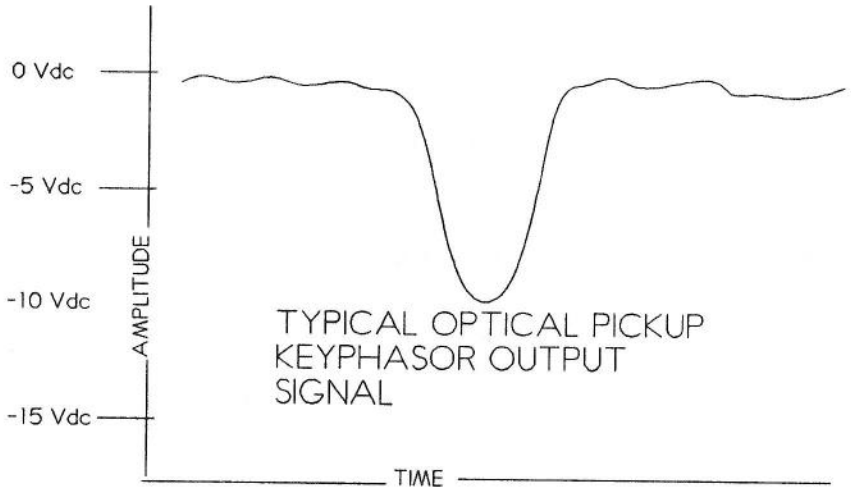
INTRODUCTION

Purpose Of Using Optical Pickup with TK15

Using an optical pickup with TK15 provides timing and phase reference data for a machine that does not have a permanently installed Keyphasor transducer. This data provides a common reference throughout a machine train, and is vital for diagnostics and balancing. Note that this reference is only valid within the time period that the optical pickup is connected, and remains in a fixed position.

Method

A once-per-turn physical event is created (usually by applying reflective tape to the shaft). Every time this (reflective tape) event passes by the optical pickup, the pickup generates a negative voltage pulse. This pulse is conditioned by TK15 and becomes the once-per-turn timing reference event (marker) for use by other instruments.



Information Made Available

When the once-per-turn reference marker is made available (by the optical pickup and TK15) to other instruments (such as tachometers, vector filter meters, and oscilloscopes) the following machine balancing and diagnostic information can be obtained:

- Shaft rotation speed
- Vibration waveforms and orbits
- Phase angle measurements
- Polar plot
- Bodé plots

Additional information is available in a Bently Nevada Applications Note, "The Keyphasor: A Necessity for Machinery Diagnosis," literature No. AN016.

SPECIFICATIONS

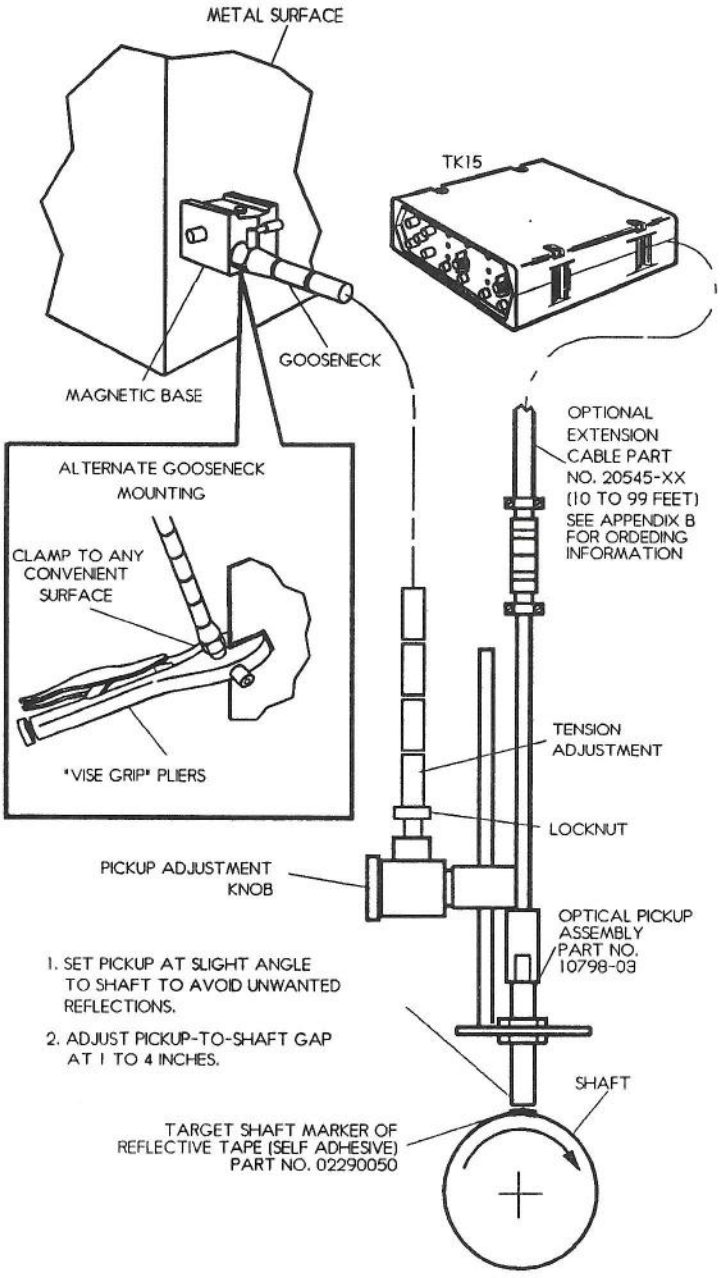
The Optical Pickup Sensor and Extension Cable have Mil spec "Bantam", twist-lock type, 4-pin connectors.

ORDERING INFORMATION

For Optical Pickup and accessory ordering information refer to Appendix B.

INSTALLATION OF OPTICAL PICKUP

See following page for functional diagram showing an Optical pickup installed as a temporary Keyphasor transducer. For addional information refer to "Optical Pickup Package" manual referenced in specifications paragraph above.



Optical Pickup Installed as Temporary Keyphasor Transducer



APPENDIX D
GROUNDING GUIDELINES

Good Grounding Practices

Good grounding practices prevent ground connections from introducing error voltage and noise into the signal information going into, or coming out of, the equipment and instruments being used.

Cause of Ground Induced Signal Error

Ground connection induced signal error is caused by current flow in the ground (common) wires between the transducers and instruments interconnected. This current flow is due to a difference of potential between the earth ground points used by the different transducers and instruments.

A difference of potential between earth ground points can be caused by:

- Long distance between the earth ground points
- Different ac power sources for instruments at each point
- Chemical composition of the earth at the ground point
- Moisture content of the earth at the ground point

Unless good grounding practices are used, the ground (common) interconnection wires between the transducers and instruments being used will act as potential equalizing connections; and therefore will carry ground-introduced current flow.

Avoiding Ground Connection Induced Signal Errors

All connections between system signal common and earth ground must occur at earth ground points of equal potential to avoid ground connection errors and noise. Usually, this is best accomplished by connecting system signal common to earth ground at a single point. This point can be at a monitor, instrument, or, for intrinsically safe systems, at the barrier earth ground bus bar. All other points must be isolated from earth ground.

Ground Connections at TK15

When TK15 is connected between a transducer and a diagnostic instrument, another device with an earth ground connection point is introduced.

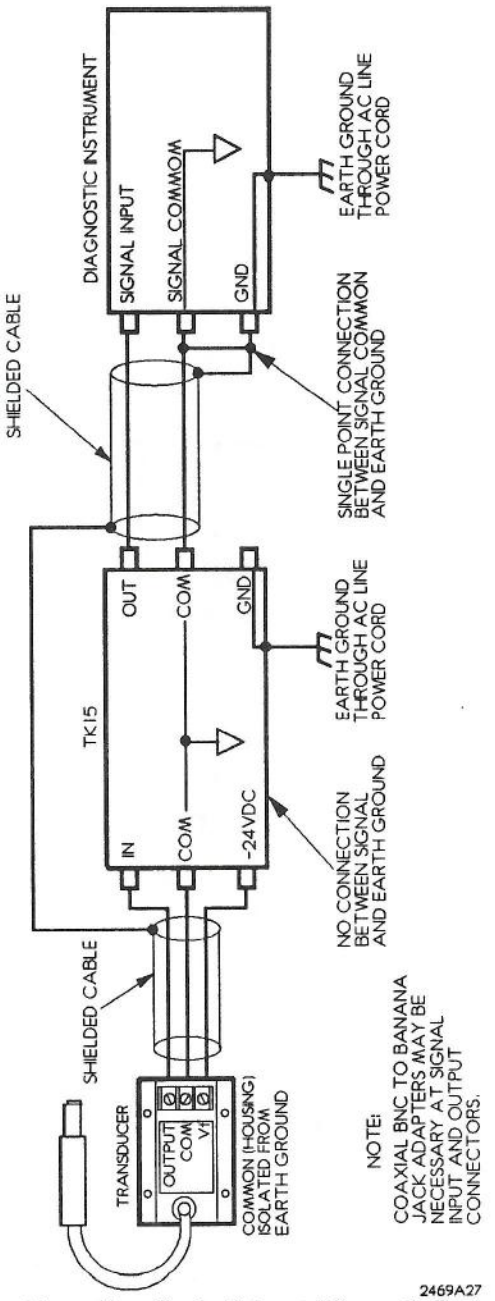
Generally TK15 COM (signal common) should not be connected to TK15 GND (earth ground) unless it is first determined that no other signal-to-earth ground connection exists in the system. The transducer is usually isolated from earth ground at its mounting point; however, this should be determined. All instruments having a signal common connected to TK15 COM should be checked for a signal-to-earth ground connection.

Good practice is to make the signal-to-earth ground connection at the instrument taking critical measurements; however this is not always necessary or practical.

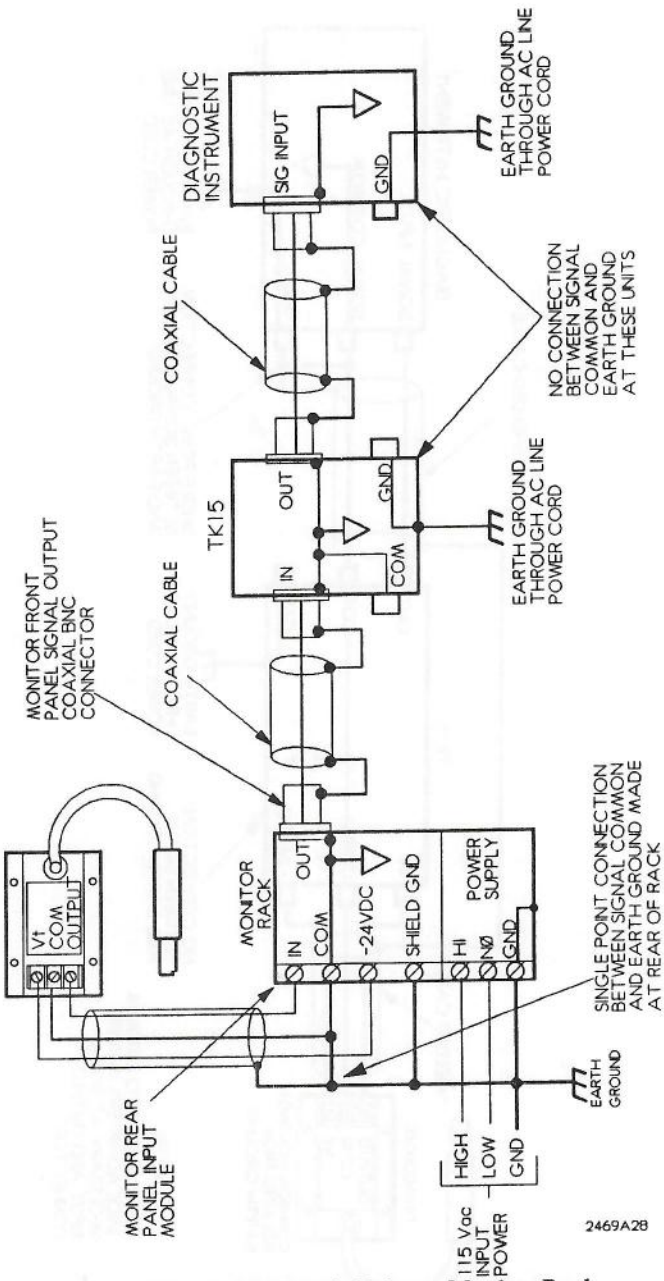
Coaxial or shielded wiring

Shielded wiring between transducers and instruments should have the shield braids connected together; and then connected to earth ground only at the single point where signal common is connected to earth ground. See grounding example "*Proper Grounding, Single Point at Diagnostic Instrument*" of this appendix. If this method of connecting the shield braids is not possible (or desired), connect each shield braid to signal common, or earth ground, at the instrument the cable connects to. If coaxial cable and connectors are being used, this connection is made by the connector itself. See grounding example "*Proper Grounding, Single Point at Monitor Rack*" of this appendix. (Some instruments, such as high frequency oscilloscopes, connect the coaxial BNC connector shell to earth ground, not signal common).

Typical examples of properly grounded systems follow:



Proper Grounding, Single Point at Diagnostic Instrument



Proper Grounding, Single Point at Monitor Rack

APPENDIX E
PROBLEM RESOLUTION



WARNING

High voltage present could cause shock, burns or death

Do not touch exposed wires or terminals

Problem Cause/Solution

1. TK15 power LED does not light.

a. Rear panel fuse open:
Replace with correct type fuse.
b. No ac input power to TK15 rear panel:
Check ac input power connections and circuit breakers.
c. TK15 +15 Vdc OUT is defective or has excessive load:
Remove loads one at a time from + 15 Vdc OUT to determine which load is drawing excessive current.
d. TK15 defective.

2. One or more TK15 transducer power outputs are below tolerance.

a. If TK15 power LED is out, go to step 1. above.
b. Excessive load has been applied to the power output:
Remove loads one at a time to determine which load is drawing excessive current.
c. Ac input power is below specifications:
Check ac input power voltage.
d. TK15 defective.

Problem Cause/Solution

3. TK15 rear panel very hot. *

a. Ac input voltage is not within required specifications: Check ac input line voltage.
b. Rear panel AC INPUT power select switch not correct: Set to correct position for voltage being used.
c. Excessive load applied to transducer power outputs: Measure current drawn from each transducer power output connector, determine if their sum is within TK15 specifications.
d. TK15 defective.

4. No output or distorted signal at TK15 OUT.

a. If TK15 power LED is out, go to step 1. above.
b. TK15 POS or NEG CLAMP adjustments clipping output: Set POS and NEG CLAMP adjustments to MIN.
c. TK15 GAIN setting too high/low for input signal amplitude: View input signal and set GAIN of TK15 and oscilloscope to give observable output waveform.
d. Connections between transducer and TK15 incorrect: Check signal, common, and shield connections.
e. TK15 OUT signal loaded down by external equipment: Disconnect all equipment except oscilloscope from TK15 OUT, if still no output check oscilloscope channel by connecting it to a known good signal.
f. TK15 transducer power outputs low or zero volts: Measure transducer power outputs, if any are low go to step 2. above.
g. TK15 defective.

* Greater than 35 deg. C (95 deg. F) above surrounding ambient air temperature.

5. TK15 transducer power supply outputs have excessive noise.

a. Ac input voltage not within required specifications:
Check ac input power voltage.

b. Excessive load applied to transducer power outputs:
Measure current drawn from each transducer power output connector, determine if their sum is within TK15 specifications.

d. TK15 defective.

6. TK15 OUT signal has excessive noise.

a. Improper grounding procedures used:
Refer to appendix D, Grounding Guidelines.

b. External noise coupling into signal wiring:
Use shielded cable to interconnect transducer, TK15, and oscilloscope. Connect shield braids together, and to earth ground at only one point.

c. Noise may already exist at transducer output:
Disconnect transducer output from TK15 (at transducer) and check output at transducer terminals.

7. Data does not match previously acquired signal.

a. TK15 INV switch setting not the same as when previous data was taken:
If no record of previous setting, try setting INV switch to opposite position.

b. Temporary Keyphasor signal incorrect:
If using radially mounted transducer as a temporary Keyphasor transducer, ensure that event triggering TK15 OUT signal is really a once-per-turn event, and is not shifting in phase.

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