

Appendix – Part Numbering

Part numbering: Here is an example the interface module part number:

 **CM100A00**

CM = Communications

100 = amp rating of 100 amps

A = voltage rating of 480V

00 = Modbus RTU over RS485

A suffix of 00 = Modbus RTU over RS485

A suffix of 01 = Ethernet/IP

Here would be the part number possibilities available as of this revision:

CM45A00, CM50A00, CM90A00, CM100A00, CM200A00, CM45A01, CM50A01, CM90A01,
CM100A01, CM200A01

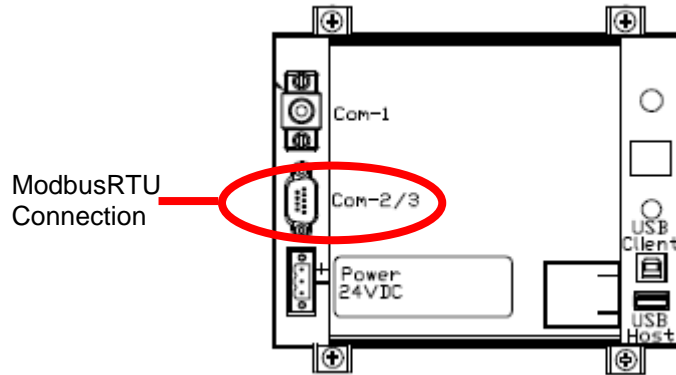


Figure 6.4 – HMI ModbusRTU Connection

Table 6.4 – Modbus Connector Pin Definitions

COM2/3 DB9 Pin	Signal Name	Signal Type
1	no connect	-
2	no connect	-
3	no connect	-
4	D+	RS-485 B (non-inverting)
5	GND	RS-485 SC/G
6	no connect	-
7	no connect	-
8	no connect	-
9	D-	RS-485 A (inverting)

Table 6.5 – ModbusRTU Protocol Settings

Parameter	Default Value	Units
Baud Rate	19200	bps
Data Bits	8	bits
Stop Bits	1	bits
Parity	Even	-
Slave ID	113	-

Communications Gateway Connections (Optional)

If an optional advanced network Communications Gateway is included in the Interface Module see the appendix for the specific Communications Gateway wiring details.

If the optional network Communications Gateway is present, the integrated ModbusRTU interface on the HMI Display will not be available. When configured, the Communications Gateway will occupy the ModbusRTU COM2/3 DB9 connector on the back of the HMI Display.


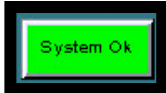

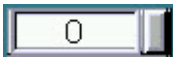
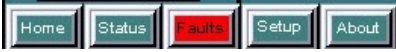

■ Section 7

Operation

HMI Screen Elements

This section focuses on the operation of the HMI Display. The HMI Display contains several screens that allow the user to monitor the status of the line/load and the HarmonicGuard Active filter. Additionally the HMI display can be used for local run/stop control and basic setup of the HarmonicGuard Active filter.

Table 7.1 – General HMI Screen Elements

HMI Graphic Element	Example	Description
Buttons		Buttons will appear raised or depressed, depending on set point and command conditions.
Indicators		Indicator status fields will appear flat and are read only.
Numerical Displays		Display fields will appear flat. Numerical displays are read only.
Numerical Entry Fields		Numerical Entry fields appear indented. Selecting them will open a keypad for numerical entry.
Navigation Bar		The Navigation Bar allows for easy navigation between the five major HMI screens. The Navigation Bar appears on all HMI screens.
Title Bar		The Title Bar contains the current system time, screen selection, and a stop button to turn off the system. The Navigation Bar appears on all HMI screens.

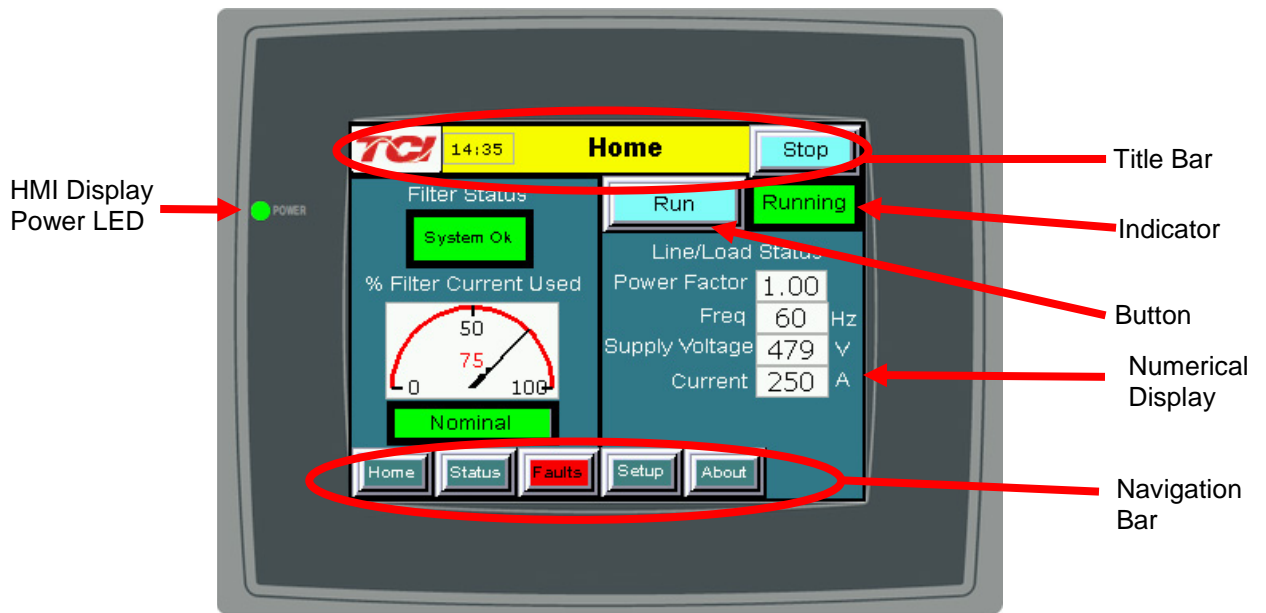


Figure 7.1 – HMI Display

Initialization

When first powered, the green LED (Power) on the HMI Display will light (see **Figure 7.1**).

After a five second boot up sequence the Home Screen will be displayed. If the home screen is not displayed and power is available to the HMI Display see the troubleshooting section at the end of this user manual for diagnosing common problems.

HMI Screens

Home screen

The Home screen displays a dashboard of overall filter status information and allows the user to run and stop the HarmonicGuard Active filter. **Figure 7.2** illustrates the functions.

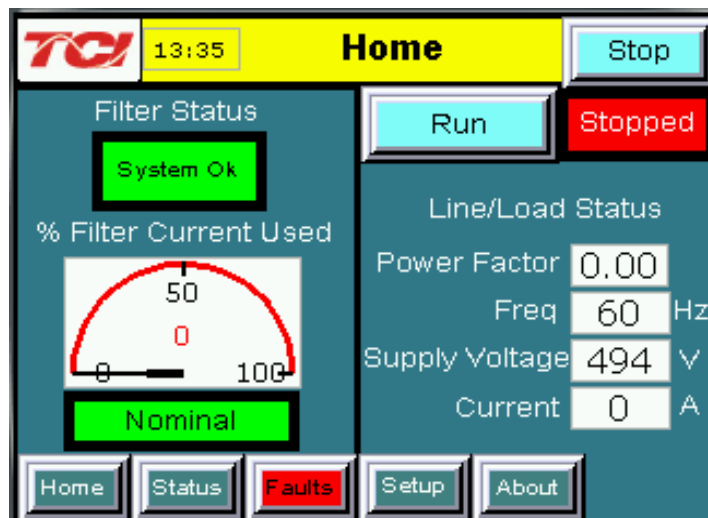


Figure 7.2 – Home Screen

Table 7.2 – Home Screen Elements

Screen Element	Description
Filter Status Display	Indicates if a converter fault is active and preventing the HarmonicGuard Active filter from running. If a fault occurs the indicator will flash red and display "Fault". Specific Fault codes can be viewed on the "Fault" Screen.
% Filter Current Used Display	This gauge displays the current filter capacity as a percentage of total available capacity. In normal operation the display will read "Nominal". If the unit output corrective current is above 95% of maximum capacity the indicator light will turn red and display "At Capacity". When the converter is at capacity the Relay K4 (J12 Connector), and J11 Contacts used for a remote indicator will also be energized. If the monitor continually displays "At Capacity" a second filter may be required to handle the load. Please contact TCI for assistance.
Run/Stop Button	Runs and stops the HarmonicGuard Active filter.
System State Indicator (located immediately below stop button)	When the HarmonicGuard Active filter is in a stop mode the "Status" light will turn red and display "Stopped". When the converter is running the status light will be green and will display "Running". The status light will also show if the HarmonicGuard Active filter is in Input line Sync mode, Reset mode, Precharge mode, Calibrate mode, Power Save mode or Faulted. When the HarmonicGuard Active filter is faulted it will shut down automatically
Power Factor Display	Displays current line/load power factor. 1.00 indicates unity power factor. A negative power factor indicates lagging power factor.
Line Frequency Display	Displays the current utility line frequency in Hz.
Supply Voltage	Displays the supply voltage coming into the HarmonicGuard Active filter.
Line/Load Current Display	Displays the current line/load phase current in Amps RMS. NOTE: the displayed current is affected by the CT Ratio configuration on the "Setup" page.

Status Screen

The Status screen shows more specific information on the performance of the system such as current and voltage waveforms, Power Factor and information specific to the Line/Load screen and Converter screen. **Figure 7.3** explains the main “Status” Screen.

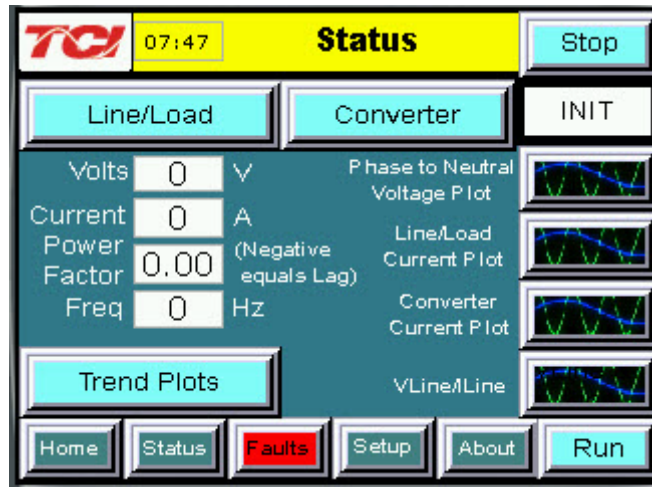


Figure 7.3 – Status Screen

Table 7.3 – Status Screen Elements

Screen Element	Description
Line/Load Button	Use this button to get to the “Line/Load Status” Sub Screen (see Figure 7.6).
Volts Display	Displays the current utility phase to phase line voltage in Volts RMS.
Current Display	Displays the current line/load phase current in Amps RMS.
Power Factor Display	Displays current line/load power factor. A value of 1.00 indicates unity power factor. A negative power factor indicates lagging power factor.
Frequency Display	Displays the current utility line frequency in Hz.
Run/Stop Button	Runs and stops the HarmonicGuard Active filter.
Converter Button	This button will take the user to the “Converter Status” Sub Screen (see Figure 7.4).
Phase to Neutral voltage, Line Voltage, Line/Load Current, and Converter Current, and Vline/line Waveform Screens	The “Waveform” screen buttons will take the user to one of the four real-time waveform capture screens: Phase to Neutral voltage, Line Voltage, Line Current, Converter current, or VLine/ILine plot (see Figures 7.7 and 7.8).
Trend Menu Screen	When the user presses the “Trend” button the “Historical Trend screen menu is displayed (see Figure 7.9).

Converter Status Sub Screen

The converter status sub screen shows the present status of the HarmonicGuard Active filter power converter module.

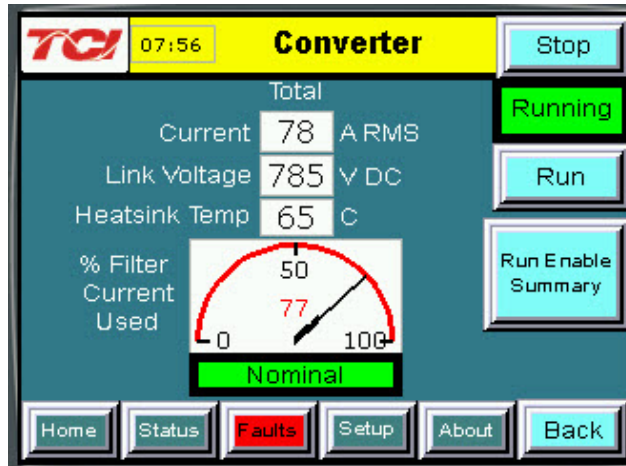


Figure 7.4 – Converter Status Sub Screen

Table 7.4 – Converter Status Sub Screen Elements

Screen Element	Description
Run/Stop Button	Runs and stops the HarmonicGuard Active filter.
Current Display	Displays the present HarmonicGuard Active filter output corrective current in Amps RMS.
Link Voltage Display	Displays the internal DC Link Bus voltage of the HarmonicGuard Active filter in Volts DC.
Heatsink Temp Display	Displays the present HarmonicGuard Active filter power converter heat sink temperature in Degrees Celsius.
% Filter Current Used Display	This gauge displays the current filter capacity as a percentage of total available capacity. In normal operation the display will read "Nominal". If the unit output corrective current is above 95% of maximum capacity the indicator light will turn red and display "At Capacity". When the converter is at capacity the Relay K4 (J12 Connector), and J11 Contacts used for a remote indicator will also be energized. If the monitor continually displays "At Capacity" a second filter may be required to handle the load. Please contact TCI for assistance.
Run Enable Summary	Displays the current state of all enables that affect the running of the HarmonicGuard Active filter. If a button is red that option is disabled and if it is green that option is enabled. If the "Auto Start" is enabled a countdown timer will run to the right of the button, when the count reaches 0 the converter will start (See Figure 7.5).
Back Button	Returns to the main status screen.

Run Enable Summary Sub Screen

The Run Enable Summary sub screen shows state of all the enables that affect the running of the HarmonicGuard Active filter.

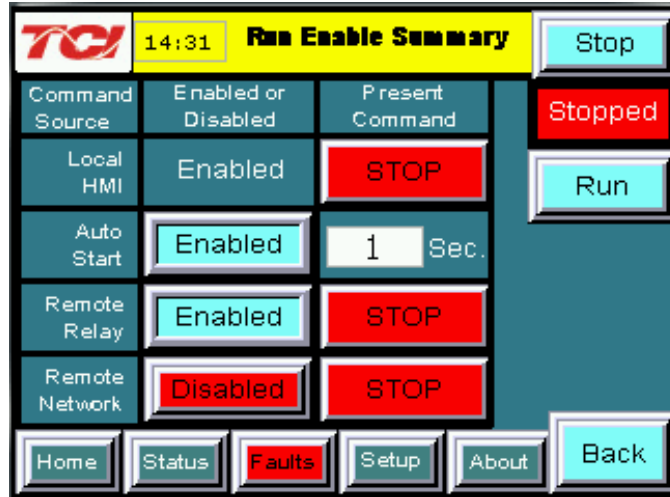


Figure 7.5 – Run Enable Summary Sub Screen

Table 7.5 – Run Enable Summary Sub Screen Elements

Screen Element	Description
Run/Stop Button	Runs and stops the HarmonicGuard Active filter.
Local HMI Enabled	Shows if the start or stop button is enabled.
Auto Start	Changes to blue if enabled or the left button is pressed, and the countdown timer (to the right of the button) will start. When it reaches 0 the HarmonicGuard Active filter will start.
Remote Relay	Changes to blue if enabled or the left button is pressed, if enabled the HarmonicGuard Active filter can be remotely stopped with a contact closure. When enabled and the option is active the field to the right will be green and read "RUN".
Remote Network	Changes to blue if enabled or the left button is pressed, if enabled the HarmonicGuard Active filter can be remotely stopped/started with a contact closure. When the contact is closed the unit will run and when opened the unit will stop. When enabled and the option is active the field to the right will be green and read "RUN".
Back	This button will take you back to the converter status screen.

Line/Load Status Sub Screen

The Line/Load Status Sub Screen shows more specific information regarding the source and load voltage, current, power, power factor and THD measurements.

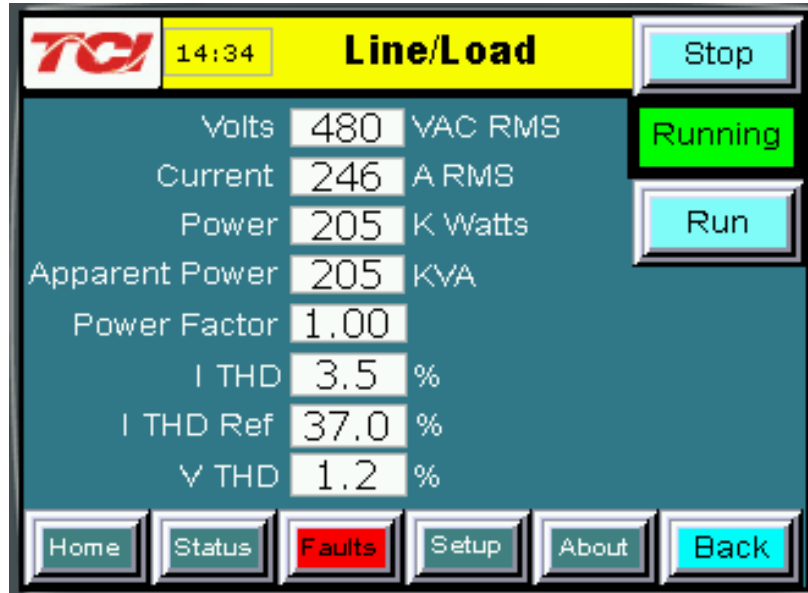


Figure 7.6 – Line/Load Status Sub Screen

Table 7.6 – Line/Load Status Sub Screen Elements

Screen Element	Description
Volts Display	Displays the current utility phase to phase line voltage in Volts RMS.
Current Display	Displays the current line/load phase current in Amps RMS. NOTE: the displayed current is affected by the CT Ratio configuration on the “Setup” page.
Power Display	The three phase real power (P) of the line/load in kW.
Apparent Power	The three phase apparent power (S) of the line/load in kVA.
Power Factor Display	Displays current line/load power factor. 1.00 indicates unity power factor. A negative power factor indicates lagging power factor.
I THD Display	Displays the Total Harmonic Distortion of the utility Line/Load current as a percentage.
V THD Display	Displays the Total Harmonic Distortion of the utility line Voltage as a percentage.
I THD Ref Display	Displays the reference Total Harmonic Distortion of the utility Line/Load current in percent. This THD display is the <i>uncorrected THD</i> of the Line/Load taken when the HarmonicGuard Active filter was not running.
Run/Stop Button	Runs and stops the HarmonicGuard Active filter.
Back Button	Returns to the main Status Screen

Waveform Plot Sub Screens

The HMI display supports capture and display of real time system voltage and current data. Three phase waveform data can be viewed for Line Voltage, Line/Load Current, and Converter Corrective Current.

The waveform screens contain a zoom feature which supports three magnitude scales: 1 X, 2 X and 4X (see **Figure 7.7**). The Refresh button on the waveform screens will update the plot with new data from the HarmonicGuard Active filter converter.

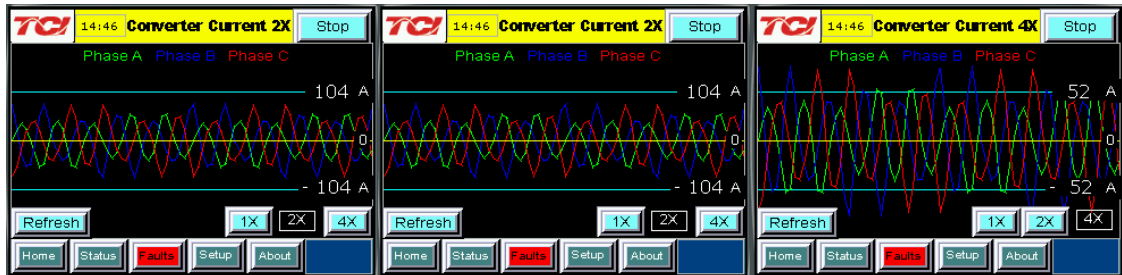


Figure 7.7 – Example Waveform Plot Sub Screens (Converter Corrective Current)

Table 7.7 – Waveform Plot Sub Screen Elements

Screen Element	Description
Refresh Button	The “Refresh” button will reload the data from the HarmonicGuard Active filter power converter controller and redraw the waveform plot.
1X, 2X and 4X Buttons	Waveform zoom buttons will redraw the present data at a different scale.

VLine & ILine Waveform Plot Sub Screen

The VLine & ILine Waveform Plot Sub Screen is available to verify the proper installation of the HarmonicGuard Active filter power connections and system current CT feedbacks. The waveform plot shows voltage and current feedback for both Phase A and C on the same plot. When the HarmonicGuard Active filter is powered, but in the stopped state this plot can be used to check for the following:

- Proper Line Voltage phase rotation
- Proper Line/Load Current phase rotation
- Proper Line Voltage and Line/Load Current relative polarity and phase.
- Missing/Open Circuit System Current CT Feedback

In the event that the HarmonicGuard Active filter performance is degraded the VLine & ILine waveform plot should be examined as a means to determine if any system connection errors are present. Prior to examining the VLine & ILine waveform plot, the HarmonicGuard Active filter should be put in the stopped state by pressing the stop button in the upper left corner of the HMI screen. **Figure 7.8** shows the VLine & ILine waveform plot sub screen for a properly connected, but non-running HarmonicGuard Active filter when connected to a typical non-linear, rectifier load. Note the following characteristics:

- Phase C voltage (Blue) leads Phase A voltage (Green).
- Phase C current (Yellow) leads Phase A current (Red).
- Phase A voltage (Green) and Phase A current (Red) are in phase and the same polarity.
- Phase C voltage (Blue) and Phase C current (Yellow) are in phase and the same polarity

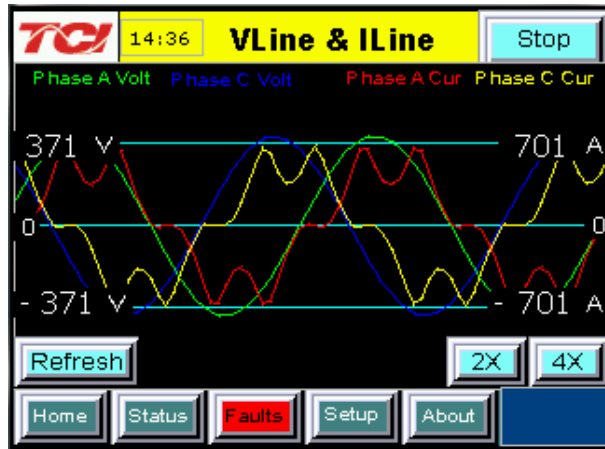


Figure 7.8 – VLine & ILine Waveform Plot of a Properly Connected HarmonicGuard Active filter (unit in stopped state)

Note: The example VLine & ILine Waveform Plot screens apply to rectifier loads only. For low power factor loads the VLine & ILine waveform screen will appear different.

Table 7.8 shows what the VLine & ILine Waveform Plot Sub Screen would look like with various connection errors present in the system.

Table 7.8 – VLine & ILine Waveform Plot Screen Examples when Typical Connections Errors Present in System

VLine & ILine Waveform Plot Sub Screen with Rectifier Load	Connection Error Description	Connection Error Resolution
	<p>Phase rotation is incorrect: Phase A leads Phase C instead of Phase C leading Phase A.</p>	<p>To correct swap Phase A and Phase C HarmonicGuard Active filter power connections AND swap Phase A and Phase C system CT current feedback then recheck plot.</p>

<p>TCI 14:46 VLine & ILine Stop</p> <p>Phase A Volt Phase C Volt Phase A Cur Phase C Cur</p> <p>371 v 701 A</p> <p>0 0</p> <p>- 371 v - 701 A</p> <p>Refresh 2X 4X</p> <p>Home Status Faults Setup About</p>	<p>Phase C system CT current feedback missing:</p> <p>Phase C current is zero while Phase A current is present.</p>	<p>Check Phase C CT for open circuit or loose connection.</p>
<p>TCI 14:41 VLine & ILine Stop</p> <p>Phase A Volt Phase C Volt Phase A Cur Phase C Cur</p> <p>371 v 701 A</p> <p>0 0</p> <p>- 371 v - 701 A</p> <p>Refresh 2X 4X</p> <p>Home Status Faults Setup About</p>	<p>Phase A and Phase C CT current feedback swapped:</p> <p>Phase A current (red) in phase with Phase C voltage (blue) instead of Phase A voltage (green).</p>	<p>To correct swap Phase A and Phase C system CT current feedback and recheck plot.</p>
<p>TCI 14:43 VLine & ILine Stop</p> <p>Phase A Volt Phase C Volt Phase A Cur Phase C Cur</p> <p>371 v 701 A</p> <p>0 0</p> <p>- 371 v - 701 A</p> <p>Refresh 2X 4X</p> <p>Home Status Faults Setup About</p>	<p>Phase A current (red) is opposite polarity of Phase A voltage (green) and Phase C current (yellow) is opposite polarity of Phase C voltage (blue).</p>	<p>To correct, re-install both Phase A and Phase C system CTs with polarity arrow in opposite direction OR swap positive and negative connections of each CT at HGA filter terminal block then recheck plot.</p>

Historical Trend Plot Menu Sub Screen

From the historical trend plot menu sub screen you can view trend graphs of various HarmonicGuard Active filter system signals (see **Figure 7.10**).

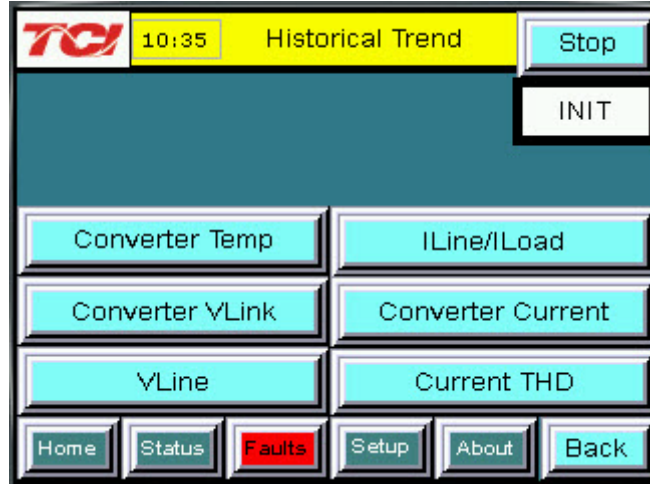


Figure 7.9 – Historical Trend Plot Menu Sub Screen

Table 7.9 – Historical Trend Plot Menu Sub Screen Elements

Screen Element	Description
Converter Temp Button	Opens the HarmonicGuard Active filter heatsink temperature historical trend graph screen. This signal is sampled every 15 seconds and historical data is maintained for 10 hours.
Converter VLink Button	Opens the HarmonicGuard Active filter DC Link Voltage historical trend graph screen. This signal is sampled every 3 seconds and 2 hours of historical data is maintained.
VLine Button	Opens the utility input RMS voltage historical trend graph screen. This signal is sampled every 3 seconds and 2 hours of historical data is maintained.
ILine/ILoad Button	Opens the line/load RMS current historical trend graph screen. This signal is sampled every 3 seconds and historical data is maintained for 2 hours.
Converter Current Button	Opens the HarmonicGuard Active filter RMS current historical trend graph screen. This signal is sampled every 3 seconds and 2 hours of historical data is maintained.
Current THD Button	Opens the line/load Total Harmonic Distortion historical trend graph screen. This signal is sampled every 3 seconds and 2 hours of historical data is maintained.

Historical Trend Plot Sub Screens

The historical trend plot screens graph time-stamped feedback data over an extended period of time. Once the trend plot display data buffer is full the oldest data is overwritten. Historical data can be viewed using the integrated scroll bars of the trend plot. All trend plot data is maintained between power on/off cycles of the HarmonicGuard Active filter. See **Figure 7.10** for an example of a typical trend graph (trend plot example is for the HarmonicGuard Active filter power converter heatsink temperature measurement). For data buffer sample times and size see **Figure 7.10**.



Figure 7.10 – Example Historical Trend Plot Sub Screen

Table 7.10 – Trend Plot Screen Elements

Screen Element	Description
Run/Stop Button	Runs and stops the HarmonicGuard Active filter.
Plot Scale Display (located on the left side of the graph)	Indicates the magnitude of the samples of the trend plot. The scale varies with each of the trend plots.
Right Timestamp	Indicates the date and time the right-most sample displayed on the screen was taken.
Left Timestamp	Indicates the date and time the left-most sample displayed on the screen was taken.
Scroll Bar	Allows the user to scroll through all sample points available in the trend plot data buffer.
Trend Plot Display	The historical graph of the value being sampled over time.

Fault Screen

This button takes the user to the “Active Fault” screen (see **Figure 7.11**) which lists all of the active faults. The faults will stay in this list until the “Reset”, or “Stop” button is pressed or the fault self clears. From here the user can also go to the “Fault History” screen.

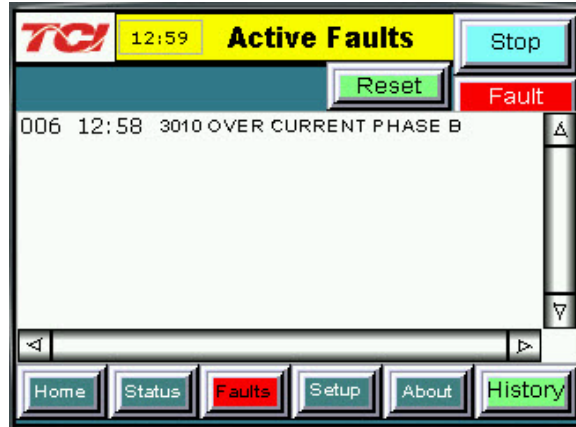


Figure 7.11 – Fault Screen

Table 7.11 – Fault Screen Elements

Screen Element	Description
Stop Button	Turns off the HarmonicGuard Active filter.
Reset Button	This button will remove all faults from the list if the fault conditions have cleared. Once cleared, a fault will still be viewable in the fault history log.
Fault Trip Entry Display	When a fault occurs the fault screen will display information about the fault including the (from left to right across the screen): <ul style="list-style-type: none"> • Fault bit mask number • Fault timestamp • Fault code (see Table 7.12) • Fault description
History Button	This button will take the user to the “Fault History” sub screen where previous faults can be reviewed.

Table 7.12 – Fault Codes

Fault Code	Critical or Non-critical Fault	Auto or Manual Reset	Fault Description
10	Critical	Manual*	Desat (IGBT Gate Driver) Fault Phase A
20	Critical	Manual*	Desat (IGBT Gate Driver) Fault Phase B
30	Critical	Manual*	Desat (IGBT Gate Driver) Fault Phase C
1000	Non-critical	Auto	DC Bus Overvoltage
1250	Non-critical	Auto	DC Bus Undervoltage
3000	Non-critical	Auto	Overcurrent on Phase A
3010	Non-critical	Auto	Overcurrent on Phase B
3020	Non-critical	Auto	Overcurrent on Phase C
4000	Critical	Power Cycle**	Overtemperature
4250	Non-critical	Auto	Undertemperature
7000	Non-critical	Auto	Calibration Fault
7010	Non-critical	Auto	Communications Fault
Unit N Faulted	Non-critical	Auto	Fault location indication. Fault originated in Unit N where N is in the range 1 to 8. For factory configured parallel systems the unit numbers are sequential ordered from left to right when looking at the front of the system. Unit 1 is the left most unit in the system.

*Critical faults flagged with a manual reset require a HMI stop button or run/stop switch stop command at the unit to clear.

**Critical faults flagged with a power cycle reset require a manual on/off power cycle of the unit to clear.

Fault History Sub Screen

The “Fault History” sub screen (See **Figure 7.12**) contains up to 120 entries that mark the onset and clearing of system faults. At the onset of a fault condition an entry will be generated in the fault history marked with an “O” on the left side of the fault entry. When a fault clears an entry will be generated in the fault history marked with an “X” on the left side of the fault entry.

The Fault History persists through power on/off cycles. In the event the fault history log exceeds the max number of 120 entries the oldest entry will be overwritten by new entries.



Figure 7.12 – Fault History Sub Screen

Table 7.13 – Fault History Log Entry Format

Column (from left to right)	Format	Description
Onset/Clear Marker	O = Fault Onset X = Fault Cleared	Marks the start and end of a fault in the fault history.
Timestamp	HH:MM MM/DD/YYYY	Time and date the fault entry was logged.
Fault Code	Four digit code	Fault code (see Table 7.12)
Fault Description	Text	A short text description of the fault

Setup Screen

Note: Some set-up screens are password protected to prevent changes that could damage the filter.

When the user presses the “Setup” button a splash screen will appear saying “The Filter is about to stop” (see **Figure 7.13**). Choosing “Next” will stop the filter and take the user to the “Setup” screen (see **Figure 7.14**). Pressing the “Back” button returns the user to the “Home” screen and does not turn off the filter. If the filter is off this splash screen will not appear.



Figure 7.13 – Setup Transition Sub Screen

The Setup Screen (see **Figure 7.14**) allows basic configuration of the HarmonicGuard Active filter operation. When a feature is enabled via a button, press the corresponding button will be highlighted in GREEN. When a feature is disabled the corresponding button will turn BLUE.

Note: It is recommended that the new settings are saved when changes are made. See the description of the “Save Settings” button in **Table 7.14**.

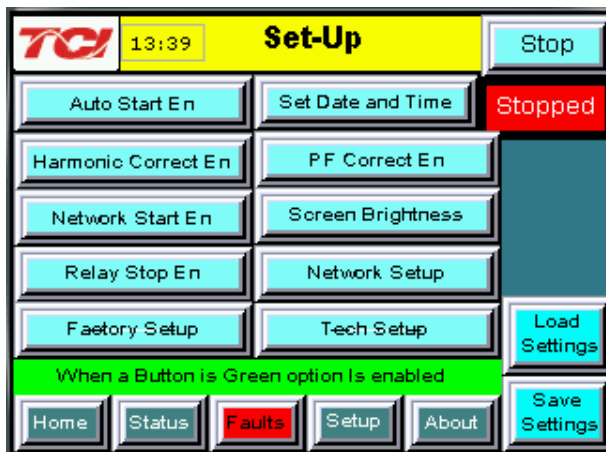
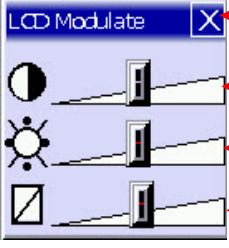
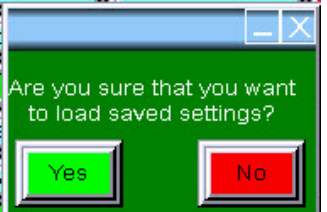



Figure 7.14 – Setup Screen

Table 7.14 – Setup Screen Elements

Screen Element	Description
Auto Start Enable Button	This option will set the converter to start automatically after a programmed delay after power is applied or after a fault occurs. This option is on by default.
Harmonic Correction Enable Button	This option turns the Automatic Harmonic Correction on or off. This option is on by default. If both harmonic correction and power factor correction are enabled and the HarmonicGuard Active filter is at its maximum capacity the power factor correction will automatically be phased back to allow the system to continue correcting harmonics.
Network Start Enable Button	This option allows the Active Line Condition to be remotely turned on or off across a network connection. If the stop button is pressed locally on the HMI Display the Network Start Enable is automatically set to DISABLED and has to be re-enabled manually via the HMI display.
Relay Start Enable Button	This option allows the Active Line Condition to be remotely turned on or off via an external relay. J2 on the interface requires a switch closure to stop the converter. If the stop button is pressed locally on the HMI Display the Relay Start Enable is automatically set to DISABLED and has to be re-enabled manually via the HMI display.
Factory Setup Button	This button is password protected and used during the factory and technician setup only.
Set Date and Time Button	Presents a sub screen which allows the user to change the date and time displayed on the screen. The date and time are also used for time stamps in the fault history and historical trend plots.
Power Factor Correction Enable Button	This option turns the Automatic Power Correction on or off. This option is on by default. If both harmonic correction and power factor correction are enabled and the HarmonicGuard Active filter is at its maximum capacity, the power factor correction will automatically be phased back to allow the system to continue correcting harmonics.
Screen Brightness Button	This option allows the user to change the brightness and gamma of the display. The contrast control is not enabled in this display model.

	 <p>Close screen</p> <p>Contrast (disabled)</p> <p>Brightness</p> <p>Gamma</p>
<p>Network Setup Button</p>	<p>This option lets the user view the status of and configure the integrated ModbusRTU network connection in the HMI display</p>
<p>Technician Setup Button</p>	<p>This button is password protected and used during technician setup and commissioning only.</p> <p>The Technician Setup Screen is used by TCI qualified personnel to configure the System CT Ratio, Autostart/AutoReset Delay Time, Unit Power Save Threshold, System Metering Voltage, Sensor Wiring Error Auto Detection Parameters and to initiate the built in Auto Calibration Procedure.</p>
<p>Language Setup</p>	<p>Sets display language of HMI text</p>
<p>Load Settings Button</p>	<p>This button will restore the user saved settings from non-volatile persistent memory. A confirmation screen will pop up asking “Are you sure you want to load saved settings”. If “Yes” is chosen any temporary changes made to the working set point parameters will be lost and the user saved settings will be restored. If “No” is pressed the user will be sent back at the “Basic Setup” screen.</p> 
<p>Save Settings Button</p>	<p>This button will save the current working settings to non-volatile memory that persist when power is removed from the unit. To save the current settings choose “Yes” on the confirmation screen, or choose “No” to cancel and go back to the “Basic Setup”. The settings will not be saved if “No” is chosen.</p> 

Network Setup Sub Screen

The network setup sub screen (see **Figure 7.15**) allows the user to view and configure the network interface options available internally to the HMI Display. For details on the integrated Modbus RTU interface connections see the HMI Display Connections section. If an optional advanced network Communications Gateway is configured please reference the appropriate Gateway section in the Appendix. This screen also displays the default Modbus network protocol settings and the current state of the network run/stop enable and network run/stop command.

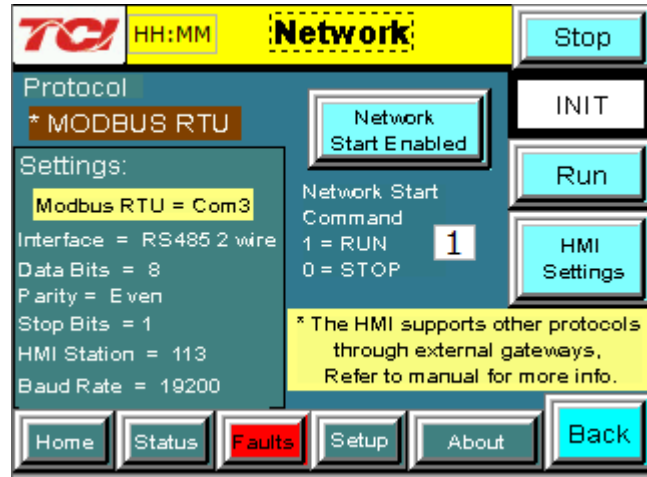


Figure 7.15 – Network Setup Sub Screen

Table 7.15 – Network Setup Sub Screen Elements

Screen Element	Description
Run/Stop Buttons	Turns on or off the HarmonicGuard Active filter.
HMI Settings Buttons	This button will take the user into the HMI display settings which allow the protocol settings of the Modbus RTU slave device to be changed (baud rate, parity, slave ID, etc...). A password is required to enter this screen. Call TCI at 1-800-824-8282 to receive a password and configuration document if needed.
Stop Button	Turns off the HarmonicGuard Active filter.
Protocol Settings Display	Displays the Modbus RTU protocol settings.
Network Start Enable Button	This option allows the HGA to be remotely turned on or off across a network connection. If the stop button is pressed locally on the HMI Display, the Network Start Enable is automatically set to DISABLED and has to be re-enabled manually via the HMI display.
Remote Start Display	Displays the current network Run/Stop command being received by the HMI Display. Note: the HarmonicGuard Active filter will only acknowledge the network run command if the Network Start Enable is set to ENABLED and there is no active fault.



Warning: If the values of the “HMI Settings” are changed from what the network administrator has set for the filter, the ability to connect to the filter

remotely will be lost. TCI will not be responsible for the loss of communication due to this change.

About Screen

The About Screen (see **Figure 7.16**) displays model number, serial number, and software/firmware version information regarding the filter.

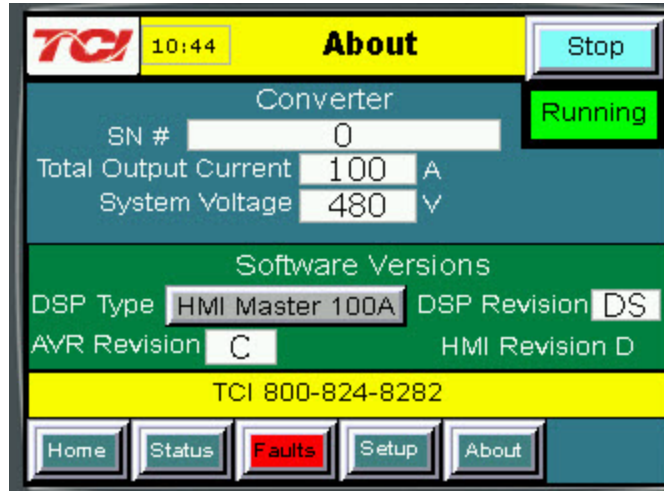


Figure 7.16 – About Screen

Table 7.16 – About Screen Elements

Screen Element	Description
Stop Button	Turns off the HarmonicGuard Active filter.
Serial # Display	Displays the pre-programmed factory serial number of the HarmonicGuard Active filter.
Total Output Current Display	Displays the total corrective current capacity in Amps RMS of the HarmonicGuard Active filter.
System Voltage	Displays the line voltage the HarmonicGuard Active filter is set to work on.
DSP Type Display	Displays the Digital Signal Processor type used in the HarmonicGuard Active filter power converter controller.
DSP Revision Display	Displays the software revision of the installed Digital Signal Processor used in the HarmonicGuard Active filter power converter controller.
AVR Revision Display	Displays the software revision of the installed microcontroller in the Interface PCB.
HMI Revision Display	Displays the software revision of the HMI Display application code.

Sensor Wiring Error Auto Detection Sub Screen

Some HarmonicGuard Active filter models are equipped with voltage and current feedback sensor wiring error detection algorithms. The detection algorithms run briefly on unit power up and check the unit sensors for signatures of common wiring errors, such as incorrect ACB phase rotation (instead of the required ABC rotation) and inverted system CT polarity. The Sensor Wiring Error Sub Screen is a pop up screen which is not accessible from any of the main navigation screens. The screen is only displayed if a wiring error is detected. If no sensor wiring errors are detected the pop up screen will remain hidden.

If a Sensor Wiring Error is detected the HGA will be inhibited from running until system power is removed from the unit and the error is corrected.

The Sensor Wiring Error Detection feature is comprised of several independent detection algorithms. The two main categories of algorithms are voltage based detections and current based detections. The voltage based detection algorithms monitor the three phase line voltage input for proper ABC phase rotation, polarity, balance and nominal magnitude. The current based detection algorithms monitor the system Current Transformer (CT) sensor feedback for proper phase rotation, polarity, balance, and CT open or shorted conditions. The current base detections are only engaged if a minimum level of load current is present during power up. Both the voltage and current detection algorithms can be globally or individually configured by TCI qualified personnel via the password protected Technician level Setup Screen.

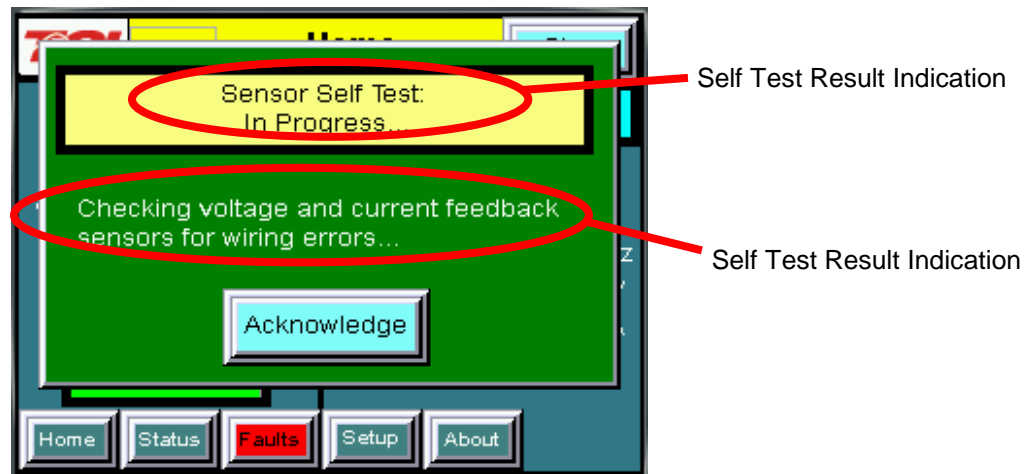


Figure 7.17 – Sensor Wiring Error Self Test Sub Screen

Table 7.17 – Sensor Wiring Error Self Test Sub Screen Elements

Screen Element	Description
Self Test Result Indication	Displays the current Pass/Fail/In-Progress State of the Sensor Wiring Error Auto Detection feature. When a sensor wiring error is detected the specific fault code will be shown. See Table 7.19 for a description of specific fault codes.
Self Test Result Description	When a sensor wiring error is detected one or more corrective actions will be displayed here. See Table 7.19 for a list of suggested resolutions.
Acknowledge Button	Pressing the Acknowledge Button will hide the Sensor Wiring Error Self Test Sub Screen so other the screens can be examined in order to trouble shoot the wiring error. If a user attempts to operate the unit while a sensor wiring error is still present by pressing the Run or Stop buttons the screen will reappear.

Table 7.18 – Sensor Wiring Error Code Table

Error Code	Error	Suggested Corrective Action
0	No Error	No corrective action required.
1	Self Test In Progress	No correction action required. Typically the self test will complete and auto clear in less than 10 seconds after power up.
2	Line Voltage Synch	Turn off unit and check 3 phase AC input voltage wiring for missing phase connection or low line voltage
3	Input Over Voltage	Turn off unit and check 3 phase AC input voltage wiring for high line voltage
4	Reverse Voltage Phase Rotation	Turn off unit and check 3 phase AC input voltage wiring for A,B,C phase rotation or missing phase connection
5	Phase A Input Under Voltage	Turn off unit and check 3 phase AC input voltage wiring for missing phase or low line voltage
6	Phase B Input Under Voltage	Turn off unit and check 3 phase AC input voltage wiring for missing phase or low line voltage
7	Phase C Input Under Voltage	Turn off unit and check 3 phase AC input voltage wiring for missing phase or low line voltage
8	Reverse CT Current Rotation	Turn off unit and check system CT feedback for A,B,C phase rotation, inverted CT polarity, or CT short/open
9	Phase A CT Under Current	Turn off unit and check system CT feedback for no feedback (CT short or open)
10	CT Under Current	Turn off unit and check system CT feedback for no feedback (CT short or open)
11	Phase C CT Under Current	Turn off unit and check system CT feedback for no feedback (CT short or open)
12	Phase A CT Polarity	Turn off unit and check system CT phase A feedback for incorrect polarity or reverse phase rotation
13	CT Polarity	Turn off unit and check system CT phase A and C feedback for incorrect polarity or reverse phase rotation
14	Phase C CT Polarity	Turn off unit and check system CT feedback phase C for incorrect polarity or reverse phase rotation
15	Phase Power Imbalance	Turn off unit and check CT feedback and 3 phase AC input voltage for incorrect polarity or reverse phase rotation

Network Interface

The network interface on the Interface Module allows basic Run/Stop commands and internal status data and can be communicated to and from the HarmonicGuard Active filter. The HMI display implements an integrated ModbusRTU slave device for the network interface (see the HMI Display Connection section) or an optional network communications gateway can be used such as Ethernet/IP to implement other protocols (see Appendix).

The input/output register maps of the data available from the network interface are available in Table 7.18 and Table 7.19. All input and output registers are two bytes in size. For the base address of the input and output data sections please reference the connection sections in this manual specific to the configured protocol. For the integrated ModbusRTU network interface reference the HMI Display Connection section. If an option Communications Gateway is configured reference the appendix.

Table 7.19 – Network Interface OUTPUT Register Map

Parameter Name	I/O Reg Address Offset	Direction	Format	Description
SYS_RUNNING	0	Output	0 = Running 1 = Idle	Indicates if the HGA filter is currently running or in the idle state
SYS_POWER_ON	1	Output	0 = Power Off 1 = Power On	Indicates if the HGA filter has input power available
SYS_FAULTED	2	Output	0 = Not faulted 1 = Faulted	Indicates if the HGA filter is faulted
SYS_IN_I_LIMIT	3	Output	0 = Nominal 1 = At Capacity	Indicates if the HGA filter is running at its maximum capacity
V_LINE_LL_RMS	4	Output	Volts RMS	Source Utility Line Phase to Phase Voltage
I_LINE_RMS	5	Output	Amps RMS	Line/Load Phase Current
I_LINE_PF	6	Output	1000 = 1.0 Unity PF -950 = 0.95 Lagging PF 950 = Leading PF	Line/Load Power Factor - Negative values indicate lagging power factor
SYS_NW_START_EN	7	Output	0 = Network Run Disabled 1 = Network Run Enabled	Network Run/Stop command enable setpoint

Table 7.20 – Network Interface INPUT Register Map

Parameter Name	I/O Reg Address Offset	Direction	Format	Description
SYS_NW_START_IN	0	Input	0 = Network Command Stop 1 = Network Command Run	Remote Network Run/Stop command to the HGA
unused	1	Input	-	-
unused	2	Input	-	-
unused	3	Input	-	-
unused	4	Input	-	-
unused	5	Input	-	-
unused	6	Input	-	-
unused	7	Input	-	-

The network Run/Stop command allows a remote network to send a run command to the HarmonicGuard Active filter. The network command input will only be acknowledged if the Relay Run/Stop Enable is set to ENABLED on the HMI Display setup screen. Pressing stop locally via the HMI Display will set the enable for the Relay Run/Stop Enable to DISABLED.