

HARMONICGUARD *PASSIVE*

HarmonicGuard® Series Drive-Applied Harmonic Filter Installation, Operation, and Maintenance Manual



TCI, LLC
W132 N10611 Grant Drive
Germantown, Wisconsin 53022

Phone: 414-357-4480
Fax: 414-357-4484
Helpline: 800-TCI-8282
Web Site: <http://www.transcoil.com>
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Performance Guarantee

Select & install the appropriate HarmonicGuard® Passive Harmonic Filter in a variable torque, variable frequency AC drive application, within our published technical specifications & we guarantee that the input current distortion will be less than or equal to 5% THID for standard HGP Series filters at full load, and less than 8% at 30% load. If a properly sized & installed filter fails to meet its specified THID level, TCI will provide material for necessary modifications or replacement filter at no charge.

HG filters can also provide similar performance in other drive applications such as constant torque, DC drives & other phase controlled rectifiers, but actual THID levels can vary by load and/or speed & therefore cannot be guaranteed.

Consult factory for assistance when applying HGP filters on these types of equipment.

MINIMUM SYSTEM REQUIREMENTS:

The guaranteed performance levels of this filter will be achieved when the following system conditions are met:

Frequency: 60Hz \pm 0.75Hz

System Voltage: Nominal System Voltage (line to line) \pm 10%

Balanced Line Voltage: Within 0.5%

Background Voltage Distortion: < 0.5% THVD

The input VFD current waveform shall be consistent with that of a VFD with 3% AC line reactance at full load.

NOTE: The presence of background voltage distortion will cause motors & other linear loads to draw harmonic currents.

Additional harmonic currents may flow into the HGP filter if there is harmonic voltage distortion already on the system.

If higher levels of harmonic voltage distortion (2%-5%) are present, please use the high background distortion version of the HGP filter.

Revision	Description	Date
A	Release	10/16/13
B	Added Fuse Monitor Option	02/03/14
C	Added Heater & Vibration Pad Options	09/10/14
D	Added 600V Option Changed P/N to 28557-1	11/24/14
E	Updated Part Numbering System Added Floor Stand Option	01/04/16
F	Updated 480V Watts Loss Updated Table 3	03/28/17
G	Updated 600V and 400V Fuse Recommendation Table	06/19/17

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Introduction

Safety Instructions Overview

This section provides the safety instructions which must be followed when installing, operating, and servicing the HarmonicGuard® Passive (HGP) filter. If neglected, physical injury or death may follow, or damage may occur to the filter or equipment connected to the HGP filter. The material in this chapter must be read and understood before attempting any work on, or with, the product.

The HGP filter is intended to be connected to the input terminals of one or more VFDs. Three-phase power is connected to the input terminals of the HGP and power is supplied to the VFD or VFDs through the HGP. The instructions, and particularly the safety instructions, for the VFDs, motors, and any other related equipment must be read, understood, and followed when working on any of the equipment.




Warnings and Cautions

This manual provides two types of safety instructions. Warnings are used to call attention to instructions that describe steps that must be taken to avoid conditions that can lead to a serious fault condition, physical injury, or death.

Cautions are used to call attention to instructions that describe steps that must be taken to avoid conditions that can lead to a malfunction and possible equipment damage.


Warnings

Readers are informed of situations that can result in serious physical injury and/or serious damage to equipment with warning statements highlighted by the following symbols:

Warning 	Dangerous Voltage Warning: warns of situations where high voltage can cause physical injury and/or damage equipment. The text next to this symbol describes ways to avoid the danger.
Warning 	General Warning: warns of situations that can cause physical injury and/or damage equipment by means other than electrical. The text next to this symbol describes ways to avoid the danger.
Warning 	Electrostatic Discharge Warning: warns of situations in which an electrostatic discharge can damage equipment. The text next to this symbol describes ways to avoid the danger.







Cautions

Readers are informed of situations that can lead to a malfunction and possible equipment damage with caution statements:

Caution 	General Caution: identifies situations that can lead to a malfunction and possible equipment damage. The text describes ways to avoid the situation.
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General Safety Instructions

These safety instructions are intended for all work on the HGP. Additional safety instructions are provided at appropriate points on other sections of this manual.

<p>Warning</p> 	<p>Be sure to read, understand, and follow all safety instructions.</p>
<p>Warning</p> 	<p>Only qualified electricians should carry out all electrical installation and maintenance work on the HGP filter.</p>
<p>Warning</p> 	<p>All wiring must be in accordance with the National Electrical Code (NEC) and/or any other codes that apply to the installation site.</p>
<p>Warning</p> 	<p>Disconnect all power before working on the equipment. Do not attempt any work on a powered HGP filter.</p>
<p>Warning</p> 	<p>The HGP filter, drive, motor, and other connected equipment must be properly grounded.</p>
<p>Warning</p> 	<p>After switching off the power, always allow 5 minutes for the capacitors in the HGP filter and in the drive to discharge before working on the HGP, the drive, the motor, or the connecting wiring. It is a good idea to check with a voltmeter to make sure that all sources of power have been disconnected and that all capacitors have discharged before beginning work.</p>

Receiving Inspection and Storage

Thank you for selecting the HarmonicGuard® Passive (HGP) filter. TCI has produced this filter for use in many variable frequency drive (VFD) applications that require input power line harmonic current reduction. This manual describes how to install, operate and maintain the HGP filter.

Receiving Inspection

The HGP filter has been thoroughly inspected and functionally tested at the factory and carefully packaged for shipment. When you receive the unit, you should immediately inspect the shipping container and report any damage to the carrier that delivered the unit. Verify that the part number of the unit you received is the same as the part number listed on your purchase order.

TCI Limited Warranty Policy

TCI, LLC (“TCI”) warrants to the original purchaser only that its products will be free from defects in materials and workmanship under normal use and service for a period originating on the date of shipment from TCI and expiring at the end of the period described below:

Product Family	Warranty Period
KLR, KDR	For the life of the drive with which they are installed.
KLC, KLCUL, KMG, V1k	One (1) year of useful service, not to exceed 18 months from the date of shipment.
HGP, KH, 3H, KRF	Three (3) years from the date of shipment.
KCAP, KTR, KMP	Five (5) years from the date of shipment.
All Other Products	One (1) year of useful service, not to exceed 18 months from the date of shipment.

The foregoing limited warranty is TCI’s sole warranty with respect to its products and TCI makes no other warranty, representation, or promise as to the quality or performance of TCI’s products. THIS EXPRESS LIMITED WARRANTY IS GIVEN IN LIEU OF AND EXCLUDES ANY AND ALL EXPRESS OR IMPLIED WARRANTIES INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

This warranty shall not apply if the product was:

- a) Altered or repaired by anyone other than TCI;
- b) Applied or used for situations other than those originally specified; or
- c) Subjected to negligence, accident, or damage by circumstances beyond TCI’s control, including but not limited to, improper storage, installation, operation, or maintenance.

If, within the warranty period, any product shall be found in TCI’s reasonable judgment to be defective, TCI’s liability and the Buyer’s exclusive remedy under this warranty is expressly limited, at TCI’s option, to (i) repair or replacement of that product, or (ii) return of the product and refund of the purchase price. Such remedy shall be Buyer’s sole and exclusive remedy. TCI SHALL NOT, IN ANY EVENT, BE LIABLE FOR INCIDENTAL DAMAGES OR FOR CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF INCOME, LOSS OF TIME, LOST SALES, INJURY TO PERSONAL PROPERTY, LIABILITY BUYER INCURS WITH RESPECT TO ANY OTHER PERSON, LOSS OF USE OF THE PRODUCT OR FOR ANY OTHER TYPE OR FORM OF CONSEQUENTIAL DAMAGE OR ECONOMIC LOSS.

The foregoing warranties do not cover reimbursement for removal, transportation, reinstallation, or any other expenses that may be incurred in connection with the repair or replacement of the TCI product.

The employees and sales agents of TCI are not authorized to make additional warranties about TCI’s products. TCI’s employees and sales agent’s oral statements do not constitute warranties; these shall not be relied upon by the Buyer, and are not part of any contract for sale. All warranties of TCI embodied in this writing and no other warranties are given beyond those set forth herein.

TCI will not accept the return of any product without its prior written approval. Please consult TCI Customer Service for instructions on the Return Authorization Procedure.

Storage Instructions

If the HGP filter is to be stored before use, be sure that it is stored in a location that conforms to published storage humidity and temperature specifications stated in the HarmonicGuard® Passive Filter Technical Specifications. Store the unit in its original packaging.

Pre-installation Planning

Verify the Application


HGP Ratings

Make sure that the HGP filter is correct for the application. The voltage ratings of the filter must match the input voltage rating of the connected drive. The horsepower and current ratings of the filter must be appropriate for the connected load.

Select a Suitable Location

Environment

Locating the HGP in a suitable environment will help ensure proper performance and a normal operating life. Refer to the environmental specifications listed in Table 2 and/or noted on the drawings furnished with the unit.

Warning 	<p>Unless specifically labeled as approved for such use, this equipment is not suitable for use in an explosive atmosphere or in a "Hazardous (Classified) Location" as defined in article 500 of the National Electrical Code (NEC).</p>
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The unit must be installed in an area where it will not be exposed to:

- Direct sunlight
- Rain or dripping liquids (unless filter is in a Type 3R enclosure)
- Corrosive liquids or gasses
- Explosive or combustible gases or dust
- Excessive airborne dirt and dust
- Excessive vibration

Working Space

Provide sufficient access and working space around the unit to permit ready and safe installation, operation and maintenance. Make sure that the installation conforms to all working space and clearance requirements of the National Electrical Code (NEC) and/or any other applicable codes. Provide sufficient unobstructed space to allow cooling air to flow through the unit. Keep the widest or deepest portion of the unit enclosure having ventilation openings a minimum of six inches from adjacent walls or other equipment. The unit enclosure sides that do not have ventilation openings should be kept a minimum of three inches from adjacent walls or other equipment.

Mounting an Open Panel Unit

If you are mounting an open panel unit in your own enclosure, you must provide an enclosure that is adequately sized and ventilated sufficiently to prevent overheating. The rating and dimension tables for open panel units list the watts of heat loss dissipated by the HGP filter. The maximum temperature of the air around the HGP filter capacitors, line reactor, and tuning reactor should not exceed 50°C (122°F).

Power Wiring

When selecting a mounting location for the HGP filter, plan for the routing of the power wiring.

Route the conduit and wiring from the power source to the filter and then to the VFD.

The HGP is provided with internal fuses.

Installation Guidelines

Mounting

The HGP must be mounted vertically on a smooth, solid surface, free from heat, dampness, and condensation.

Wiring

Cable Entry Locations

The enclosed HGP filters are not provided with enclosure wiring knockouts. A location can be selected at the time of installation. Typical or recommended cable entry locations are shown in the drawings section of this manual.


Field Wiring Connection Terminals

Compression type terminals are provided for all field wiring connections. The wire size capacity ranges and tightening torques for all field wiring connections are listed in the drawings and other information shipped with the unit.

Grounding

The HGP panel equipment-grounding lug must be connected to the ground of the wiring system. The equipment-grounding connection must conform to the requirements of the National Electrical Code (NEC) and/or any other codes that apply to the installation site. The ground connection must be made using a wire conductor. Metallic conduit is not a suitable grounding conductor. The integrity of all ground connections should be periodically checked.

Power Wiring

<p>Caution</p> 	<p>Use copper wire that is appropriate for the voltage and current rating of the equipment. The wire selection must conform to the requirements of the National Electrical Code (NEC) and/or other applicable electrical codes.</p> <p>For units rated less than 100 amps, use wire with an insulation temperature rating of 60°C or higher.</p> <p>For units rated 100 amps or more, use wire with an insulation temperature rating of 75°C or higher.</p>
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Connect three-phase power of the appropriate voltage and current capacity to the circuit protective device to the HGP input power terminals.

Note: in large units, the input power conductors are connected directly to the input terminals on the line reactors.

Connect the output terminals of the HGP to the input power terminals of the VFD.

Note: in large units, the output power conductors are connected directly to the output terminals on the line reactors. Refer to the VFD installation instructions for additional information.

HGP Filter Operation

<p>Caution</p> 	<p>Thoroughly check the installation before applying power and operating the equipment for the first time.</p>
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Before Applying Power for the First Time

Inspect the installation to make sure that all equipment has been completely and correctly installed in accordance with the *Installation Guidelines* section of this manual.

- Check to see that the cooling fan(s) are operating in units so equipped.
- Check to make sure power connections are torqued to recommended torque value.

Operation


Since the HGP is a passive filter, it is always operating whenever the drive is operating.

Installation

Intended Audience

This manual is intended for use by all personnel responsible for the installation, operation and maintenance of the HGP filters. Such personnel are expected to have knowledge of electrical wiring practices, electronic components and electrical schematic symbols.

Additional Information

<p>Caution</p> 	<p>This manual provides general information describing your HGP filter. Be sure to carefully review the more specific information that is provided by the drawings shipped with the unit. Information provided by the drawings takes precedence over the information provided in this manual.</p> <p>The ratings, dimensions and weights given in this manual are approximate and should not be used for any purpose requiring exact data. Contact the factory in situations where certified data is required. All data is subject to change without notice.</p>
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Installation Checklist

The following are the key points to be followed for a successful installation. These points are explained in detail in the following sections of this manual.


- Make sure that the installation location will not be exposed to direct sunlight, corrosive or combustible airborne contaminants, excessive dirt or liquids.
- Select a mounting area that will allow adequate cooling air and maintenance access.
- Make sure that all wiring conforms to the requirements of the National Electrical Code (NEC) and/or other applicable electrical codes.
- Connect the HGP equipment-grounding lug to the system ground of the premises wiring system. Use a properly sized grounding conductor.
- Connect three-phase power to the input terminals of the HGP, L1, L2 & L3.
- Connect the output power terminals, of the HGP, T1, T2 & T3, to the input power terminals of the VFD.

Maintenance and Service

HGP Filter Reliability and Service Life

The HGP has been designed to provide a service life that equals or exceeds the life of the VFD. It has been thoroughly tested at the factory to assure that it will perform reliably from the time it is put into service. It is recommended that the following maintenance is performed once a year to ensure that the HGP filter will always operate reliably and provide the expected service life.

Periodic Maintenance

<p>Warning</p> 	<p>Only qualified electricians should carry out all electrical installation and maintenance work on the HGP filter.</p> <p>Disconnect all sources of power to the drive and HGP before working on the equipment. Do not attempt any work on a powered HGP.</p>
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Check to see that the installation environment remains free from exposure to excessive dirt and contaminants. Refer to the ***Pre-installation Planning*** section of this manual.

Check to make sure that the enclosure ventilation openings are clean and unobstructed.

Clean the air filter in units that have filtered air inlets. Clean as often as necessary to prevent dirt build-up from impeding air flow.


Check the operation of the cooling fan.

Inspect the interior of the enclosure for signs of overheated components. Clean the interior of the enclosure whenever excess dirt has accumulated.

Torque all power wire connections, loose connections can overheat and damage the filter.

All electrical connections must be re-torqued annually.

Troubleshooting

<p>Warning</p> 	<p>Only qualified electricians should carry out all electrical installation and maintenance work on the HGP filter.</p> <p>Disconnect all sources of power to the drive and HGP before working on the equipment. Do not attempt any work on a powered HGP filter.</p> <p>The harmonic filter contains high voltages and capacitors. Wait at least five minutes after disconnecting power from the filter before you attempt to service the harmonic filter. Check for zero voltage between all terminals on the capacitors. Also, check for zero voltage between all phases of the line side of the fuses, Fu1(a)–Fu2(a)–Fu3(a), and all input terminals L1, L2 and L3 of the line reactor (KDR). All setup, maintenance, and troubleshooting must be done by a qualified electrician. Failure to follow standard safety procedures may result in death or serious injury.</p>
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Note: when disconnecting wires from components and terminations, mark the wires to correspond to their component and terminal connection.

Replacement Parts

If replacement parts are needed, please contact your TCI representative. To ensure that the HGP filter continues to perform to its original specifications, replacement parts should conform to TCI specifications.

Fuse Specifications

Always refer to the drawings and other information shipped with your unit. Consult applicable wiring codes, UL and NEC, for current limiting and disconnect requirements.

100 kA SCCR Fusing Requirements

See Table 1 for line fusing requirements that must be supplied to comply with the 100kA SCCR rating.

Table 1 – Customer Installed Line Fuse Requirements to comply with the 100kA SCCR

Voltage	Size	Customer Installed Line Fuse Requirements to Comply with the 100 kA SCCR
600	≤ 40	Use appropriately rated Class J, T, or L fuse less than or equal to 60 A
600	> 40	No requirement for SCCR
480	≤40	Use appropriately rated Class J, T, or L fuse less than or equal to 60 A
480	> 40	No requirement for SCCR
440	≤30	Use appropriately rated Class J, T, or L fuse less than or equal to 60 A
440	> 30	No requirement for SCCR
415	≤30	Use appropriately rated Class J, T, or L fuse less than or equal to 60 A
415	> 30	No requirement for SCCR
240	≤ 10	Use appropriately rated Class J, T, or L fuse less than or equal to 60 A
240	> 10	No requirement for SCCR
208	≤ 10	Use appropriately rated Class J, T, or L fuse less than or equal to 60 A
208	> 10	No requirement for SCCR

Provisional 480V Fuse Table

The fuse tables, provided below (Tables 2, 3, 4, 5, 6, and 7), show the fuse ratings of the included branch circuit fuse internal to the HGP unit as a fuse replacement reference.

The fuse tables also show a typical line fuse or circuit breaker current rating for overcurrent protection, given the unit's nameplate power rating, if necessary, based on the installation. The line current fuses listed below are typical values given the unit power rating, not required values. Line fusing ratings are determined by the installer, based on input conductor sizing and protection required for downstream equipment. Any drawings or documentation included with the unit literature kit take precedence over the fuse tables below.

Note that to achieve a 100kA SCCR rating, the customer provided line fuse must be installed as per the requirements in Table 1 and sized following NEC (National Electrical Code) guidelines for the source conductors selected by the installer. The branch fuses are required to be installed at the shown ratings.

Table 2 – Fuse Table for HGP 480 Volt, 60Hz Models

HGP Rating (HP)	Branch Circuit Fuse Current Rating (Included Internal to HGP Unit)	Typical Line Current Fuse or Circuit Breaker Rating (Customer Supplied)
	(J or T)	
1.5	20	30
3	20	30
5	20	30
7.5	20	30
10	20	30
15	20	30
20	20	60
25	20	60
30	20	60
40	30	60
50	30	80
60	50	90
75	50	125
100	60	150
125	80	200
150	100	225
200	125	300
250	150	350
300	175	450
350	200	500
400	225	600
450	250	600
500	300	800
250	150	350
300	175	450
350	200	500
400	225	600
450	250	600
600	350	800
700	400	1000
800	500	1100
900	250/250 (Parallel Branches)	1200
1000	300/300 (Parallel Branches)	1400
1100	350/350 (Parallel Branches)	1500
1200	350/350 (Parallel Branches)	1600
1250	400/400 (Parallel Branches)	1800

Table 3 – Fuse Table for HGP 440 Volt, 60Hz Models

HGP Rating (HP)	Branch Circuit Fuse Current Rating (Included Internal to HGP Unit)	Typical Line Current Fuse or Circuit Breaker Rating (Customer Supplied)
	(J or T)	
2.5	20	30
3	20	30
5	20	30
7.5	20	30
10	20	30
15	20	60
20	20	60
25	20	60
30	30	60
40	30	80
50	50	90
60	50	125
75	60	150
100	80	200
125	100	225
150 & 175	125	300
200	150	350
250	175	450
300	225	600
350	300	600
400	300	800
500	350	800
600	400	1000
650 & 700	500	1100
750	250/250 (Parallel Branches)	1200
800 & 850	300/300 (Parallel Branches)	1400
900 & 1000 & 1050	400/400 (Parallel Branches)	1800

Table 4 – Fuse Table for HGP 380-415 Volt, 60Hz Models

HGP Rating (HP)	Branch Circuit Fuse Current Rating (Included Internal to HGP Unit)	Typical Line Current Fuse or Circuit Breaker Rating (Customer Supplied)
	(J or T)	
2	20	30
3	20	30
7.5	20	30
10	20	30
15	20	60
20	20	60
25 & 30	30	60
40	30	80
50	50	125
60	60	150
75	80	200
100	100	225
125	125	250
150	125	300
175	150	350
200	175	450
250	200	500
300	300	600
350	300	800
400 & 450	350	800
500	400	1000
600	500	1100
700	300/300 (Parallel Branches)	1350
750	300/300 (Parallel Branches)	1500
800	400/400 (Parallel Branches)	1500
900	400/400 (Parallel Branches)	1600
950	400/400 (Parallel Branches)	1800

Table 5 – Fuse Table for HGP 240 Volt, 60Hz Models

HGP Rating (HP)	Branch Circuit Fuse Current Rating (Included Internal to HGP Unit)	Typical Line Current Fuse or Circuit Breaker Rating (Customer Supplied)
	(J or T)	
5	20	30
7.5	20	30
10	20	60
15	30	60
20	50	70
25	50	80
30	60	80
40	80	120
50	100	150
60	125	200
75	150	225
100	175	300
125	200	400
150	225	450
200	250	600
250	500	800
300	250/250 (Parallel Branches)	900
400	400/400 (Parallel Branches)	1100

Table 6 – Fuse Table for HGP 208 Volt, 60Hz Models

HGP Rating (HP)	Branch Circuit Fuse Current Rating (Included Internal to HGP Unit)	Typical Line Current Fuse or Circuit Breaker Rating (Customer Supplied)
	(J or T)	
5	20	30
7.5	20	30
10	30	60
15	50	60
20	50	70
25	60	80
30	80	100
40	125	150
50	125	175
60	150	200
75	175	250
100	225	350
150	350	450
200	500	600
250	300/300 (Parallel Branches)	800
300	400/400 (Parallel Branches)	900

Table 7 – Fuse Table for HGP 600 Volt, 60Hz Models

HGP Rating (HP)	Branch Circuit Fuse Current Rating (Included Internal to HGP Unit)	Typical Line Current Fuse or Circuit Breaker Rating (Customer Supplied)
	(J or T)	
5	20	30
7.5	20	30
10	20	30
15	20	30
20	20	60
25	20	60
30	20	60
40	30	60
50	30	70
60	35	80
75	40	90
100	50	125
125	70	150
150	80	200
200	100	250
250	125	300
300	150	350
350	175	400
400	200	450
450	225	500
500	250	550
600	300	650
700	350	750

Factory Contacts and Tech Support

For technical support, contact your local TCI distributor or sales representative. You can contact TCI directly at 800-TCI-8282. Select "Customer Service" or "Tech Support" and have your HGP filter nameplate information available.

Product Description

HGP Drive-Applied Filter

The HGP is a drive-applied harmonic filter designed and developed by TCI to reduce the harmonic currents drawn from the power source by VFDs. The published HGP voltage, Power (Hp or kW) and current ratings apply to matching power (Hp or kW) rated standard VFDs with six-pulse diode bridge rectifiers. The HGP may also be sized to filter other loads such as SCR six-step drives, SCR Direct Current (DC) motor drives, thyristor furnaces, battery chargers, electroplating supplies or other types of non linear loads. In many cases, the filter power rating (Hp or kW) will differ from load power rating (Hp or kW). Please contact TCI Technical Support for additional information and support on sizing HGP harmonic filters for your non six-pulse diode front end VFD applications.

The HGP is a passive filter connected in series with the input terminals of a VFD or several VFDs that operate as a group. It is designed to provide a low impedance path for the major harmonic currents demanded by the drive. The filter is a stand-alone device that can be furnished in its own enclosure and mounted adjacent to the drive. It is also available on an open panel for mounting within an enclosure with the drive or other equipment.

The HGP filters consist minimally of the following features and components:

- A KDR tuned series reactor to prevent system interaction and improve filter performance
- An L-C-L filter circuit with:
- A TCI 3-phase tuning reactor specifically designed for the HGP filter
- High-endurance, harmonic-rated capacitors
- Larger filters may have multiple tuned circuits. Consult fuse tables to determine if the filter in question has “parallel” branches.
- Bleeder resistors to ensure safe capacitor discharge upon filter shutdown
- Cooling fans (on select models) to ensure adequate cooling and safe operating temperatures
- Compression terminals for ease and integrity of all power and control wiring
- Fuses, sized to protect the capacitor wiring

Nameplate Data

The following information is marked on the nameplate:

- Part number: encoding is explained on the following page
- FLA: the rated continuous operating current (RMS amps)
- System Voltage: the rated 3-phase line voltage (RMS volts)
- Hz: the rated frequency
- Phase: 3 – The HGP filter is designed for use only with 3-phase power.
- Drawing #: outline and mounting dimension drawing number
- Schematic #: schematic diagram drawing number
- Manufacturing #: for TCI internal use
- Enclosure Type: UL designation or "Open" panel construction

Part Number Encoding

Figure 1 identifies the significance of each character in the HGP part number. The example part number, HGP0150AW1S0000 designates an HGP filter that is rated 150 HP, 480 volts, 60 Hz. It includes a line reactor, tuning reactor, and capacitors in a UL Type 1 enclosure. It is designed for use with a 150 HP drive.

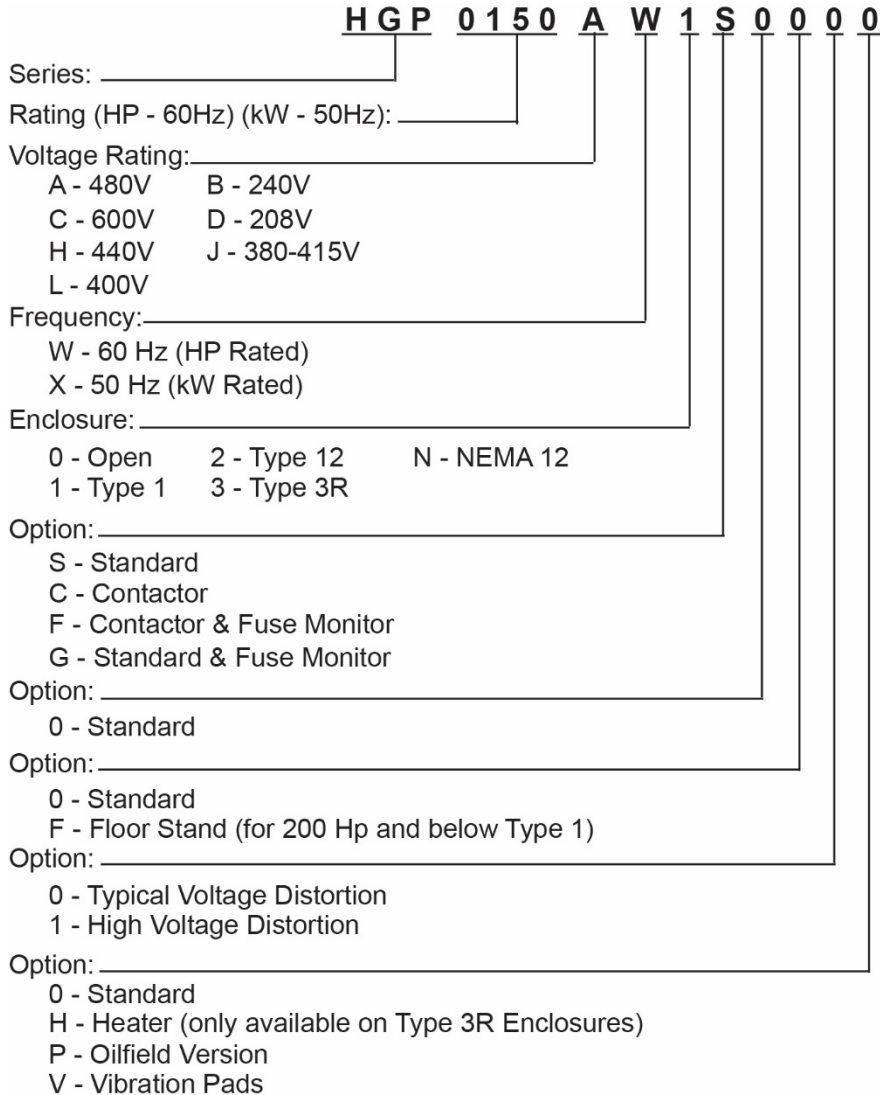


Figure 1 – HGP Part Number Encoding

Product Technical Specifications

Table 8 lists the major technical specifications for the HGP Filter.

Table 8 – HGP Technical Specifications


Voltage ratings	208V, 3 phase, 60 Hz / 240V, 3 phase, 60Hz / 400V, 3 phase, 50 Hz /480V, 3 phase, 60 Hz / 600V, 3 phase, 60 Hz
kVar ratings	1.3 to 380 kVar depending on voltage.
Load types	3-phase diode bridge rectifier loads such as PWM AC drives
Load power range	1.5-1250HP for 480V units. Power range varies depending on system voltage
Current ratings	The included series reactors can tolerate 200% of rated current for no more than 3 minutes.
SCCR (short circuit current rating)	Standard rating is 100kA.
Maximum elevation	3,000 feet (1,000 meters) as standard.
Maximum ambient operating temperature	50°C (122°F) – Open Panel; 40°C (104°F) – Enclosed Panel. Product must be equipped with special cooling provisions for operation above this temperature.
Maximum ambient storage temperature	60°C (140°F)
Maximum humidity, operating or storage	95%, non-condensing.
Enclosure options	UL Type 1 enclosure UL Type 3R enclosure UL Type 12 enclosure Open Panel
Agency approvals or certifications	 UL and cUL Listed to UL508A
Insertion Impedance	10% at full load current
Fusing and protection:	All units have internal fuse protection for the capacitor branch circuit
Performance Guarantee	
To meet the requirements for the Performance Guarantee the minimum system conditions must conform to the following: <ul style="list-style-type: none"> • No more than 1.5% Source inductance • The input VFD current waveform shall be consistent with that of a VFD with 3% AC line reactance at full load 	

Table 9 – 480V HGP Watts loss

HP	Open	Type 1	Type 3R
3	110	110	125
5	110	110	125
7.5	140	140	160
10	160	160	175
15	215	215	230
20	260	260	275
25	310	310	325
30	265	265	280
40	460	460	500
50	490	490	525
60	650	650	675
75	800	800	850
100	775	775	800
125	900	900	900
150	1150	1150	1200
200	1425	1500	1500
250	1575	1625	1650
300	1975	2020	2025
350	1800	1875	1875
400	1950	2000	2025
450	2175	2550	2275
500	2500	2875	2575
600	1975	2375	2075
700	2150	2550	2575
800	2200	2600	2600
900	3650	4100	4100
1000	2675	3100	3100

Table 10 – 600V HGP Watts loss

HP	Open	Type 1	Type 3R
15	170	170	185
30	275	275	295
40	450	450	480
50	450	450	500
60	620	620	660
75	775	775	800
100	800	800	850
125	850	850	900
150	1100	1100	1175
200	1350	1400	1400
250	1500	1575	1575
300	1450	1500	1500
350	1825	1900	1900
400	1450	1875	1550
450	1950	2350	2010
500	1800	2200	1875
600	1850	2250	1925
700	2100	2500	2500
800	2400	2800	2800
900	2450	2850	2850

Standard Option (S)

The Standard Option includes high quality harmonic-grade capacitors and line reactors. This filter will meet the majority of application requirements found today. This cost effective product is available as an open panel version, in a UL Type 1 or UL Type 12 enclosure, or in an UL Type 3R enclosure. The open panel is perfect for inclusion in a MCC section or easy installation into industry standard enclosures. The UL Type 1 enclosed units maintain the same vertical profile as the open panel design. This design is perfect for applications where floor space is at a premium. The UL Type 3R enclosure protects the filter from harsh conditions.

Product Description

HGP S Option Filter

The HGP is a drive-applied harmonic filter designed and developed by TCI to reduce the harmonic currents drawn from the power source by VFDs. The published HGP voltage, Power (Hp or kW) and current ratings apply to matching power (Hp or kW) rated standard VFDs with six-pulse diode bridge rectifiers. The HGP may also be sized to filter other loads, such as SCR six-step drives, SCR Direct Current (DC) motor drives, thyristor furnaces, battery chargers, electroplating supplies or other types of non linear loads. In many cases, the filter power rating (Hp or kW) will differ from load power rating (Hp or kW). Please contact TCI Technical Support for additional information and support on sizing HGP harmonic filters for your non six-pulse diode front end VFD applications.

The HGP harmonic filter is a passive filter connected in series with the input terminals of a VFD or several VFDs that operate as a group. It is designed to provide a low impedance path for the major harmonic currents demanded by the VFD. The filter is a stand-alone device that can be furnished in its own enclosure and mounted adjacent to the VFD. It is also available on an open panel for mounting within an enclosure with the VFD or other equipment.

The HGP Standard Option consists of the following standard features and components:

- A KDR tuned series reactor.
- A TCI 3-phase tuning reactor specifically designed for the HGP filter.
- High-endurance, harmonic-rated capacitors.
- Bleeder resistors to ensure safe capacitor discharge upon filter shutdown, located on capacitors.
- Cooling fans (on select models) to ensure adequate cooling and safe operating temperatures.
- Control Power transformer on enclosed units requiring auxiliary cooling fans.
- Compression terminals for ease and integrity of all power and control wiring.
- Fuses

Contactor Option (C)

The Contactor Option includes a contactor, control power transformer and connection terminals in the filter circuit which allows the VFD user to control the insertion of this circuit through the use of a relay contact in the VFD. It is recommended that the VFD contact be programmed to open the contactor below 33% motor power. For variable torque (fan) loads this will be approximately below 70% speed, so the at-speed contact may be used. This reduces the possibility of leading power factor interacting with other devices on the power system. Contactor logic should also maintain the contactor closed in cases where the VFD is bypassed and the filter is not bypassed.

Product Description

HGP C Option Filter

The HGP is a drive-applied harmonic filter designed and developed by TCI to reduce the harmonic currents drawn from the power source by VFDs. The published HGP voltage, Power (Hp or kW) and current ratings apply to matching power (Hp or kW) rated standard VFDs with six-pulse diode bridge rectifiers. The HGP may also be sized to filter other loads such as SCR six-step drives, SCR Direct Current (DC) motor drives, thyristor furnaces, battery chargers, electroplating supplies or other types of non linear loads. In many cases, the filter power rating (Hp or kW) will differ from load power rating (Hp or kW). Please contact TCI Technical Support for additional information and support on sizing HGP harmonic filters for your non six-pulse diode front end VFD applications.

The HGP harmonic filter is a passive filter connected in series with the input terminals of a VFD or several VFDs that operate as a group. It is designed to provide a low impedance path for the major harmonic currents demanded by the VFD. The filter is a stand-alone device that can be furnished in its own enclosure and mounted adjacent to the VFD. It is also available on an open panel for mounting within an enclosure with the VFD or other equipment.

The HGP Contactor Option consists of the following standard features and components:

- A KDR tuned series reactor.
- A TCI 3-phase tuning reactor specifically designed for the HGP filter.
- High-endurance, harmonic-rated capacitors.
- Bleeder resistors to ensure safe capacitor discharge upon filter shutdown, located on capacitors.
- Filter enable/disable contactor with protection and drive interlock provisions.
- Cooling fans (on select models) to ensure adequate cooling and safe operating temperatures.
- Control power transformer
- Compression terminals for ease and integrity of all power and control wiring.
- Fuses
- Contactor

Fuse Monitor with Contactor Option (F)

The Fuse Monitor with Contactor Option includes a voltage monitor module and relay that can be connected to a VFD or other device. The fuse monitor will indicate a fuse failure and communicate this condition through the relay to a connected device.

This option includes a contactor, control power transformer, and connection terminals in the filter circuit which allows the VFD user to control the insertion of this circuit through the use of a relay contact in the VFD. It is recommended that the drive contact be programmed to open the contactor below 33% motor power. For variable torque (fan) loads this will be approximately below 70% speed, so the at-speed contact may be used. This reduces the possibility of leading power factor interacting with other devices on the power system. Contactor logic should also maintain the contactor closed in cases where the VFD is bypassed and the filter is not bypassed.

Product Description

HGP F Option Filter

The HGP is a drive-applied harmonic filter designed and developed by TCI to reduce the harmonic currents drawn from the power source by VFDs. The published HGP voltage, Power (Hp or kW) and current ratings apply to matching power (Hp or kW) rated standard VFDs with six-pulse diode bridge rectifiers. The HGP may also be sized to filter other loads such as SCR six-step drives, SCR Direct Current (DC) motor drives, thyristor furnaces, battery chargers, electroplating supplies or other types of non linear loads. In many cases, the filter power rating (Hp or kW) will differ from load power rating (Hp or kW). Please contact TCI Technical Support for additional information and support on sizing HGP harmonic filters for your non six-pulse diode front end VFD applications.

The HGP harmonic filter is a passive filter connected in series with the input terminals of a VFD or several VFDs that operate as a group. It is designed to provide a low impedance path for the major harmonic currents demanded by the VFD. The filter is a stand-alone device that can be furnished in its own enclosure and mounted adjacent to the VFD. It is also available on an open panel for mounting within an enclosure with the VFD or other equipment.

The HGP F Option consists of the following standard features and components:

- A KDR tuned series reactor
- A TCI 3-phase tuning reactor specifically designed for the HGP filter
- High-endurance, harmonic-rated capacitors
- Bleeder resistors to ensure safe capacitor discharge upon filter shutdown, located on capacitors
- Filter enable/disable contactor with protection and drive interlock provisions.
- Cooling fans (on select models) to ensure adequate cooling and safe operating temperatures
- Control power transformer
- Compression terminals for ease and integrity of all power and control wiring
- Fuses
- Contactor
- Voltage monitor module to report status of fuses to control

Fuse Monitor without Contactor Option (G)

The Fuse Monitor without Contactor Option includes a voltage monitor module and relay that can be connected to a VFD or other device. The fuse monitor will indicate a fuse failure and communicate this condition through the relay to a connected device.

Product Description

HGP G Option Filter

The HGP is a drive-applied harmonic filter designed and developed by TCI to reduce the harmonic currents drawn from the power source by VFDs. The published HGP voltage, Power (Hp or kW) and current ratings apply to matching power (Hp or kW) rated standard VFDs with six-pulse diode bridge rectifiers. The HGP may also be sized to filter other loads such as SCR six-step drives, SCR Direct Current (DC) motor drives, thyristor furnaces, battery chargers, electroplating supplies or other types of non linear loads. In many cases, the filter power rating (Hp or kW) will differ from load power rating (Hp or kW). Please contact TCI Technical Support for additional information and support on sizing HGP harmonic filters for your non six-pulse diode front end VFD applications.

The HGP harmonic filter is a passive filter connected in series with the input terminals of a VFD or several VFDs that operate as a group. It is designed to provide a low impedance path for the major harmonic currents demanded by the VFD. The filter is a stand-alone device that can be furnished in its own enclosure and mounted adjacent to the VFD. It is also available on an open panel for mounting within an enclosure with the VFD or other equipment.

The HGP G Option consists of the following standard features and components:

- A KDR tuned series reactor
- A TCI 3-phase tuning reactor specifically designed for the HGP filter
- High-endurance, harmonic-rated capacitors
- Bleeder resistors to ensure safe capacitor discharge upon filter shutdown, located on capacitors
- Cooling fans (on select models) to ensure adequate cooling and safe operating temperatures
- Control Power transformer on enclosed units requiring auxiliary cooling fans
- Compression terminals for ease and integrity of all power and control wiring
- Fuses
- Voltage monitor module to report status of fuses to control

Filter and Fuse Monitor Operation

HGP Filter Overview

The Harmonic Guard Passive (HGP) Filter provides a low impedance path for the major harmonic currents demanded by Variable Frequency Drives (VFDs). This greatly reduces the amount of harmonic currents flowing through the electrical power distribution system, bringing those harmonic currents in line with the IEEE-519 standard for harmonic distortion mandated by an increasing number of utilities.

The HGP Filter includes branch fuses on the harmonic trap circuit capacitors. These fuses are included in the design to prevent damage to the capacitors in the event of excessive harmonic trap current if the filter is misapplied.

HGP Fuse Monitor Overview

The HGP Fuse Monitor Option is used in conjunction with the HGP filter to monitor the status of the HGP branch circuit capacitor fuses and optional contactor. If three phase power with correct phase sequence is presented to sense terminals of fuse monitor, the SPDT relay contact will change state as illustrated in Table 2. Additionally, the Fuse Monitor Option is used to indicate the state of the optional contactor that allows users to remove the capacitors from the circuit, eliminating the possibility of leading power factor. The HGP Fuse Monitor Option will energize a SPDT relay contact if line power is applied to the filter, the fuses are intact, and the optional contactor was energized and closed. Finally, the Fuse Monitor Option provides the additional benefit of detecting drive input voltage phase reversal and loss of phase.

The HGP Fuse Monitor can be connected to a programmable digital input available on most modern VFDs and/or Programmable Logic Controllers (PLCs). Once the status of the HGP Fuse Monitor is routed to a programmable digital input, the status of the Fuse Monitor can be relayed on the VFDs or PLCs integrated communications field bus or Industrial Ethernet network interface. The Fuse Monitor is available on 480V and 600V HGP filters.

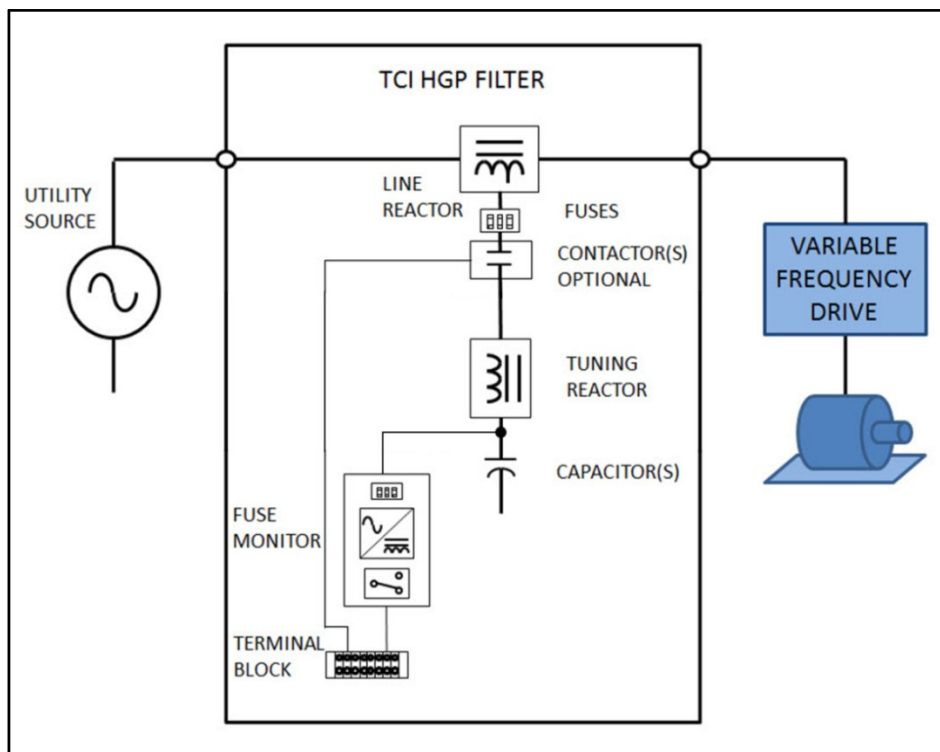


Figure 2 – HGP Filter and Fuse Monitor Option Block Diagram

Fuse Monitor Operation and Relay Specifications

The fuse monitor relay contact is a single pole, double throw (SPDT) dry type contact. Terminal Block connection TBa-7 is the common connection, TBa-6 is the Normally Closed (NC) connection, and TBa-8 is the Normally Open (NO) Connection. If three phase power with correct phase sequence is presented to sense terminals of fuse monitor, the SPDT relay contact will change state as illustrated in Table 2 below.

Table 2 – Fuse Monitor Operation Modes and Output Table

Operating State	Input Voltage	HGP Filter	N.C. Relay Contact (TBa-6 TBa-7)	N.O. Relay Contact (TBa-7 TBa-8)	Monitor Status LED
No Input Line Voltage	Not Present	X*	Closed	Open	Off
Input Line Voltage has Missing Phase	Phase Loss	X*	Closed	Open	Blinking Red
Input Line Voltage has Phase Reversal	Phase Reversal	X*	Closed	Open	Solid Red
HGP Filter has Blown Trap Fuse	Nominal	Blown Trap Fuse	Closed	Open	Blinking Red or Off
HGP Fuse Monitor has Blown Fuse	Nominal	Blown Monitor Fuse	Closed	Open	Blinking Red or Off
HGP Filter Contactor is Open	Nominal	Contactor Open	Closed	Open	Off
Nominal	Nominal	Contactor Closed	Open	Closed	Solid Green
Nominal	Nominal	No Contactor Option Installed	Open	Closed	Solid Green

*X = don't care condition

** During unit power on / restart monitor LED will be blinking green

Table 3 – HGP Filter Fuse Monitor Relay Contact Specifications

Relay Contact	Location	Contact Rating
Normally Open Contact	(TBa-7 TBa-8)	10A @ 277V AC/ 7A @ 30VDC 1 HP @ 250V AC, 1/2HP @125V AC, C300 Pilot Duty
Normally Closed Contact	(TBa-6 TBa-7)	10A @ 277V AC/ 7A @ 30VDC 1 HP @ 250V AC, 1/2HP @125V AC, C300 Pilot Duty

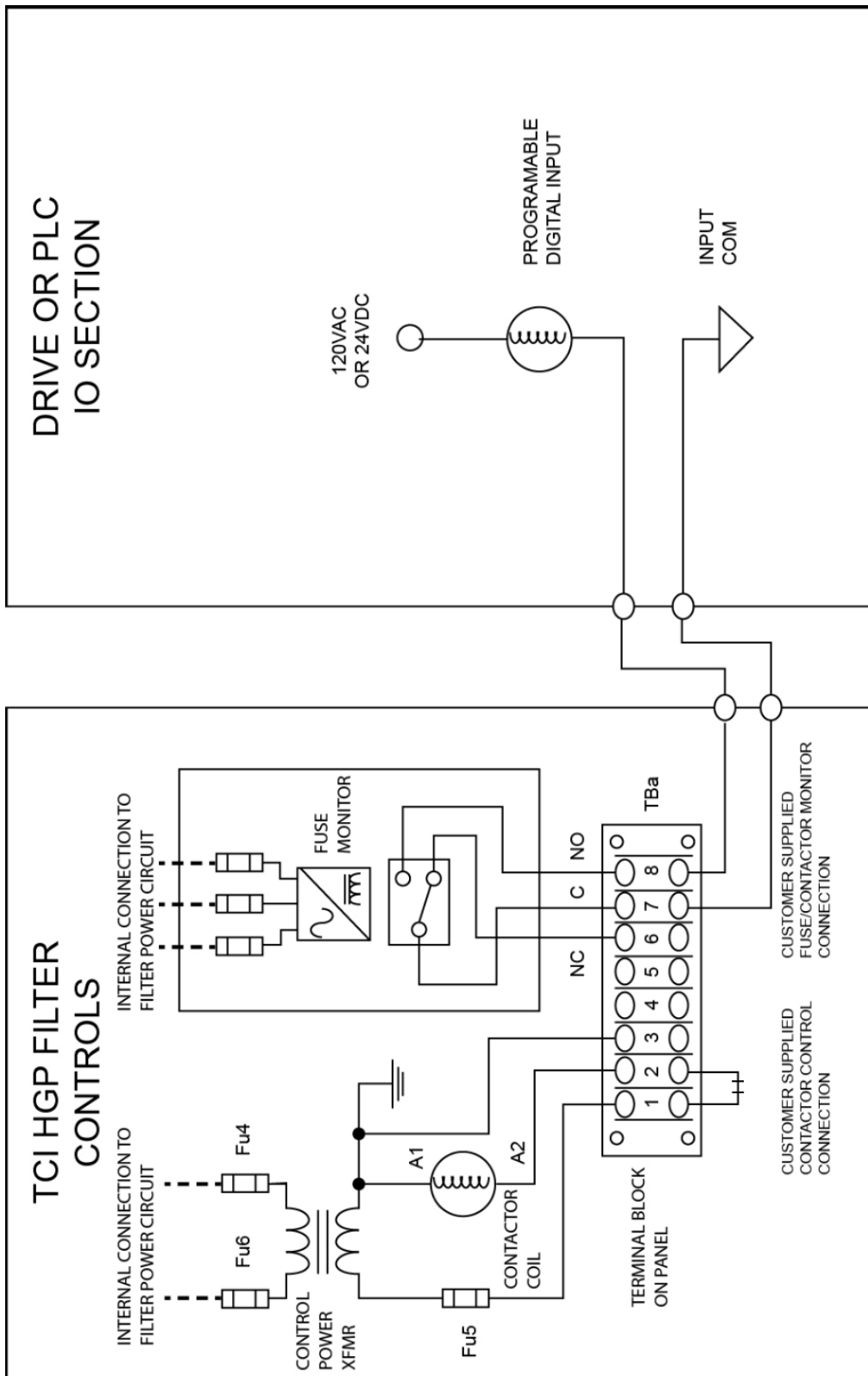


Figure 3 – HGP Filter Fuse Monitor Typical Connection Circuit Diagram

Typical Voltage Distortion Option (0)

The Typical Voltage Distortion Option, intended for applications with levels of background voltage distortion less than 2%, is a configuration that enables the HGP filter to achieve lower levels of current harmonic distortion in applications with low background voltage distortion.

This performance option is available in all of the package options.

High Voltage Distortion Option (1)

The High Voltage Distortion Option, intended for applications with levels of background voltage distortion of 2% or higher, is a configuration that enables the HGP filter to achieve lower levels of current harmonic distortion in applications with high background voltage distortion.

This performance option is available in all of the package options.

Heater Option (H)

The Heater Option is intended for use in applications which require the environmental protection of a NEMA 3R enclosure. The heater is mounted to the interior of the enclosure and protects sensitive electronic equipment from the harmful effects of corrosion and condensation.

The Heater option is available for all 3R enclosures.

Vibration Pad Option (V)

The Vibration Pad Option is intended for use in applications which require environmental noise protection. The resilient mounting material is placed between the reactor and the interior of the enclosure and dampens noise produced by the reactor.

The Vibration Pad option is available for all enclosure types.

Floor Stand Option (F)

The Floor Stand Option is intended for use in applications which require the HGP enclosure to be elevated from the floor. The Floor Stand option consists of 12" steel feet available for Type 3R enclosures 125hp and below.



TCI, LLC
W132 N10611 Grant Drive
Germantown, Wisconsin 53022

Phone: 414-357-4480

Fax: 414-357-4484

Helpline: 800-TCI-8282

Web Site: <http://www.transcoil.com>

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