CONTROL CONCEPTS

FUSION

CONTROL PANEL SOFTWARE

USER'S MANUAL

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1. OVERVIEW

The FUSION Control Panel Software is intended to assist during installation, parameter setup, operation, and troubleshooting through a simple Windows interface.

Note: This manual refers to Build 8 of the Control Panel.

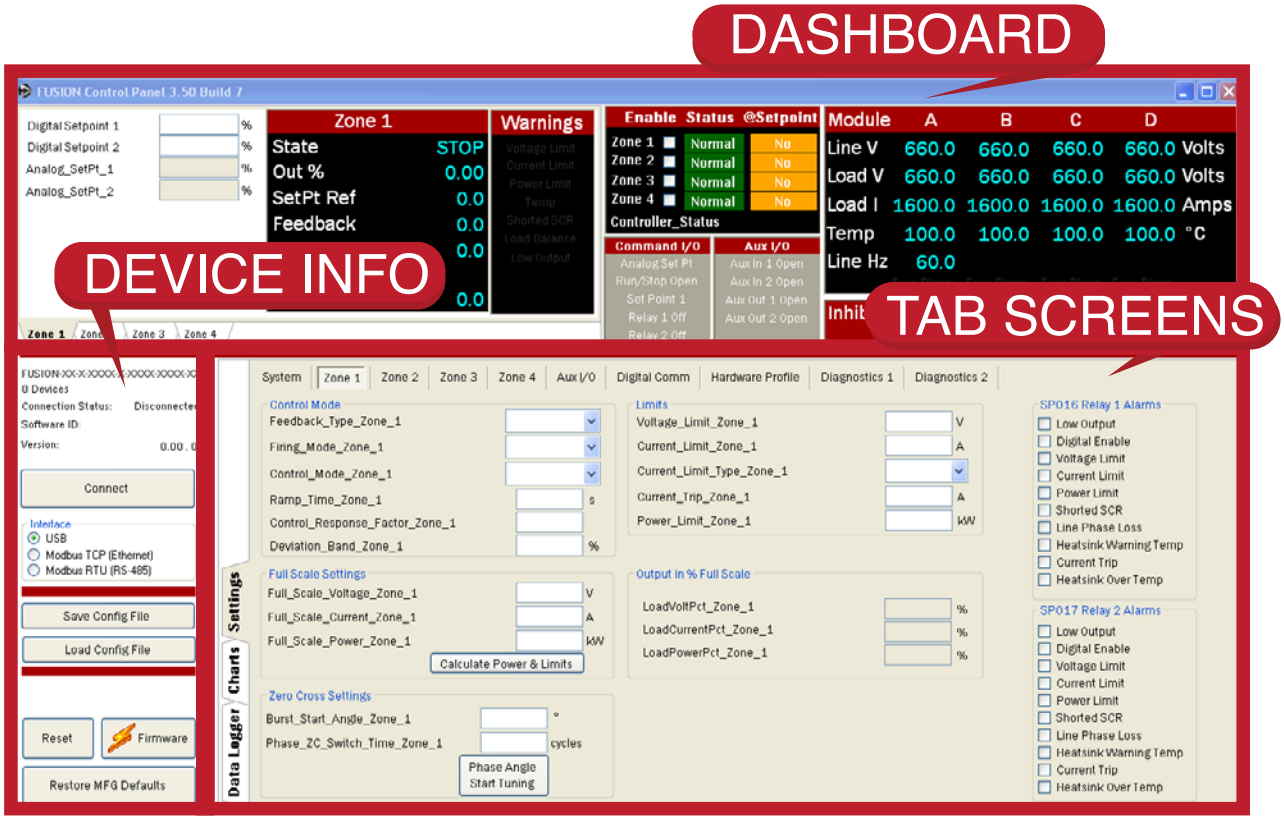


FIGURE 1.00

Configuring the controller is made easier with the software, as multiple things may be viewed at the same time. The screen is broken into 3 main sections: Device Info, Dashboard, and Tab Screens (See Figure 1.00). Each of these will be described in detail within this manual.

The different Tab screens allow for an easy system setup, even with multiple zones of control. Once a controller is set up with desired settings, a configuration file can be saved. This file can then be loaded to other systems for quick and easy setup.

Connection to the Fusion Control Panel Software is accomplished with a USB cable from the controller to a PC.

Warning: Do not use the FUSION Power Controller keypad for data entry while connected via USB cable to a computer. Values from the keypad entry will not be updated within the FUSION Control Panel unless you click the “Connect” button after changes are made.

GETTING STARTED

Load the CD containing the FUSION Control Panel software into a PC. Any previous versions of the control panel MUST be uninstalled before attempting to install a newer version.

Note: Not all features described in this manual are available with all versions of the FUSION or Compact FUSION power controller. The features are dependent on hardware configuration and firmware versions.

Install FUSION Control Panel software by clicking Setup.exe or Setup.msi. Follow the on-screen instructions for installation details. Before running the software for the first time, a controller must be connected to the computer.

Apply universal input power to the controller. Connect the USB cable from the PC to the controller. Run the software via Fusion Control Panel.exe.

2.1 Minimum PC Requirements

- Intel® Pentium® Processor
- 32 MB RAM
- 10 MB of available hard disk space
- 1280 x 768 x 60 Hz Compatible Display Adapter
- Microsoft® Windows XP® Service Pack 3
- Microsoft® .NET Framework 3.5 SP1

The FUSION Control Panel is compatible with Windows XP, Windows Vista, and Windows 7. 32-bit and 64-bit operating systems are supported.

2.2 Connecting

The Fusion Control Panel software can be utilized once the PC has the software correctly installed, the controller has the universal input power applied, and the USB cable is connected to the PC and the controller.

With the user interface open, press the *Connect* button in the Device Info & Command Functions section (See Figure 2.00). The USB status will change from Disconnected to Connected and the controller's serial number, software ID, and version number will register. Once connected, the Dashboard will display readings from the controller, and the tab screens will reflect the parameters the controller is using.

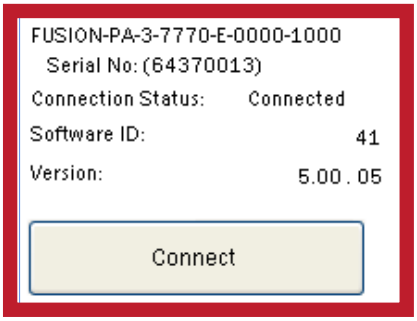


FIGURE 2.00

2.3 Disconnecting

To disconnect the controller simply disconnect the USB cable from the controller or the PC, or close the FUSION Control Panel software window. A message will appear stating that the controller has been disconnected.

With the controller disconnected the Dashboard will not update and parameters cannot be changed.

3. PROCESSOR & FAULT RESETS

Fault Resets

- Toggle the Run/Reset pin on the P1 controller
- Disable, then re-enable the Digital System command

Processor Resets

- Using the Control Panel software, press the Processor Reset button
- Cycle the controller power
- Processor Reset Key Sequence
  1) Press and hold the Up and Down arrow keys for three seconds.
  2) Press enter when the "**SYSTEM RESET**" message displays
  3) If the Arrow keys are released, the controller returns to normal operation.
  4) When the Enter key is pressed, Line 2 changes to "Release Key"
  5) When all keys are released, the Processor resets.

4. DEVICE INFO

See Figure 4.00. When a controller is connected, this area shows the model number and serial number. This information is also displayed on the frame label that is on the side of the controller.

Upon opening the Control Panel, the program will try to locate the controller connected to the PC via a USB cable. *1 Device* or *0 Device* will display under the model number. *1 Device* indicates that a controller is is ready to be connected to; *0 Device* indicates that no controller is available. However, note that if a controller is connected or disconnected via USB *after* the Control Panel is open, the status will not change.

Connection status displays if the controller is *Connected* or *Disconnected*.
Software ID refers to the specific firmware the controller is operating.
Version refers to the firmware release level the controller is operating.

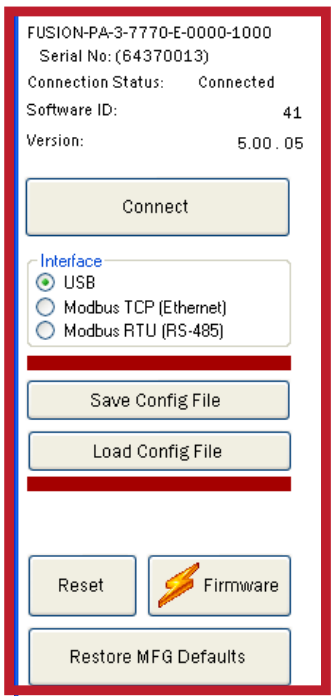


FIGURE 4.00

4.1 Connect Button

This button is used to connect the controller to the FUSION Control Panel software. This can only be done with the universal input power applied to the controller and a USB cable connected from PC to controller.

4.2 Interface Options

The USB radio button must be selected when connecting to the controller via USB. This should be done regardless of whether the controller has a digital communication option installed. After connecting to the controller via USB the digital communication settings can be changed for the desired network under the Digital Comm Tab. See the Digital Comm Tab section of this manual for more details on what can be set up with the Control Panel software.

Each digital communications option has a seperate manual for communication structure and setup. Options include Modbus, DeviceNet, EtherNet/IP, and PROFINET.

4.3 Save Config Button

This button saves a copy of all setup parameters and calibration data for the FUSION Power Controller to a readable xml file. A dialog will appear prompting you to save the .xml file. The default file name is the units' serial number.

A configuration file should be saved after all parameters are set to the desired values. This file can then be loaded on to other controllers where the same configuration is desired. This will save time when multiple systems are identical.

Even with one master configuration file that is loaded to multiple units it is recommended to save individual configuration files for each controller for future reference.

This file can also be sent to the factory in order to assist in troubleshooting purposes. There is no limit to the number of times the file can be saved.

4.4 Load Config Button

Warning: Do not attempt to load a config file while the controller is in "RUN" state

This button loads only the setup parameters within the previously-saved config file. If a FUSION Power Controller is connected, the setup parameters will be downloaded into the unit. A dialog will appear prompting you to load the .xml file. After loading, select the "Reset" button to make sure all the changes have taken effect.

4.5 Reset Button

Warning: Power to the load will be interrupted during the reset!

This button resets / reboots the onboard processor when a FUSION Power Controller is connected.

4.6 Flash Firmware Button

Use this button to load the firmware for the onboard processor of a FUSION Power Controller into flash memory. Control Concepts pre-programs each power controller at the factory. **Do not load firmware unless directed to do so by Control Concepts Inc. or an authorized representative.**

Flashing Instructions

1) Connect your PC to the FUSION Power controller via a USB cable.
2) Apply universal input power to the power controller.
3) Start the FUSION Control Panel software.
4) Select “Flash Firmware”.
5) A dialog will open prompting you to select a .hex file.
6) Select the .hex file provided by Control Concepts, Inc.

Warning: Do not disconnect the USB cable or control power while flashing is in progress!

Note: Changing the firmware ID requires a password. This will be provided by Control Concepts with the new firmware file.

A progress bar above the Reset and Firmware buttons will indicate the progress of the flash programming operation. Upon completion, the “USB FLASH PROGRAM COMPLETE” message box will appear and the processor will automatically reset. Check the display on the controller. Press the enter button (the green check box) if directed to do so. It is necessary to re-connect using the “Connect” command button in order to re-establish communications with the FUSION Power Controller.

4.7 Restore MFG Defaults Button

Use this button to restore the FUSION Power Controller setup parameters to the original factory settings. A dialog box will ask you to confirm your intent to overwrite the current settings with factory settings (See Figure 4.01).

Warning: Any changes made to settings will be lost by restoring factory defaults.

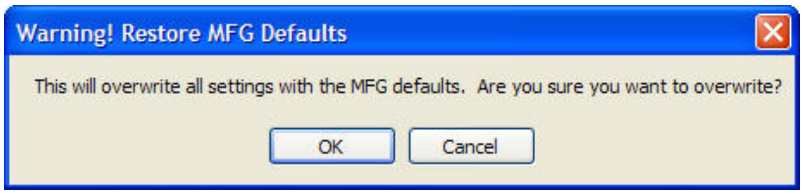


FIGURE 4.01

5. THE DASHBOARD

The dashboard contains runtime operating values for the FUSION Power Controller. These values are updated every 250 msec whenever a FUSION power controller is connected via the USB cable. The dashboard contains five sections: the Zone tab(s), Controller Status, Command & Auxiliary I/O, Module Operating Values, and Inhibit Alarms.

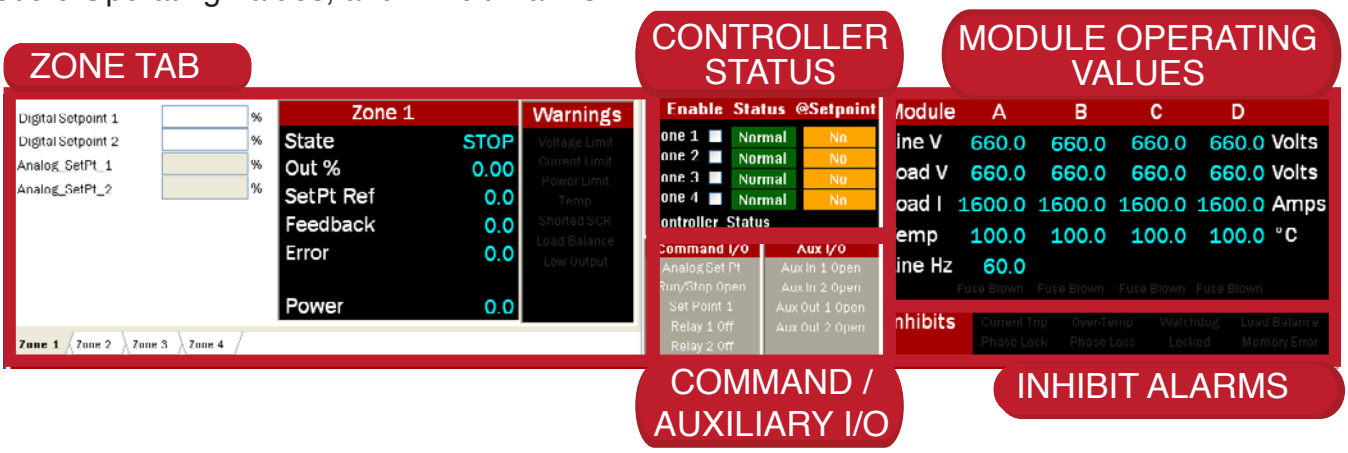


FIGURE 5.00

5.1 Zone Tab

Each Zone Tab has a setpoint, control loop, and warning alarm section. Single zone controllers have only one Zone Tab, while multi-zone controllers have a tab for each zone.

5.1.1 Setpoints

This area allows you to enter a control loop set-point via the Digital Setpoint 1 and Digital Setpoint 2 text boxes as a percentage of full scale. The analog signal value command percentages are displayed for Analog Setpoint 1 and Analog Setpoint 2.

5.1.2 Control Loop Data

This area shows the control loop values for the selected Zone:

State: Run, Stop, or Fault

Out %: Percent SCR is on for:

Phase Angle: % on for full conduction

Zero Cross: % duty cycle

Setpoint Ref: The setpoint in engineering units, based on the feedback selection

Feedback: The engineering units read back, based on feedback selection

Error: The difference between the SetPt Ref and Feedback

Power: Power in Watts delivered to the load

5.1.3 Warning Alarms

The following alarms may register on the Control Panel for each zone: Voltage Limit, Current Limit. Power Limit, Temp, Shorted SCR, Low Output. Any warnings for the zone will be displayed to the right of the zones' Control Loop data.

5.2 Controller Status

For each zone, this area shows whether the controller is enabled or disabled, fault conditions, and whether it is at setpoint.

Each zone has a "Digital Enable" check box which is in series with the Run/Reset of Pin 9 of the P1 connector. This allows Run/Reset control of each zone independently through the digital communications interface if desired.

The @Setpoint column is for monitoring when the controller output of each zone is within the deviation band, of the desired setpoint. See the settings section of this manual.

Note: The Digital Enable feature will quickly turn off the controller, but it is limited to communincation rates and software timing. It is therefore not as fast as using the hardware-based Run/Reset Pin 9 on the P1 connector. Control Concepts strongly recommends continuing to use the hardware-based Run/Reset for emergancy situations.

5.3 Command & Auxiliary I/O

This area allows you to view the current state of the digital I/O of the command connector. The Aux I/O will always be displayed but is only active if the Auxiliary I/O expansion card is present.

5.4 Module Operating Values

This area shows line voltages, load voltages, load currents, and temperatures for each module, and also the line frequency.

For Compact FUSION controllers, there is an additional "Fuse Blown" indicator for each module.

5.5 Inhibit Alarms

This area shows any alarms that, when activated, inhibit the controller's operation and places the controller in a "Stop" or "Fault" state. The most common inhibit alarms are Phase Lock / Phase Loss when line power is not present.

A "Current Trip" alarm requires a fault reset in order to clear the fault. An "Over-Temp" alarm also requires a fault reset for the particular zone to be cycled and the temperature to return to normal operating range in order to clear the fault. See Section 3 for more information on resetting the controller.

6. TAB SCREEN: SETTINGS

There are two different tab controls (horizontal and vertical) in the tab screens section. The vertical section contains *Settings*, *Charts* and *Data Logger*. The *Settings* and the *Charts* tab each contain a horizontal section.

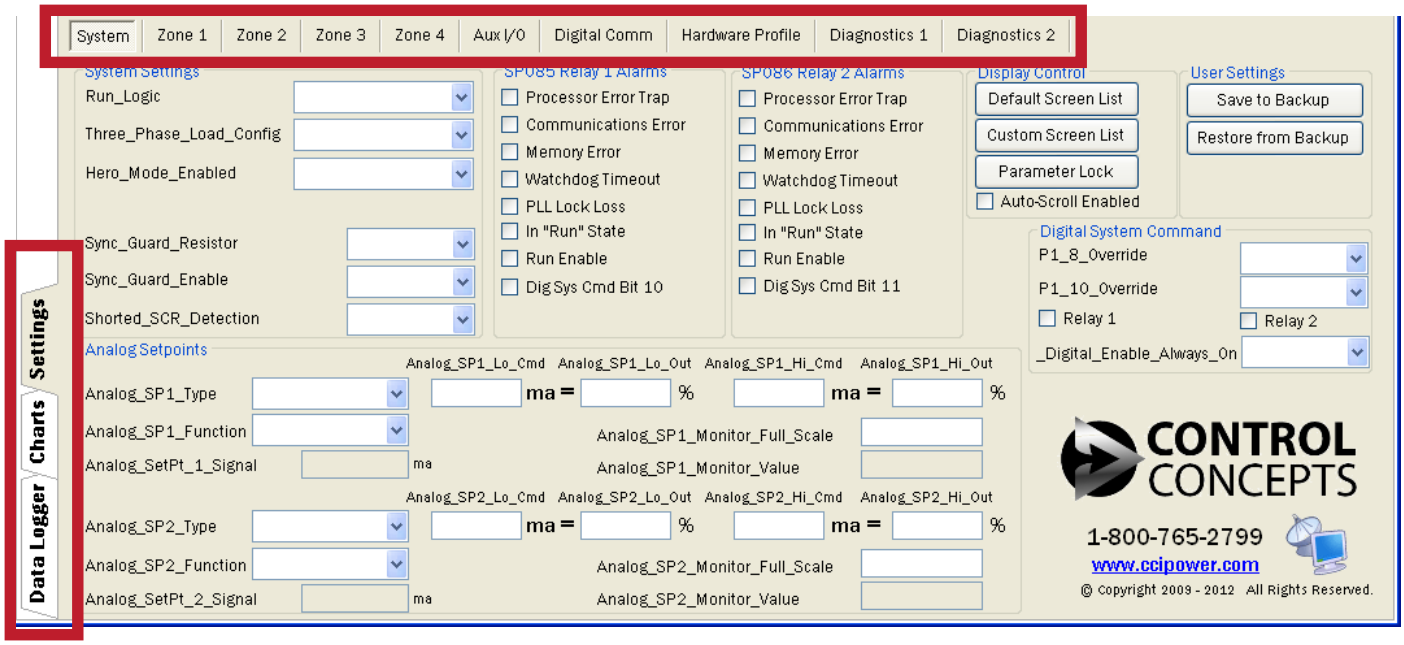


FIGURE 6.00

6.1 System Tab

This tab allows setup of the system level settings, analog setpoints and system alarm mapping to Relay 1 and/or Relay 2.

It also contains contact information along with a link to Control Concepts' webpage. The satellite and monitor icon is a link that can be used for video web conferencing.

6.1.1 System Settings

Run Logic [SP 82]

Setting	Description
Closed for Run [Default]	Connection on P1 between pin 7 and 9 must be CLOSED before a Run State can be achieved
Open for Run	Connection on P1 between pin 7 and 9 must be OPEN before a Run State can be achieved

Sets the Logic for Run/Reset (pin 9) of the P1 Command I/O (green 12 pin) connector on the side of the controller.

Three Phase Load Config [SP 80]

Setting	Description
Delta / Wye [Default]	Load is configured as either a Delta or a 3 Wire Wye
4 Wire Wye	Load is configured as a 4 Wire Wye
Inside Delta	Load is configured as an Inside Delta

Note: This is for three phase three leg controllers only.

This indicates the load wiring configuration. This is generally determined before the controller is ordered from the factory, but can be changed in the field if a different load type is desired.

Changing this parameter requires an internal wiring change that can only be done with a wire harness from Control Concepts, Inc.

FOR MORE INFORMATION:

THREE PHASE LOAD CONFIGURATION
Instructions for wiring the controller for each load type can also be found in the **Installation and Maintenance Manual.**

Hero Mode Enabled [SP 84]

Setting	Description
Disabled [Default]	Hero Mode is disabled
Enabled	Hero Mode is enabled

Note: Controller warranty is voided when Hero Mode is Enabled **AND** an over-temperature condition occurs. When the controller is operating within proper environment and specifications it is extremely rare that the SCR would exhibit an over- temperature condition. Contact factory for details about this feature.

If Hero Mode is enabled, the over-temperature inhibit alarm will be disabled. The over-temp alarm is designed to shut the controller down when the SCR temperature exceeds its safety ratings. This is designed in for customers that need to keep their process in operation, even if it may damage the SCR power controller.

When enabled and an over temp condition occurs, Inhibit Alarm (MP 210) will still indicate the over-temp condition. If a relay mask (SP 16 or SP 17) has “Heatsink Over Temp” Selected, the relay will energize. Meanwhile the controller will stay in the Run State. The display will register “Warning Alarm Heatsink Temp” and the Status LED on the front lid of the controller will flash orange. The over-temp indications will clear when the temperature drops below the over-temp limit threshold.

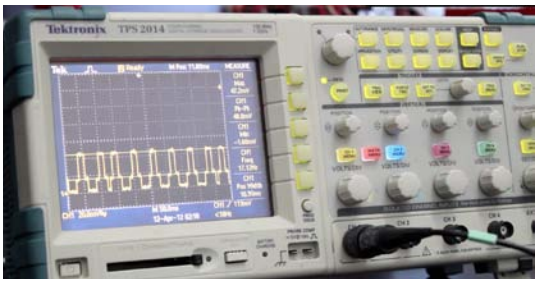
SYNC-GUARD™ OVERVIEW

SYNC-GUARD™ is a feature for zero-cross controllers only. It reduces the possibility of synchronous operation of two or more zero cross controllers. When using only one controller this feature is not used.

When using this feature all controllers should have the SYNC-GUARD™ enabled. The controllers must have the SYNC-GUARD™ pins of the P1 connector wired in parallel. One and only one controller should have the SYNC-GUARD™ resistor (SP 115) enabled.

To learn more about the advantages and applications of SYNC-GUARD™, see the Operator Manual. For wiring and setup see the Installation and Maintenance Manual.

FOR MORE INFORMATION:



SYNC-GUARD™
Check our **Youtube channel** (ControlConceptsInc) and watch our SYNC-GUARD™ overview video!

Sync Guard Resistor [SP 115]

Setting	Description
Disabled	SYNC-GUARD™ resistor is disabled
Enabled [Default]	SYNC-GUARD™ resistor is enabled

When using this feature one and only one of the controllers should have the SYNC-GUARD™ resistor enabled. The controllers must have the SYNC-GUARD™ pins of the P1 connector wired in parallel.

SYNC-GUARD™ Enable [SP 131]

Setting	Description
Disabled [Default]	Sync Guard is disabled
Enabled	Sync Guard is enabled

When using this feature all controllers should have the SYNC-GUARD™ enabled.

Shorted SCR Detection [SP 132]

Setting	Description
Disabled	Shorted SCR Detection is disabled
Enabled [Default]	Shorted SCR Detection is enabled

This disables the Shorted SCR alarm (MP 301 bit 4). With the use of some particular load types, the controller will detect false Shorted SCRs and trigger the alarm. By disabling Shorted SCR Detection, the controller will no longer trigger an alarm.

A shorted SCR can occur when excessive voltage and/or current passes through the SCR in a short period of time. The limit and trip features are intended to prevent damage to the controller/SCR but may not respond fast enough in every scenario. To determine if the SCR has a short, make sure that the line and the load has been disconnected from the controller. With a multimeter measure the resistance from the line connection to the load connection. This measurement typically measures greater than 300kΩ. If this measures less, the SCR is likely to have a short and in need of repair.

FOR MORE INFORMATION:

ANALOG INPUT SCALING
An analog setpoint tutorial can be found **on our Youtube channel**.
Search "ControlConceptsInc."

A false Shorted SCR warning can also happen if the controller does not have the settings in the Zone Tab correctly set up. Check the Full Scale settings (SP 8, SP 9 & SP 10). If nuisance alarms are continuing to happen or if a Shorted SCR is thought to be present, consult with Control Concepts, Inc.

6.1.2 Analog Setpoints

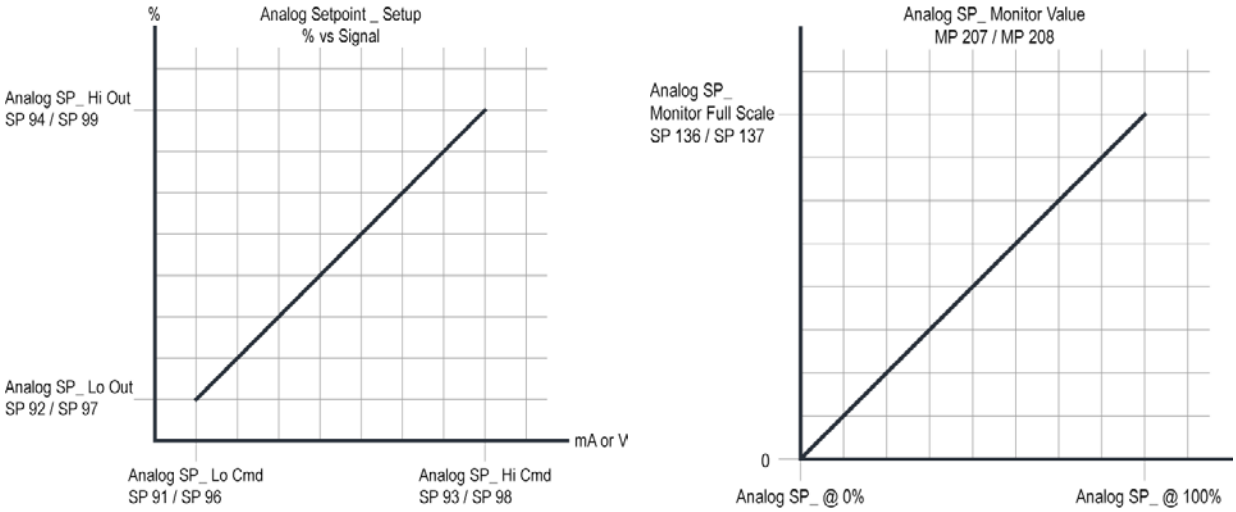


FIGURE 6.01

This is a graphical representation of how the Analog Setpoints and the Monitor Values are configured.

Analog SP1 Type [SP 90]

Setting	Description
Voltage	Voltage input scalable from 0 – 10 Vdc
Current [Default]	Current input scalable from 0 – 20 mA (default 4-20mA)

This selects the input signal type for Analog Setpoint 1. The wiring diagram for the inputs can be found in the Installation and Maintenance manual.

Analog SP1 Function [SP 88]

Setting	Description
Normal [Default]	Uses the Analog Setpoint 1 to control the Set Point Reference (MP 250).
Reserved	To Be Determined
Monitor	Uses the Analog Setpoint 1 as a monitor variable that can be scaled for monitoring purposes.

Under *Normal* operation, the setpoint is used for control. When *Monitor* is chosen it can be scaled with a full scale parameter (SP 136). The monitor value is then viewed with parameter (MP 208). When using the Monitor setting the controller will not use Analog Setpoint for control.

Analog SetPt 1 Signal [MP 204]
This gives the value of the setpoint signal.

Analog SP1 Lo Cmd [SP 91]
Default value: **4.00** mA

This is paired with Analog SP1 Lo Out (SP 92). This parameter is the signal value at the percent displayed in (SP 92). This is typically your lowest possible signal value that can be achieved.

Analog SP1 Lo Out [SP 92]
Default value: **0.00** %

This is paired with Analog SP1 Lo Cmd (SP 91). This parameter is the percentage at the signal value displayed in (SP 91).

Analog SP1 Hi Cmd [SP 93]
Default value: **20.00** mA

This is paired with Analog SP1 Hi Out (SP 94). This parameter is the signal value at the percent displayed in (SP 94). This is typically the highest possible signal value that can be achieved.

Analog SP1 Hi Out [SP 94]
Default value: **100.00** %

This is paired with Analog SP1 Hi Cmd (SP 93). This parameter is the percentage at the signal value displayed in (SP 93).

Analog SP1 Monitor Full Scale [SP 136]
Default value: **1000**

This is for scaling the Analog Setpoint 1 - Monitor Value (MP 208). This value can be scaled for any type of user input. If this value is desired to be monitored on the Display, it can be viewed by adding (MP 208) to the custom screen list. On the custom screen list window a four-character title can be edited and up to three characters may be entered for units to be displayed with MP-208.

Analog SP1 Monitor Value [MP 208]
The Analog Setpoint 1 monitor value that is calculated from the analog input signal and scaled by the full scale setting (SP 136).

Analog SP2 Type [SP 95]

Setting	Description
Voltage [Default]	Voltage input scalable from 0 – 10 Vdc (default 0 – 5 Vdc)
Current	Current input scalable from 0 – 20 mA

This selects the input signal type for Analog Setpoint 2. The wiring diagram for the input can be found in the Installation and Maintenance manual.

Analog SP2 Function [SP 89]

Setting	Description
Normal [Default]	Uses Analog Setpoint 2 to control the Set Point Reference (MP 250).
External CT for Leg C	Use to monitor the third leg current when using a three phase 2 leg controller.
Monitor	Uses Analog Setpoint 2 as a monitor variable that can be scaled for monitoring purposes.

Under *Normal* operation, the setpoint is used for control. When using the *External CT for Leg C* an external current transducer will be measuring the current on the third leg of a three phase 2 leg controller. The scaling for the high and low commands are determined by the ratio of the current transducer with the full scale current (SP 9). When *Monitor* is chosen it can be scaled with a full scale parameter (SP 137). The monitor value is then viewed with parameter (MP 209). When using the Monitor setting the controller will not use Analog Setpoint for control.

Analog SetPt 2 Signal [MP 207]
This gives the value of the setpoint signal.

Analog SP2 Lo Cmd [SP 96]
Default value: **0.00** V

This is paired with Analog SP2 Lo Out (SP 97). This parameter is the signal value at the percent displayed in (SP 97). This is typically your lowest possible signal value that can be achieved.

Analog SP2 Lo Out [SP 97]
Default value: **0.00** %

This is paired with Analog SP2 Lo Cmd (SP 96). This parameter is the percentage at the signal value displayed in (SP 96).

Analog SP2 Hi Cmd [SP 98]
Default value: **5.00** V

This is paired with Analog SP2 Hi Out (SP 99). This parameter is the signal value at the percent displayed in (SP 99). This is typically your highest possible signal value that can be achieved.

Analog SP2 Hi Out [SP 99]
Default value: **100.00** %

This is paired with Analog SP2 Hi Cmd (SP 98). This parameter is the percentage at the signal value displayed in (SP 98).

Analog SP2 Monitor Full Scale [SP 137]
Default value: **1000**

This is for scaling the Analog Setpoint 2 - Monitor Value (MP 209). This value can be scaled for any type of user input. If this value is desired to be monitored on the Display, it can be viewed by adding (MP 209) to the custom screen list. On the custom screen list window a four-character title can be edited and up to three characters may be entered for units to be displayed with MP 209.

Analog SP2 Monitor Value [MP 209]
The Analog Setpoint 2 monitor value that is calculated from the analog input signal and scaled by the full scale setting (SP 137).

6.1.3 SP085 Relay 1 Alarms [SP 85] / SP086 Relay 2 Alarms [SP 86]

Click on the checkbox next to the particular alarm/function to energize the relay if the condition is met. Both relays can be mapped to any number of conditions and both relays can contain the same condition. See the Installation and Maintenance Manual for wiring and ratings. These relay outputs work in conjunction with (SP 16, SP 36, SP 56, SP 76) for Relay 1 and (SP 17, SP 37, SP 57, SP 77) for Relay 2.

Processor Error Trap*
These are rare types of errors where the controller will not be functioning. Errors that are included are: flash program error, stack over flow error, math error, address error, and DMA conflict. To clear these errors follow the message(s) on the display. For further assistance contact Control Concepts, Inc.

Communications Error
A communication problem when using digital communications only.

Memory Error*
EEPROM check failure (MP 210 bit 6). See the Diagnostics 2 tab for errors.

Watchdog Timeout*
Specific processor error trap (MP 210 bit 7).

PLL Lock Loss*
Phase Locked Loop lost its lock on the AC line (MP 210 bit 2).

In "Run" State
When the Controller State (MP 248) is in Run.

Run Enable
When the Controller State (MP 248) is in Run.

Dig Sys Cmd Bit 10 (SP085 Relay 1 Alarms [SP 85 bit 15] only)
Directly control Relay 1 with the Digital System Command (SP 129 bit 10).

Dig Sys Cmd Bit 11 (SP086 Relay 2 Alarms [SP 86 bit 15] only)
Directly control Relay 2 with the Digital System Command (SP 129 bit 11).

*The controller will have an inhibit alarm present.

6.1.4 Display Control

In Firmware versions 4.00 and later, you may customize the controller screen list so that the controller displays the most relevant data for your application.

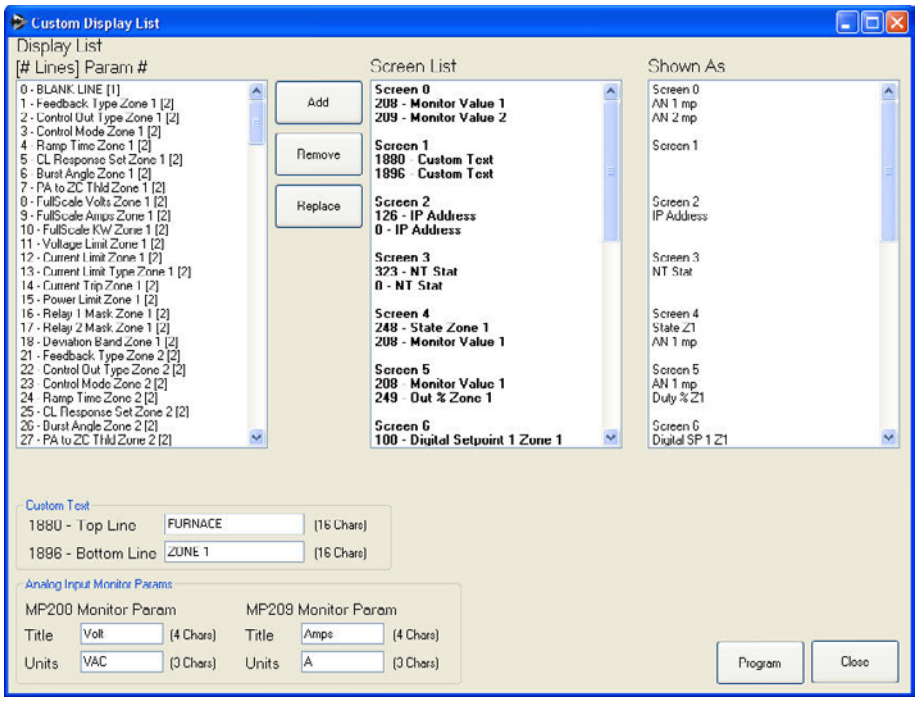


FIGURE 6.02

Default Screen List
Pressing the Default Screen List button will return the controller's screen list to the manufacturing defaults.

Custom Screen List
Pressing the Custom Screen List button opens a new window (See Figure 6.02). From here you can customize what data appears on your controller display, rank the screens in order of relevance, or create custom text.

The controller can display a maximum of 50 screens. Each screen contains up to two lines of text.

To add a parameter to the Screen List, select a parameter in the Screen List just below where you wish to add in the new parameter, then select the parameter you wish to add from the Display List and select the Add button.

To remove a parameter from the Screen List, select the parameter in the Screen List and select the Remove button.

To replace a parameter in the Screen List, select the parameter you wish to replace in the Screen List and the parameter you wish to replace it with from the Display List, and select the Replace button.

Custom text may be useful for naming a controller or giving instructions specific to your task. Enter the text you wish to display in the Custom Text fields, (maximum of 16 characters) highlight "Custom Text" from the Display list and choose "Add" or "Replace."

Under "Analog Input Monitor Params" there are options to specify titles and units for Monitor parameters, MP-208 and MP-209. These specifications apply to Monitor Options covered in 6.1.2.

To approve changes, select "Program" and close the Custom Screen List dialog box.

Parameter Lock

Many parameters can be accessed and edited from the controller display keypad. Parameter lock prevents users from changing specific parameters unless they enter the right password.

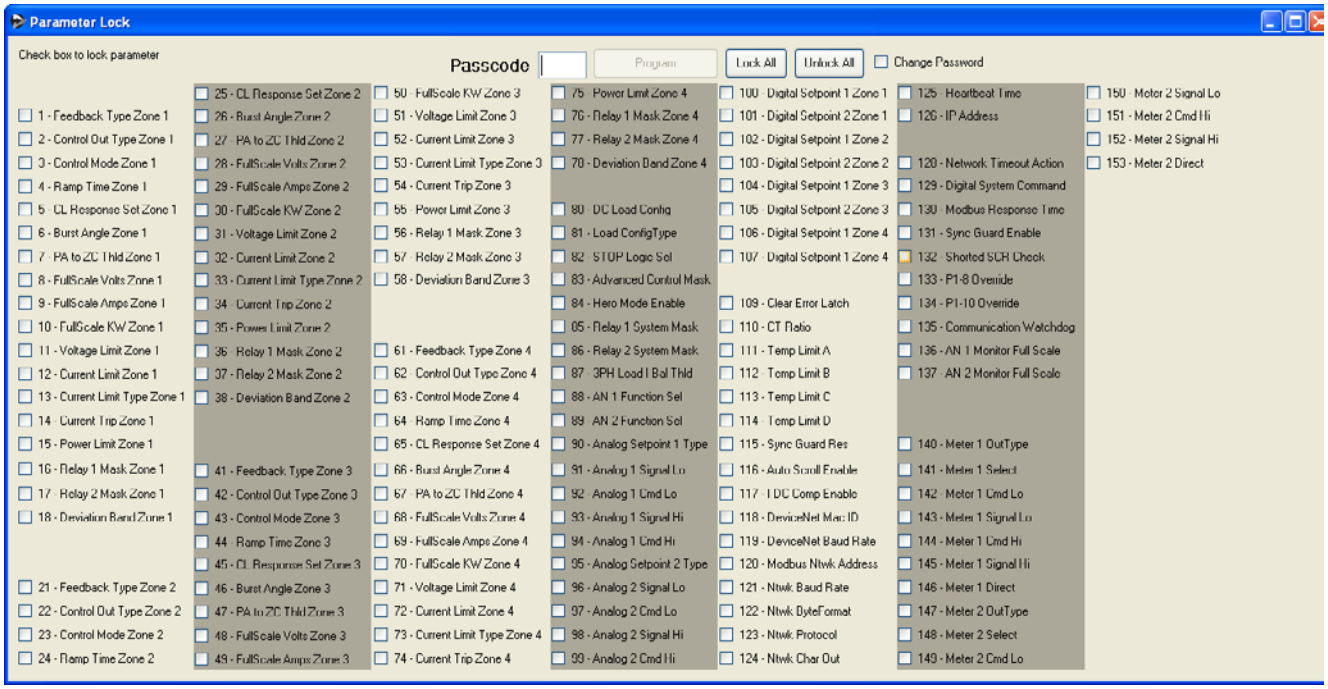


FIGURE 6.04

By default, the password is “4000.” Once the initial password is entered, you may also change the password by selecting the Change Password checkbox and entering a new 4-number combination into the field.

You may select the checkboxes of parameters you wish to lock, or use the Lock All or Unlock All buttons to select/deselect all available parameters.

An editable parameter will appear on the controller display with a dot preceding the text. Pressing the green checkmark key will allow you to edit the parameter value. When the parameter is locked, an asterisk (*) appears instead, and the green checkmark key will prompt you to enter the password. Use the arrow keys to enter the correct combination, pressing the green key to move forward to the next number. If the correct password is entered, all parameters are unlocked and can be locked again by pressing and holding the plus sign (+) key.

Locked parameter | Password prompt | Unlocked display | Editable parameter

FIGURE 6.05

Auto-Scroll Enable [SP 116]

If the “Auto-Scroll Enabled” checkbox is selected, the controller display will cycle through the approved parameters. Auto-scroll also resumes after ten minutes of inactivity, and can be manually removed via the controller display keypad by pressing and holding the Up Arrow key.

6.1.5 User Settings

Save to Backup button
This saves all of the user setable parameter (SP) values from the main user table to the user SP back up table in the EEPROM. If any of the SP values are setup incorrectly or differently in the future, this back up table can be used to restore all of the SP values. This is similar to the Save/Load config file with the exception that only the SP values are saved in the EEPROM instead of the computer. This can only be used to restore values that are stored in the backup table.

Note: This does not save the screen list.

Restore from Backup button
Writes the stored SP values from the user setpoint backup table in the EEPROM to the main user table.

6.1.6 Digital System Command

The Digital System Command is used mainly when using digital communications. It is a 16 bit parameter that contains sections that put the controller into the RUN/Stop state, determines which setpoint to use and to turn the relays On/Off. For bit values see the FUSION Parameter list (SP 129). This section is used to bypass the functionality of the P1 and P2 connector.

P1 8 Override [SP 133]

Setting	Description
Disabled [Default]	Use switch setting on P1 connector (pins 7 and 8)
Enabled	Override P1 connector. Use SP 129 bits 12 – 15.

If Enabled the controller will use the Digital System Command to determine setpoint type (Analog/ Digital - SP 129 bits 12 -15.) Each zone is set to Analog (0) by default.

P1 10 Override [SP 134]

Setting	Description
Disabled [Default]	Use switch setting on P1 connector (pins 7 and 10)
Enabled	Override P1 connector. Use SP 129 bits 4 – 7.

If Enabled the controller will use the Digital System Command to determine the setpoint (setpoint 1 / setpoint 2 - SP 129 bits 4 – 7.) Each zone is set to Setpoint 1 (0) by default.

Relay 1 checkbox [SP 129 bit 10]
When the checkbox for Dig Sys Cmd Bit 10 (SP-85, bit 15) under SP085 Relay 1 Alarms has been checked, checking this box (SP-129, bit 10) will energize Relay 1.

Relay 2 checkbox [SP 129 bit 11]

When the checkbox for Dig Sys Cmd Bit 11 (SP-86, bit 15) under SP086 Relay 2 Alarms has been checked, checking this box (SP-129, bit 11) will energize Relay 2.

Digital Enable Always On [XP 3401, Bits 0:3]

Setting	Description
Disabled [Default]	Use the Digital System Command to put the controller in a RUN/Stop state. During power-up/reset initialization, Digital System Command (SP-129) defaults to put all zones into STOP State (setting SP-129, Bits 0:3 = 0). Digital System Command (SP-129) is used by default when digital setpoints are in use by the controller.
All Enabled	For all zones set the Digital System Command power up defaults to be in Run state. This will still use the Run/Reset connection on the P1 Connector (Pin 7 and 9) to place the controller into Run state.
(Blank) [Not Selectable]	The XP 3401 parameter was set without using this drop box. To determine the power up defaults, read parameter 3401 on the Diagnostics 1 tab.

Enable this when only the RUN/Stop from the P1 connector (pins 7 and 9) is desired and the Digital System Command is not going to be used.

6.2 Zone Tab

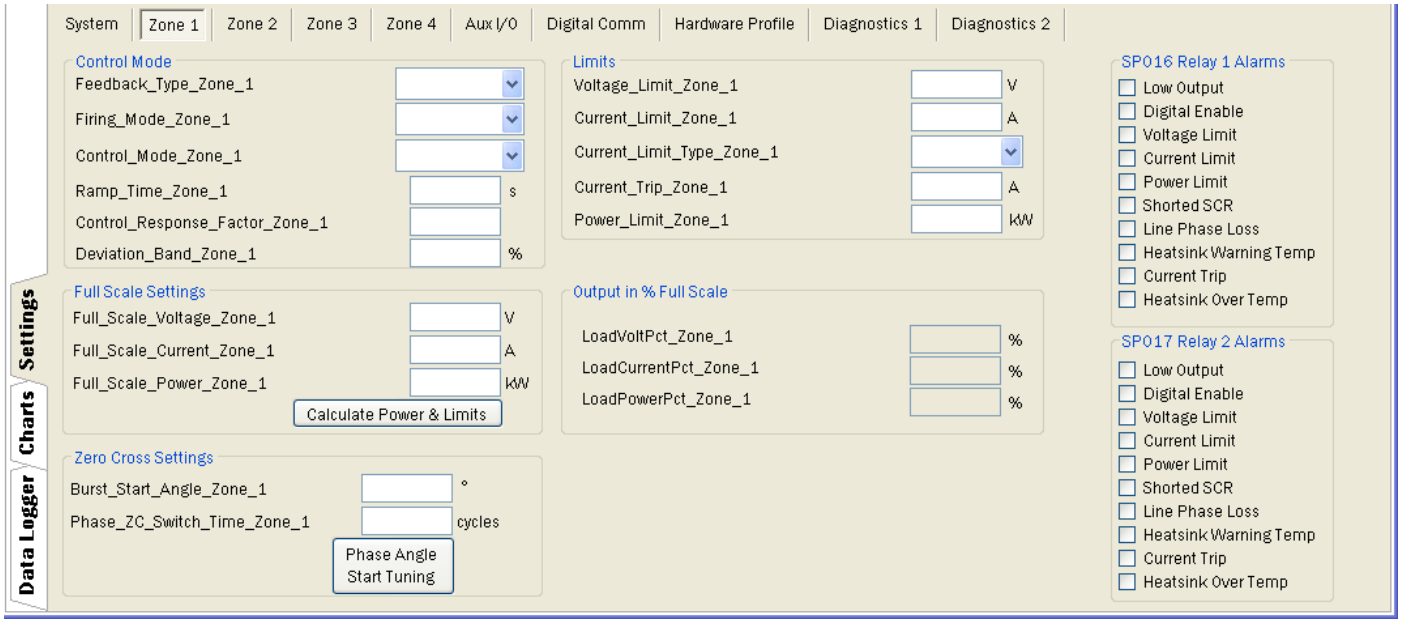


FIGURE 6.06

Tabs for Zones 2, 3, 4 have the same Layout as the Zone 1 tab. Although the parameters on each of these tabs are alike, they are specific to each zone indicated by the "_1, _2, etc," appended to each parameter name.

6.2.1 Control Mode

Feedback Type [SP 1] [SP 21] [SP 41] [SP 61]

Setting	Description
RMS Voltage [Default]	Use RMS voltage as the control loop feedback
AVG Voltage	Use average voltage as the control loop feedback
RMS Current	Use RMS current as the control loop feedback
AVG Current	Use average current as the control loop feedback
Power	Use real power as the control loop feedback
External	Use an external transducer that provides the feedback signal into Analog Setpoint 2. Analog SP2 Function (SP 89) must be set to *Normal*.
Apparent Power	Use apparent power as the control loop feedback

Firing Mode [SP 2] [SP 22] [SP 42] [SP 62]

Setting	Description
Zero Cross	The load power is turned ON for a number of complete electrical half-cycles and then turned OFF for a number of complete half-cycles.
Zero Cross Burst	The first half cycle is fired at a user specified angle and then works the same as Zero Cross mode.
Phase Angle	The SCR is on for a variable portion of the half-cycle.
Zero Cross Transformer Mode	Zero Cross firing method specifically for firing into a transformer. This uses Phase ZC Switch Time (SP7) for determining the number of soft start cycles before switching to Zero Cross firing.

The default setting will be Zero Cross or Phase Angle which is determined at the time of ordering. For DC controller this should be set to Phase Angle. For more information see the Operation Modes section in the Operator Manual.

Control Mode [SP 3] [SP 23] [SP 43] [SP 63]

Setting	Description
Open Loop	The output percentage is directly proportional to the setpoint. Feedback is not used.
Closed Loop [Default]	The output is adjusted so that the feedback equals the setpoint.

Ramp Time [SP 4] [SP 24] [SP 44] [SP 64]
Default value: 0 seconds.

This parameter allows the user to set a maximum ramp time (in seconds) for the controller to reach the full scale value from 0% output. The ramp time is not used if the setpoint is changed from something other than 0% output.

Example: If the controller is set for Voltage Feedback and the Full Scale Voltage is set to 100 Volts and the Ramp Time is set for 10 seconds, when a setpoint is applied the output will rise at 10 volts a second. So if the setpoint is set to 40% the ramp time will be 4 seconds.

Control Response Factor [SP 5] [SP 25] [SP 45] [SP 65]
Default value: 500

The control response factor controls how aggressively or slowly the system will respond to a change in feedback. A smaller number will make the system respond faster and more aggressively. A larger number will make the system respond slower. It is important that the full scale settings are set appropriately in order for the default value to work correctly.

Deviation Band [SP 18] [SP 38] [SP 58] [SP78]
Default value: 100 %

This sets an error tolerance for the feedback. The Zone Status parameter (MP 344 bits 4, 5, 6, 7) can then be monitored. The corresponding bit is set if the Zone is at setpoint.

Example: Deviation Band is set to 2% and the setpoint is set to 80%. While the controller is approaching the setpoint the Zone Status parameter will read 0 until the controller reaches 78%. As long as the feedback remains within +/- 2% of the setpoint, the Zone Status bit will read 1, indicating that the zone is at setpoint.

6.2.2 Full Scale Settings

Feedback type selects the signal you desire to control. These settings deal directly with the full scale settings (Full Scale Voltage, Full Scale Current, Full Scale Power). When using one of the voltage feedback settings, the setpoint will be proportional to the full scale voltage. Likewise if using one of the current feedback settings the setpoint will correspond to full scale current. Power works in the same way.

External feedback works in the same fashion with the exception that it uses an external transducer to provide the feedback signal into Analog Setpoint 2. The output signal of the transducer must be within 0 – 10Vdc or 0 – 20mA. The range is scaled the same way a typical analog setpoint is.

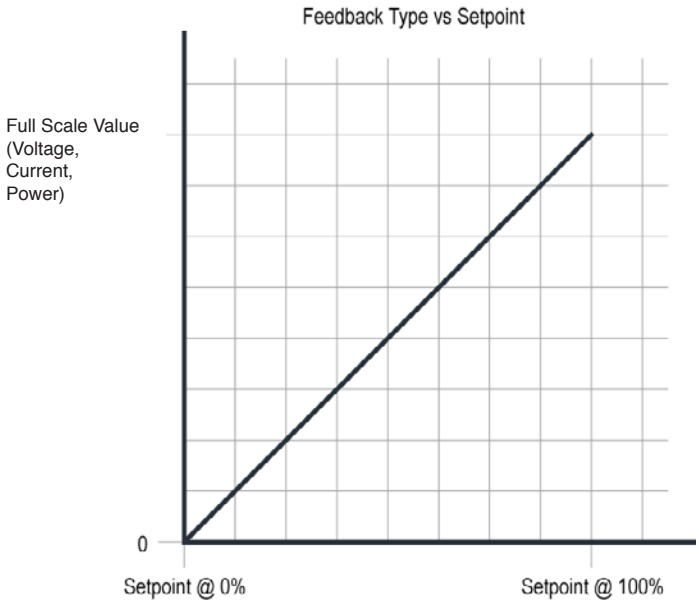


FIGURE 6.07

This figure shows how the setpoint corresponds to the full scale value.

Here is a quick example of how to setup an external feedback signal:

Example: A signal-condition CT outputs 4-20mA corresponding to 0 -100A RMS. The Full Scale Current (SP 9) = 80 Amps.

On the System tab:

Analog SP2 Type = Current
Analog SP2 Function = Normal
Analog SP2 Lo Cmd = 4.00
Analog SP2 Lo Out = 0.00
Analog SP2 Hi Cmd = 16.80*
Analog SP2 Hi Out = 100.00
*This needs to be scaled to the full scale setting. For this example it is current so here is the calculation that is used: (80A X 20mA – 4mA / 100A) + 4 mA

Example 2: A transducer outputs 0-5Vdc corresponding to 0 - 600 Vac RMS. The Full Scale Voltage (SP 8) = 480 Volts.

On the System tab:

Analog SP2 Type = Voltage
Analog SP2 Function = Normal
Analog SP2 Lo Cmd = 0.00
Analog SP2 Lo Out = 0.00
Analog SP2 Hi Cmd = 4.00*
Analog SP2 Hi Out = 100.00
*This needs to be scaled to the full scale setting. For this example it is voltage so here is the calculation that is used: (480Vac / 600Vac) X 5 Vdc

The full scale settings are used throughout the system for command input scaling, limits, and control loop response. It is also used for retransmits on the auxiliary I/O card. These values may be set within the range of the allowable limits for the parameters (see Parameter List Manual for limits).

The controller has limit parameters that prohibit the controller from reaching values that are too large for the controller. For example a 100 Amp controller can have the Full Scale Current set to 1000 Amps but limit parameters will prevent the controller from exceeding 105% (105 Amps) of the frame rating of 100 Amps. It is required that the full scale settings should not be set to more than 2X the actual full load operating valve.

Full Scale Voltage [SP 8] [SP 28] [SP 48] [SP 68]
Default value: 480 Volts

The voltage that will be applied when the load is at full capacity. The closer the full scale voltage is to the actual voltage the more accurate the controller will be. Setting this slightly higher than the actual voltage is common. This should not be set to more than 2X the expected maximum voltage.

Full Scale Current [SP 9] [SP 29] [SP 49] [SP 69]
Default value: Frame Rating for controller in Amps.

The current that will be applied when the load is at full capacity. The closer the full scale current is to the actual current, the more accurate the controller will be. Setting this slightly higher than actual current is common. This should not be set to more than 2X the expected maximum current.

Full Scale Power [SP 10] [SP 30] [SP 50] [SP 70]
The power in kilowatts that will be applied when the load is at full capacity. This should not be set to more than 2X the expected maximum power.

The default value is calculated from the following:

For 1 Phase AC and for DC controllers:
Full Scale Voltage X Full Scale Current
For 3 Phase AC with Delta, 3 or 4 wire wye loads:
Full Scale Voltage X Full Scale Current X $\sqrt{3}$
For 3 Phase AC with Inside Delta load or 4 wire wye loads:
Full Scale Voltage X Full Scale Current X 3

After setting up the Full Scale Voltage and Full Scale Current, the Calculate Power & Limits button can be used to set the Full Scale Power.

Calculate Power & Limits button
By pressing this button the Full Scale Power, Current Limit, Current Trip and Power Limit is calculated and set. The software will automatically detect the controller type and uses the Full Scale Voltage and Full Scale Current to calculate the correct settings.

6.2.3 Zero Cross Settings

Burst Start Angle [SP 6] [SP 26] [SP 46] [SP 66]
Only applies when Zero Cross Burst is selected as the Firing Mode.

Default value: 90 Degrees

This is the setting in phase angle degrees at which the SCRs are fired during the first half cycle. Adjust this depending on the system design and the downstream transformer characteristics. See the Operator Manual for why to use Burst Start Angle or consult with Control Concepts for more information.

Phase ZC Switch Time [SP 7] [SP 27] [SP 47] [SP67]
Only applies when Zero Cross Transformer is selected as the Firing Mode.

Default value: 12 Cycles

This determines the number of cycles before switching to Zero Cross firing. The Phase Angle Start Tuning button is helpful in determining the value for this parameter.

Phase Angle Start Tuning button
Only applies if Zero Cross with Phase Angle Start is selected as the Firing Mode.

This is only on the Zone 1 tab. The controller should be in RUN state with a 10% setpoint. This sets up the trigger for the DataTrace feature of the FUSION Control Panel Software which helps determine the recommended number of cycles for Phase ZC Switch Time (SP 7). Observe at the DataTrace waveforms for indication of saturation of the transformer.

6.2.4 Limits

Voltage Limit [SP 11] [SP 31] [SP 51] [SP 71]
Default: 630 Volts

Limits the load voltage to prevent the controller from exceeding this value. If the voltage reaches the limit value, a Warning Alarm will be triggered indicating that the Voltage Limit has been achieved.

Current Limit [SP 12] [SP 32] [SP 52] [SP 72]
Default: 105% Frame Rating of the controller in Amps.

Limits the lad current, to prevent the controller from exceeding this value. If the current reaches the limit value, a Warning Alarm will be triggered indicating that the Current Limit has been achieved. The maximum value for this is 105% of the frame rating.

Current Limit Type [SP 13] [SP 33] [SP 53] [SP 73]

Setting	Description
RMS	Use RMS current as the type of current for limiting
AVG	Use Average current as the type of current for limiting

Current Trip [SP 14] [SP 34] [SP 54] [SP74]
Default for Phase Angle controllers: 175% Frame Rating for controller in Amps.
Default for Zero Cross controllers: 400% Frame Rating for controller in Amps.

If the current reaches this setting the controller will exhibit an Inhibit Alarm with a message indicating that the controller has experienced a Current Trip. Current Trip responds faster than the Current Limit and protects the controller from experiencing surge currents that could damage it. A fault message will be recorded in the fault history.

After a current trip, the fault must be reset. See Section 3 for ways to reset the fault condition.

Power Limit [SP 15] [SP 35] [SP 55] [SP 77]
Default: 105% Full Scale Power setting

Limits the load power to prevent the controller from exceeding this setting. If the power reaches the limit value, a Warning Alarm will be triggered indicating that the Power Limit has been achieved.

6.2.5 Output in % Full Scale

LoadVoltPct [MP 350] [MP 355] [MP 360] [MP 365]
Displays the load voltage percentage based on the Full Scale Voltage setting.

LoadCurrentPct [MP 351] [MP 356] [MP 361] [MP 366]
Displays the load current percentage based on the Full Scale Current setting.

LoadPowerPct [MP 352] [MP 357] [MP 362] [MP 367]
Displays the load power percentage based on the Full Scale Power setting.

6.2.6 SP016 Relay 1 Alarms / SP017 Relay 2 Alarms [SP 16/17, SP 36/37, SP 56/57, SP 76/77]

Default for Relay 1 Alarms: Current Trip, Heatsink Over Temp
Default for Relay 2 Alarms: Shorted SCR, Heatsink Warning Temp

Select the checkbox next to the particular alarm/function that you wish to energize the relay if the alarm condition is met. Any number of conditions may be mapped to either or both relays and both relays can contain the same conditions. The relay outputs correspond with (SP 85) for Relay 1 and (SP 86) for Relay 2.

Low Output
The controller is at 100% output and the Set Point Reference (or command signal) is higher than the Feedback. In other words the controller is being asked to provide a higher output than the load is capable of.

Digital Enable
If the bit for the Digital System Command (SP 129 bit 0 [SP 16/17], bit 1 [SP 36/37], bit 2 [SP 56/57], bit 3 [SP 76/77]) is set the relay will energize.

Voltage Limit
If Voltage Limit is present the relay will energize.

Current Limit
If Current Limit is present the relay will energize.

Power Limit
If Power Limit is present the relay will energize.

Shorted SCR
If a Shorted SCR is present the relay will energize.

Line Phase Loss*
If a phase loss is detected the relay will energize.

Heatsink Warning Temp
If the heatsink temperature reaches within 5°C of the over-temperature alarm the relay will energize.

Current Trip*
If a Current Trip occurs the relay will energize. This will keep the relay energized until the fault condition is reset. See section 3 on resetting the fault condition.

Heatsink Over Temp*
If the heatsink temperature reaches the over-temperature alarm the relay will energize. When the temperature drops into a safe range, the relay will automatically de-energize.

*The controller will have an inhibit alarm present.

6.3 Aux I/O (Optional)

This tab screen is only present if the Auxiliary I/O expansion Card is ordered.

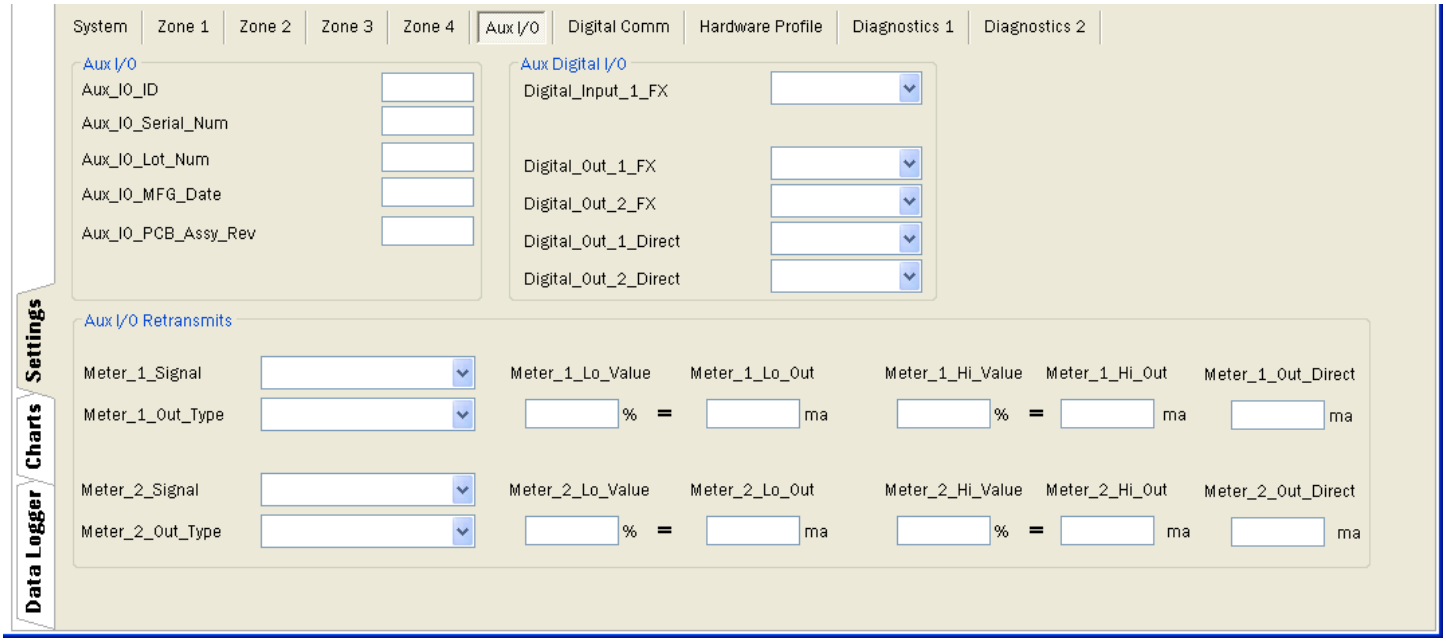


FIGURE 6.08

6.3.1 Aux I/O

This section presents the identification of the Auxiliary card that is built into the frame. These are read only fields that are only pertinent to Control Concepts.

Aux IO ID [CP 655]

This is the ID of the Auxiliary card that is associated with the model number.

Aux IO Serial Num [CP 656]

This is the serial number.

Aux IO Lot Num [CP 658]

This is the lot number associated with the batch of auxiliary cards.

Aux IO MFG Date [CP 660]

The date that the card was manufactured

Aux IO PCB Assy Rev [CP 663]

This is the revision of the card.

6.3.2 Aux Digital I/O

Digital Input 1 FX [SP 154]

Setting	Description
None [Default]	Digital IN 1 (P3 pin 2 & 4) has no function
Open Closed Loop	Switch Closed = Open Loop Switch Open = Closed Loop

This is for a single zone controller only. When set to Open Closed Loop it will override Control Loop (SP 3). The Digital IN 1 (P3 pin 2 & 4) will work as follows:

When closed the controller will be in Open Loop mode.
When open the controller will be in Closed Loop mode.

Digital Out 1 FX [SP 156] / Digital Out 2 FX [SP 157]

Setting	Description
None [Default]	Digital OUT 1 (P3 pin 5) has no function – low output Digital OUT 2 (P3 pin 6) has no function – low output
Direct Out	Sets output according to Digital Out 1 (SP 158) / Digital Out 2 (SP 159)
Voltage Limit	Sets output high if controller is in Voltage Limit
Current Limit	Sets output high if controller is in Current Limit
Power Limit	Sets output high if controller is in Power Limit
Controller Ready	Sets output high if the controller is ready to output (may or may-not be in the Run state).
Controller Output ON	Sets output high if the controller is in a Run state (may or may-not be outputting).

Digital Out 1 Direct [SP 158] / Digital Out 2 Direct [SP 159]

Setting	Description
Low Inactive [Default]	Sets the output of Digital Out 1 (SP 156) / Digital Out 2 (SP 157) low
High Active	Sets the output of Digital Out 1 (SP 156) / Digital Out 2 (SP 157) high

This is only used when Digital Out 1 FX (SP 156) / Digital Out 2 FX (SP 157) is set for Direct Out.

6.3.3 Aux I/O Retransmits

The outputs are configured similarly to the analog inputs. The two retransmits can be configured independently as either a current source (0 – 20 mA) or as a voltage source (0 – 10 Vdc).

Meter 1 Signal [SP 141] / Meter 2 Signal [SP 148]
Here is a picture of a 4 zone Compact FUSION to help determine the proper *Setting* to use.

A three phase controller would only have Modules A, B and C. A multizone single phase would use Module A for Zone 1, Module B for Zone 2, and so on. The Module letters also represent values that can be seen in the Dashboard section of this manual.

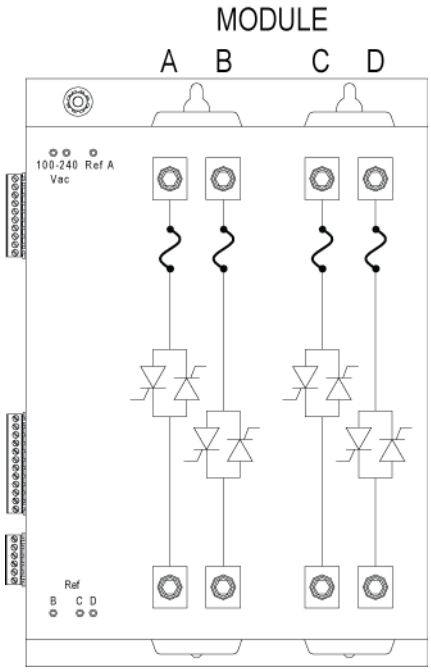


Figure 6.09

Setting	Description
RMS Load Voltage A [Meter 1 Default]	The load voltage for module A
AVG Load Voltage A	The load voltage for module A
RMS Load Current A [Meter 2 Default]	The load current for module A
AVG Load Current A	The load current for module A
Load Power A	The load power for module A
RMS Load Voltage B	The load voltage for module B
AVG Load Voltage B	The load voltage for module B
RMS Load Current B	The load current for module B
AVG Load Current B	The load current for module B
Load Power B	The load power for module B
RMS Load Voltage C	The load voltage for module C
AVG Load Voltage C	The load voltage for module C
RMS Load Current C	The load current for module C
AVG Load Current C	The load current for module C
Load Power C	The load power for module C
RMS Load Voltage D	The load voltage for module D
AVG Load Voltage D	The load voltage for module D
RMS Load Current D	The load current for module D
AVG Load Current D	The load current for module D
Load Power D	The load power for module D
Load Voltage	The controllers load voltage (For single phase only)
Load Current	The controllers load current (For single phase only)
Load Power	The controllers load power
Direct Out	Use Meter 1 Out Direct (SP 146) / Meter 2 Out Direct (SP 153) to set the value of the output.

Meter 1 Out Type [SP 140] / Meter 2 Out Type [SP 147]

Setting	Description
Voltage [Default]	Voltage output scalable from 0 – 10 Vdc (Default 0 – 5 Vdc)
Current	Current output scalable from 0 – 20 mA

Meter 1 Lo Value [SP 142] / Meter 2 Lo Value [SP 149]
Default value: 0.00 %

These are paired with Meter 1 Lo Out (SP 143) / Meter 2 Lo Out (SP 150). These parameters are the percentage at the signal value displayed in (SP 143 / SP 150).

Meter 1 Lo Out [SP 143] / Meter 2 Lo Out [SP 150]
Default value: 0.00 V

These are paired with Meter 1 Lo Value (SP 142) / Meter 2 Lo Value (SP 149). These parameters are the signal value at the percent displayed in (SP 142 / SP 149). This is typically your lowest possible signal value that is the desired output.

Meter 1 Hi Value [SP 144] / Meter 2 Hi Value [SP 151]
Default value: 100.00 %

These are paired with Meter 1 Hi Out (SP 145) / Meter 2 Hi Out (SP 152). These parameters are the percentage at the signal value displayed in (SP 145 / SP 152).

Meter 1 Hi Out [SP 145] / Meter 2 Hi Out [SP 152]
Default value: 5.00 V

These are paired with Meter 1 Out Direct (SP 146) / Meter 2 Out Direct (SP 153). These parameters are the signal value at the percent displayed in (SP 146 / SP 153). This is typically your lowest possible signal value that is the desired output.

Meter 1 Out Direct [SP 146] / Meter 2 Out Direct [SP 153]
Default value: 0.00 V

This is only used when Meter 1 Signal (SP 141) / Meter 2 Signal (SP 148) is set to *Direct Out*. This will give a constant output signal at the level specified in these parameters.

6.4 Digital Comm (Optional)

This tab screen is only present if digital communication is present on the controller. The screen appearance changes depending on the type of communication option.

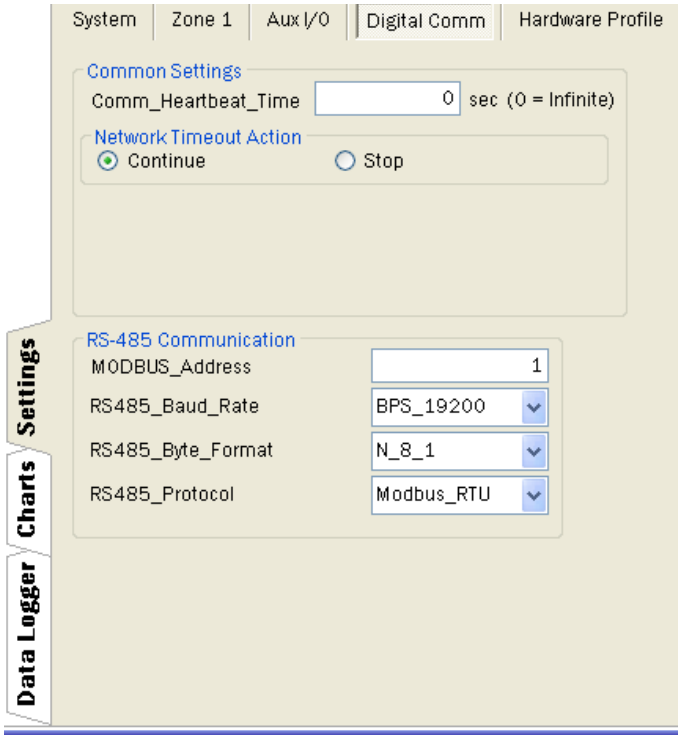


FIGURE 6.10
Modbus RTU

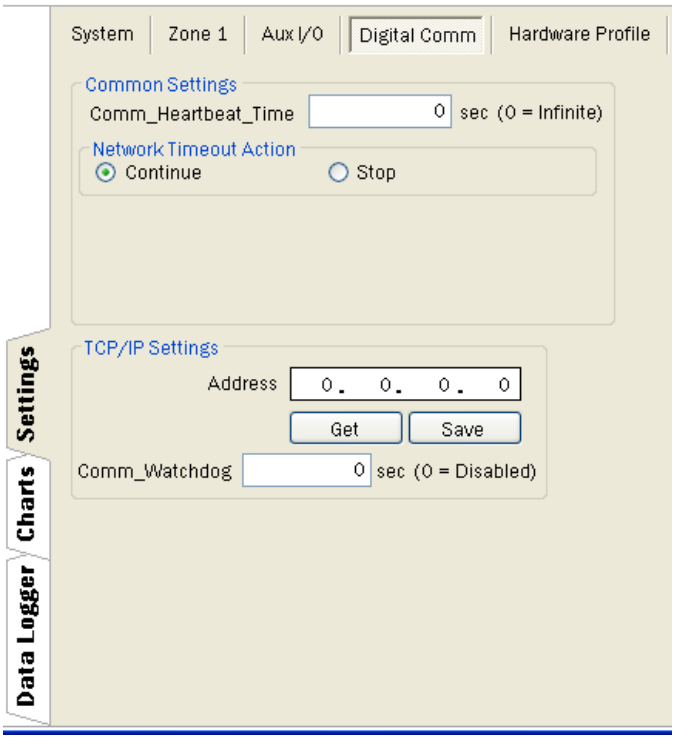


FIGURE 6.11
Modbus TCP, EtherNet/IP, PROFINET

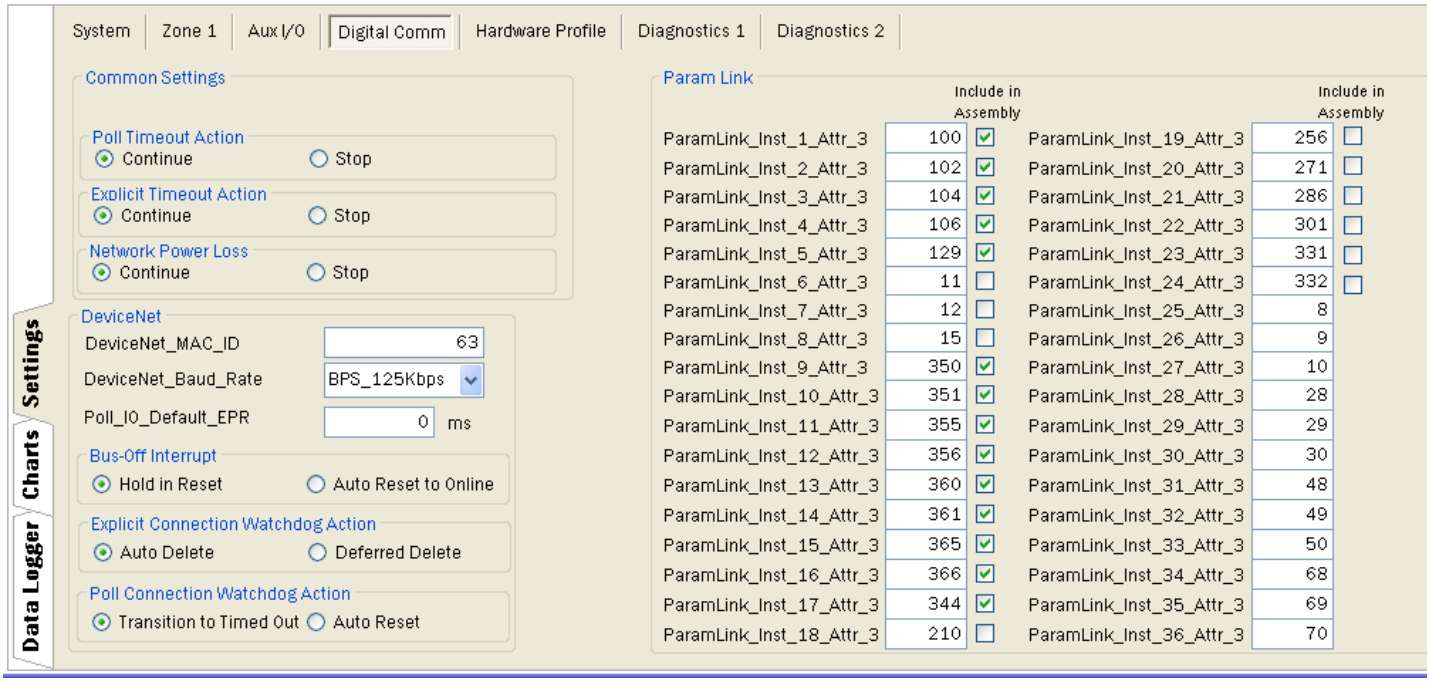


FIGURE 6.12
DeviceNet

6.4.1 Common Settings

Communications Heartbeat Timer [SP 125]
For Ethernet IP, Modbus and Profinet communications only.
Default value: 0 s

When the first message to the controller's address is received the heartbeat timer starts. Subsequent messages reset the timer. If the heartbeat timer expires the Network Timeout Action (SP 128 bit 0) is executed. A notification of a communication timeout will be indicated on the display of the controller. When the timer is timed out, the next valid message will reset the timer. When the heartbeat time is set to 0 seconds the timer will never expire.

See Network Timeout Action (SP 128 bit 0) for more details for what happens when a timeout occurs.

Network Timeout Action [SP 128 bit 0]
For all communications types.

Setting	Description
Continue [Default]	Continue without fault
Stop	Communication fault with controller shut down

For Ethernet IP, Modbus and Profinet communications only.
This is the action for when the heartbeat timer expires.

For DeviceNet communications only.
This is the action for when the Poll I/O connection times out.

When *Continue* is selected and the timer expires the controller continues to operate without a communications fault occurring. *Stop* will cause a communications fault and the controller will shut down.

When a communication fault is present the next valid message will reset the heartbeat timer but the fault also needs to be reset.

For DeviceNet, when a fault occurs the connection has to be re-established.

Explicit Timeout Action [SP 128 bit 1]
For DeviceNet communications only.

Setting	Description
Continue [Default]	Continue without fault
Stop	Communication fault with controller shut down

When *Continue* is selected and the explicit connection times out the controller continues to operate without a communications fault occurring. *Stop* will cause a communications fault and the controller will shut down.

When a communication fault is present the fault needs to be reset.

Network Power Loss [SP 128 bit 2]
For DeviceNet communications only.

Setting	Description
Continue [Default]	Continue without fault
Stop	Communication fault with controller shut down

When *Continue* is selected and DeviceNet network power is not present the controller continues to operate without a communications fault occurring. *Stop* will cause a communications fault and the controller will shut down.

When a communication fault is present the fault needs to be reset.

6.4.2 TCP/IP Settings

For Ethernet IP, Modbus TCP and Profinet communications only.

Address [SP 126 – SP 127]

Default value: 255.255.255.255
This is the address of the controller on the network.

Get button
Modbus TCP only. This verifies the address is correctly programmed on the communications module of the controller.

Save Button
This sets the address to the communications module of the controller.

Comm Watchdog [SP 135]
Default value: 0
Modbus TCP only. When this is set to 0 the timer is disabled. The minimum setting for this is 15 seconds and a maximum of 65535 seconds. If this is set to a value of 1 through 14 the timer defaults to 15 seconds.

When this timer expires, the communication modules configuration is interrogated by the controller to verify proper operation.

6.4.3 RS-485 Communication

For Modbus RTU communications only.
For more details on this section see the Modbus RTU manual.

Modbus Address [SP 120]
Default value: 1
This is the address of the controller on the network.

RS-485 Baud Rate [SP 121]

Setting	Description
9600 bps	9600 bits per second
19200 bps [Default]	19200 bits per second

RS-485 Byte Format [SP 122]

Setting	Description
N, 8, 1 [Default]	No parity, 8 data bits, 1 stop bit
E, 8, 1	Even parity, 8 data bits, 1 stop bit

RS-485 Char Out [SP 123]

Setting	Description
Modbus RTU [Default]	8 bit binary protocol
Modbus ASCII	ASCII character protocol

Modbus ASCII protocol is included for troubleshooting only, and therefore has limited capabilities.

6.4.4 DeviceNet

For DeviceNet communications only.
For more details on this section see the DeviceNet manual.

DeviceNet Mac ID [SP 118]
Default value: 63
This is the address of the controller on the network.

DeviceNet Baud Rate [SP 119]

Setting	Description
125 Kbps [Default]	125000 bits per second
250 Kbps	250000 bits per second
500 Kbps	500000 bits per second

Poll I/O Default EPR [SP 198]
Default value: 0 ms
This is the expected packet rate value assigned to the connection while it is in the “Configuration” state.

Note: During the “configuration” state, no Inactivity timer is running so this does nothing!

Bus-Off Interrupt [SP 199 bit 0]

Setting	Description
Hold in Reset [Default]	When Bus-Off condition occurs, transition to the Bus-Off state
Auto Reset to On-Line	Transition back through connection Reset and gain access on the network to the On-Line unallocated state

Explicit Connection Watchdog Action [SP 199 bit 1]

Setting	Description
Auto Delete [Default]	Connection transitions to non-existence state
Deferred Delete	The explicit connection will remain as long as the poll connection exists

Poll Connection Watchdog Action [SP 199 bit 2]

Setting	Description
Transition to Timed-Out [Default]	Transition to timed-out
Auto Reset	The connection does not time-out

6.4.5 Param Link [SP 160 – SP195]

For DeviceNet communications only.
For more details on this section see the DeviceNet manual.
See Figure 6.12 in the beginning of this section for default settings.

These set Attribute 3 of parameter link instances 1 through 36. Instances 1 through 24 have checkboxes next to the parameter. Place a checkmark on the parameters that will be included in the I/O Poll messages.

ParamLink Instance 1 through 8 are the Output Assembly checkbox [SP196 bit 0 – bit 7].
ParamLink Instance 9 through 24 are the Input Assembly checkbox [SP197 bit 0 – bit 15].

6.5 Hardware Profile

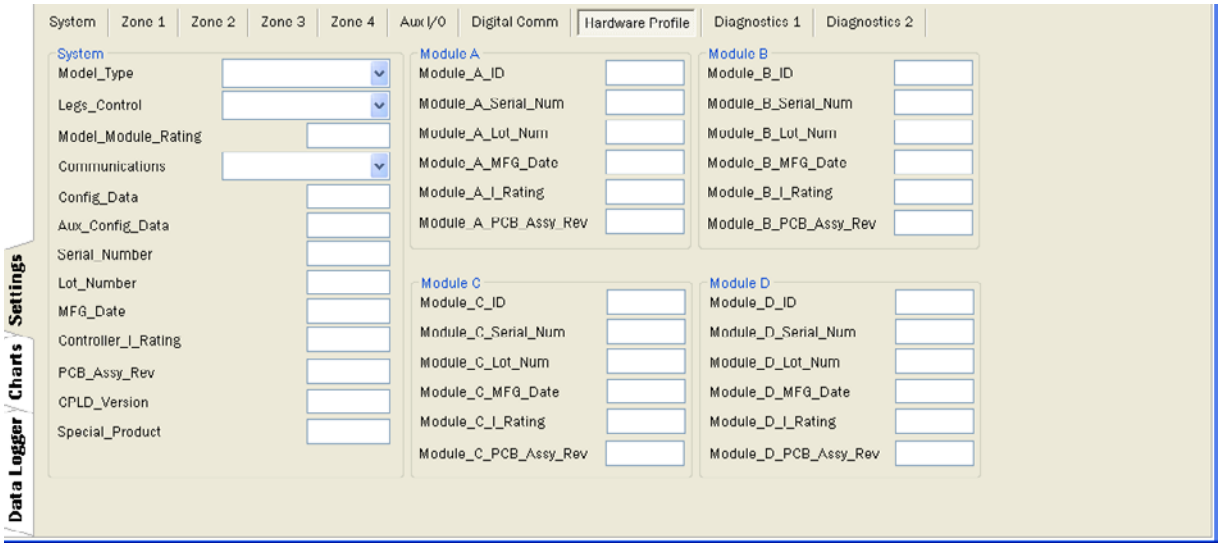


FIGURE 6.13

The tab describes the physical hardware within the FUSION Power Controller. From this tab, the board serial number, lot number, assembly revision, and manufacturing data can be obtained. These parameters are set at the factory and cannot be changed by the user, with the only exception being the communications option.

Communications [CP 603]

Setting	Description
USB [Default]	USB communications only
USB and Modbus RTU	Modbus RTU module is present
USB and Modbus TCP	Modbus TCP module is present
USB and DeviceNet	DeviceNet module is present
USB and Profinet	Profinet module is present
USB and Ethernet IP	Ethernet IP module is present

This allows the user to change the communications type if a communications module is added in the field. Each communication option has a separate communications module even though the connection looks the same. Do not try and change this from one type of communication type to another without changing the communications module. Consult with Control Concepts for changing the communication type in the field.

6.6 Diagnostics 1

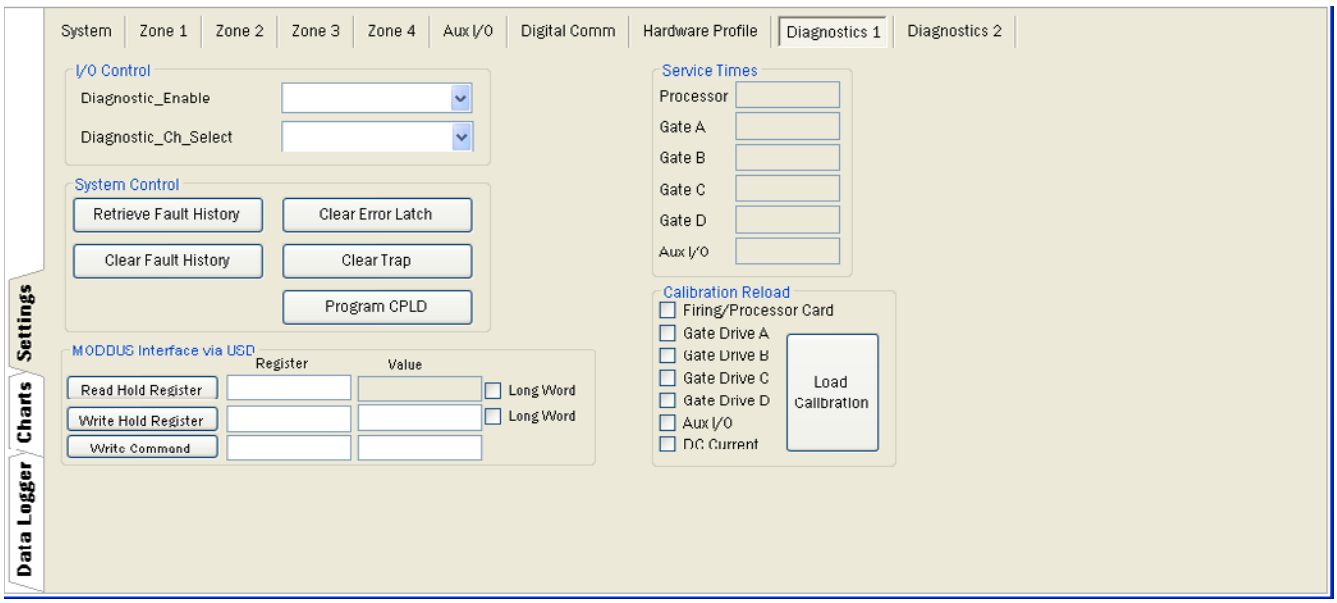


FIGURE 6.14

This diagnostics tab provides a way to test controllers' hardware and software, check controller history, program the CPLD, and load calibration data. This tab should not be used unless directed to by Control Concepts.

6.6.1 I/O Contol

Diagnostic Enable [CAL 395]

Setting	Description
Disabled [Default]	Disable diagnostic mode Do not change unless directed to do so

Diagnostic Ch Select [CAL 396]

Setting	Description
Diag Bits OFF [Default]	The diagnostic bits are OFF Do not change unless directed to do so

6.6.2 System Control

Retrieve Fault History button
Every time the controller experiences a fault, the fault information is recorded. This button retrieves the fault information and saves it to a text (.txt) file with the controller's serial number. Upon saving this file, a text file will open and display the Error Index, Error Time, Error Code and Error String. This file can be useful when determining unknown fault states

Clear Error Latch button
Clears that error latch register (MP 345).

Clear Fault History button
This clears the fault history record in the controller.

Clear Trap button
This clears the processor error trap records.

Program CPLD button
Used when loading a new CPLD program.

6.6.3 MODBUS Interface via USB

Read Hold Register button
Enter the number of the parameter you wish to read into the *Register* box next to the *Read Hold Register* button. Selecting this button will read the value of the parameter and display it in the *Value* box.

Write Hold Register button
Enter the number of the parameter into the *Register* box and the value that you wish to write into the *Value* box next to the *Write Hold Register* button. Selecting this button will write the value to the parameter.

NOTE: Some values require a high and low word and therefore have a high and low parameter associated with them. Check the *Long Word* checkbox to read or write both of these parameters. When *Long Word* is checked enter only the parameter number for the high word. The high word parameter is designated in the parameter list by HI (MSW) in the title.

Write Command button
Writes special commands to the controller. This is not used unless under direct support from Control Concepts.

6.6.4 Service Times

This displays the hours the card has been on. If a value displays as 0 the card is not present.

Processor [MP 309]
Firing card hours

Gate A [MP 311]
Gate Drive A hours

Gate B [MP 313]
Gate Drive B hours

Gate C [MP 315]
Gate Drive C hours

Gate D [MP 317]
Gate Drive D hours

Aux I/O [MP 319]
Auxiliary I/O Board hours

6.6.5 Calibration Reload

Load Calibration button
From the checkboxes beside, the calibration tables can be reloaded from a configuration file. This should not be used unless directed to do so from Control Concepts. Control Concepts saves a configuration file on every controller prior to shipment if this is deemed necessary and a configuration file has not been saved by the customer. Contact Control Concepts for this file.

6.7 Diagnostics 2

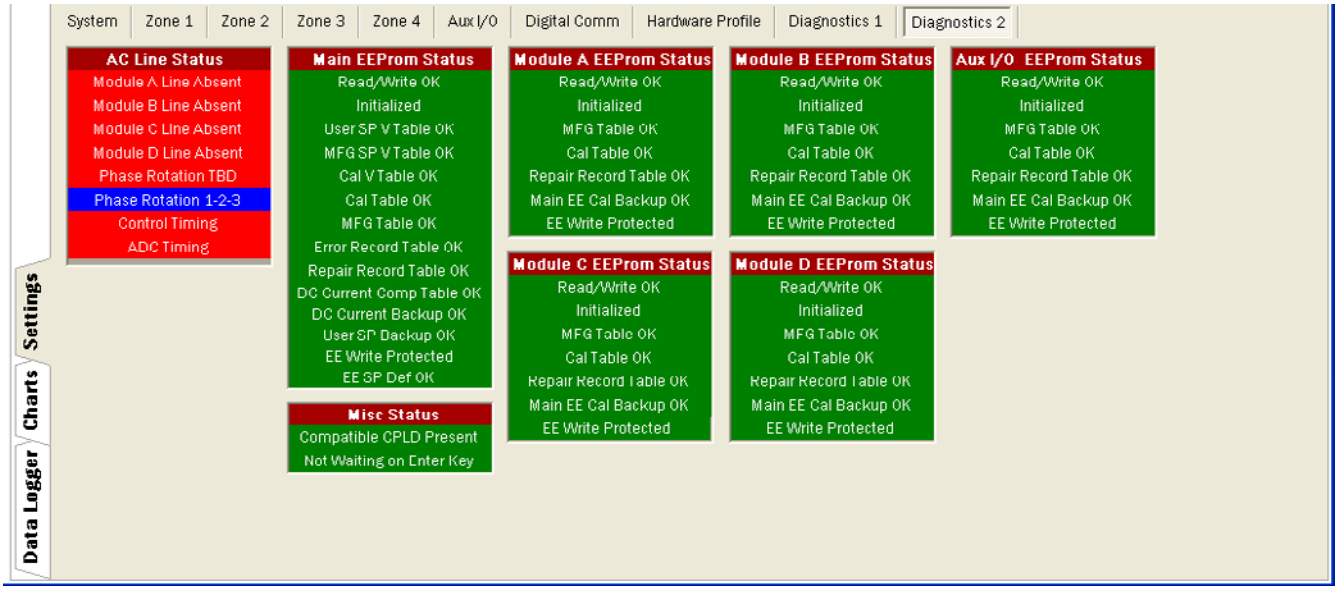


FIGURE 6.15

In the event that the Control Concepts Customer Service Department is needed to assist with the controller, this diagnostics tab provides a quick, useful picture of the internal settings of the controller.

In general, disregard this tab and do not be concerned with the status colors, as hardware presence can dictate that status color.

6.7.1 AC Line Status [MP 342]

				Status Color:	
				(Red)	**(Green)**
Bit Definition:	Bit	7	= ADC Timing	Not OK	OK
		6	= Control Timing	Not OK	OK
		5	= Phase Rotation	1-2-3 **(Blue)**	3-2-1
		4	= Phase Rotation	TBD	OK
		3	= Module D Line	Absent	Present
		2	= Module C Line	Absent	Present
		1	= Module B Line	Absent	Present
	Bit	0	= Module A Line	Absent	Present

Module A Line [MP 342 bit 0] Present / Absent

Indicates if the AC line is present on module A.

Module B Line [MP 342 bit 1] Present / Absent

Indicates if the AC line is present on module B.

Module C Line [MP 342 bit 2] Present / Absent

Indicates if the AC line is present on module C.

Module D Line [MP 342 bit 3] Present / Absent

Indicates if the AC line is present on module D.

Phase Rotation [MP 342 bit 4] TBD / OK

Indicates if the phase rotation has been determined.

Phase Rotation [MP 342 bit 5] 1-2-3 / 3-2-1

Indicates the phase rotation.

Control Timing [MP 342 bit 6] Blank / OK

The timing for SCR firing. This must be OK in order for the SCR to turn ON.

ADC Timing [MP 342 bit 7] Blank / OK

The timing for feedback data collection synchronization.

6.7.2 Main EEProm Status [MP 336]

Bit Definition:				Status Color: (Red)	(Green)
Bit	15	=	TBD		
	14	=	TBD		
	13	=	EE SP Def	Update Req	OK
	12	=	EE Write Protected	Not Protected	Protected
	11	=	User SP Backup	Fail	OK
	10	=	DC Current Backup	Fail	OK
	9	=	DC Current Comp Table	Fail	OK
	8	=	Repair Record Table	Fail	OK
	7	=	Error Record Table	Fail	OK
	6	=	MFG Table	Fail	OK
	5	=	Cal Table	Fail	OK
	4	=	Cal V Table	Fail	OK
	3	=	MFG SP V Table	Fail	OK
	2	=	User SP V Table	Fail	OK
	1	=	Initialized	Init Required	Initialized
Bit	0	=	Read/Write	Fail	OK

Read / Write [MP 336 bit 0] OK/Fail

During power up, checks to see if the EEPROM is functional.

Initialized / Init Required [MP 336 bit 1]

The EEPROM has been initialized.

User SP V Table [MP 336 bit 2] OK/Fail

Status of the user setup parameter table.

MFG SP V Table [MP 336 bit 3] OK/Fail
Status of the manufacturing setup parameter table.

Cal V Table [MP 336 bit 4] OK/Fail
Status of the calibration setup parameter table.

Cal Table [MP 336 bit 5] OK/Fail
Status of the calibration data table.

MFG Table [MP 336 bit 6] OK/Fail
Status of manufacturing data table.

Error Record Table [MP 336 bit 7] OK/Fail
Status of the error record table.

Repair Record Table [MP 336 bit 8] OK/Fail
Status of the repair record table.

DC Current Comp Table [MP 336 bit 9] OK/Fail
Status of the DC current compensation table.

DC Current Backup [MP 336 bit 10] OK/Fail
Status of the backup DC current compensation table.

User SP Backup [MP 336 bit 11] OK/Fail
Status of the backup user setup parameter table.

EE Write Protected / EE Not Write Protected [MP 336 bit 12]
The status of the EEPROM write protection.

EE SP Def / EE SP Def Update Req [MP 336 bit 13]
The status of the setup parameter definition table.

6.7.3 Misc Status [MP 335]

Compatible CPLD Present – Incompatible CPLD Present [MP 335 bit 1]
Not Waiting on Enter Key – Waiting on Enter Key [MP 335 bit 3]

6.7.4 Module A EEProm Status [MP 337]

				Status Color: (Red)	(Green)
Bit Definition:	Bit	7	= EE Write Protected	Not Protected	Protected
		6	= TBD		
		5	= Main EE Cal Backup	Fail	OK
		4	= Repair Record Table	Fail	OK
		3	= Cal Table	Fail	OK
		2	= MFG Table	Fail	OK
		1	= Initialized	Init Required	Initialized
	Bit	0	= Read/Write	Fail	OK

Read/Write [MP 337 bit 0] OK/Fail

During power up, checks to see if the EEPROM is functional.

Initialized / Init Required [MP 337 bit 1]

The EEPROM has been initialized.

MFG Table [MP 337 bit 2] OK/Fail

Status of manufacturing data table.

Cal Table [MP 337 bit 3] OK/Fail

Status of the calibration data table.

Repair Record Table [MP 337 bit 4] OK/Fail

Status of the repair record table.

Main EE Cal Backup [MP 337 bit 5] OK/Fail

Status of the backup calibration data table.

EE Write Protected / EE Not Write Protected [MP 337 bit 7]

The status of the EEPROM write protection.

6.7.5 Module B EEProm Status [MP 338]

				Status Color: (Red)	(Green)
Bit Definition:	Bit	7	= EE Write Protected	Not Protected	Protected
		6	= TBD		
		5	= Main EE Cal Backup	Fail	OK
		4	= Repair Record Table	Fail	OK
		3	= Cal Table	Fail	OK
		2	= MFG Table	Fail	OK
		1	= Initialized	Init Required	Initialized
	Bit	0	= Read/Write	Fail	OK

Read/Write [MP 338 bit 0] OK/Fail

During power up, checks to see if the EEPROM is functional.

Initialized / Init Required [MP 338 bit 1]

The EEPROM has been initialized.

MFG Table [MP 338 bit 2] OK/Fail

Status of manufacturing data table.

Cal Table [MP 338 bit 3] OK/Fail

Status of the calibration data table.

Repair Record Table [MP 338 bit 4] OK/Fail

Status of the repair record table.

Main EE Cal Backup [MP 338 bit 5] OK/Fail

Status of the backup calibration data table.

EE Write Protected / EE Not Write Protected [MP 338 bit 7]

The status of the EEPROM write protection.

6.7.6 Module C EEProm Status [MP 339]

				Status Color: (Red)	(Green)
Bit Definition:	Bit	7	= EE Write Protected	Not Protected	Protected
		6	= TBD		
		5	= Main EE Cal Backup	Fail	OK
		4	= Repair Record Table	Fail	OK
		3	= Cal Table	Fail	OK
		2	= MFG Table	Fail	OK
		1	= Initialized	Init Required	Initialized
	Bit	0	= Read/Write	Fail	OK

Read/Write [MP 339 bit 0] OK/Fail

During power up, checks to see if the EEPROM is functional.

Initialized / Init Required [MP 339 bit 1]

The EEPROM has been initialized.

MFG Table [MP 339 bit 2] OK/Fail

Status of manufacturing data table.

Cal Table [MP 339 bit 3] OK/Fail

Status of the calibration data table.

Repair Record Table [MP 339 bit 4] OK/Fail

Status of the repair record table.

Main EE Cal Backup [MP 339 bit 5] OK/Fail

Status of the backup calibration data table.

EE Write Protected / EE Not Write Protected [MP 339 bit 7]

The status of the EEPROM write protection.

6.7.7 Module D EEProm Status [MP 340]

				Status Color: (Red)	(Green)
Bit Definition:	Bit	7	= EE Write Protected	Not Protected	Protected
		6	= TBD		
		5	= Main EE Cal Backup	Fail	OK
		4	= Repair Record Table	Fail	OK
		3	= Cal Table	Fail	OK
		2	= MFG Table	Fail	OK
		1	= Initialized	Init Required	Initialized
	Bit	0	= Read/Write	Fail	OK

Read/Write [MP 340 bit 0] OK/Fail

During power up, checks to see if the EEPROM is functional.

Initialized / Init Required [MP 340 bit 1]

The EEPROM has been initialized.

MFG Table [MP 340 bit 2] OK/Fail

Status of manufacturing data table.

Cal Table [MP 340 bit 3] OK/Fail

Status of the calibration data table.

Repair Record Table [MP 340 bit 4] OK/Fail

Status of the repair record table.

Main EE Cal Backup [MP 340 bit 5] OK/Fail

Status of the backup calibration data table.

EE Write Protected / EE Not Write Protected [MP 340 bit 7]

The status of the EEPROM write protection.

6.7.8 Aux I/O EEProm Status [MP 341]

				Status Color: (Red)	(Green)
Bit Definition:	Bit	7	= EE Write Protected	Not Protected	Protected
		6	= TBD		
		5	= Main EE Cal Backup	Fail	OK
		4	= Repair Record Table	Fail	OK
		3	= Cal Table	Fail	OK
		2	= MFG Table	Fail	OK
		1	= Initialized	Init Required	Initialized
	Bit	0	= Read/Write	Fail	OK

Read/Write [MP 341 bit 0] OK/Fail

During power up, checks to see if the EEPROM is functional.

Initialized / Init Required [MP 341 bit 1]

The EEPROM has been initialized.

MFG Table [MP 341 bit 2] OK/Fail

Status of manufacturing data table.

Cal Table [MP 341 bit 3] OK/Fail

Status of the calibration data table.

Repair Record Table [MP 341 bit 4] OK/Fail

Status of the repair record table.

Main EE Cal Backup [MP 341 bit 5] OK/Fail

Status of the backup calibration data table.

EE Write Protected / EE Not Write Protected [MP 341 bit 7]

The status of the EEPROM write protection.

6.8 OEM (OEM Version Only)

Custom tabs are available if specific settings do not meet a customers' needs. The contents of the OEM tab will vary based on the collaboration between Control Concepts and the individual customer.

Contact Control Concepts for more information about Custom/OEM controllers or for examples of previous models.

7. CHART TAB

7.1 Recorder

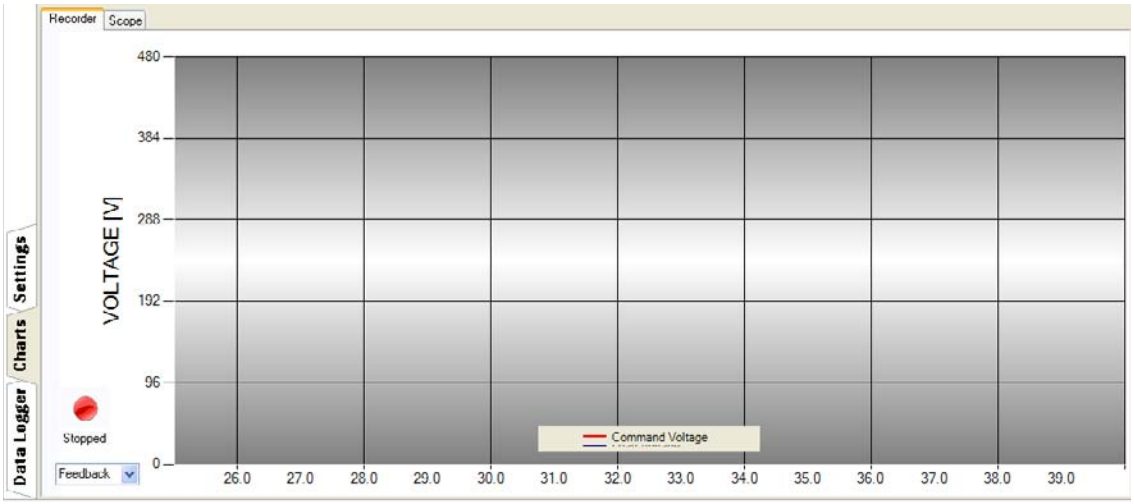


FIGURE 7.00

This tool charts the command value of the control loop against the feedback for voltage current or power. Start the tool by clicking the red button. Stop the chart tool by clicking the red button again. Select the signal you would like to chart in the lower left drop down box.

This feature is only available for Zone 1 at this time. You can select the signal using the selection box in the lower left corner of the screen. The timescale is fixed. However you can zoom in by click-and-dragging a vertical window region. Undo the zoom using the newly presented “-” symbol on the vertical scroll bar.

7.2 Scope

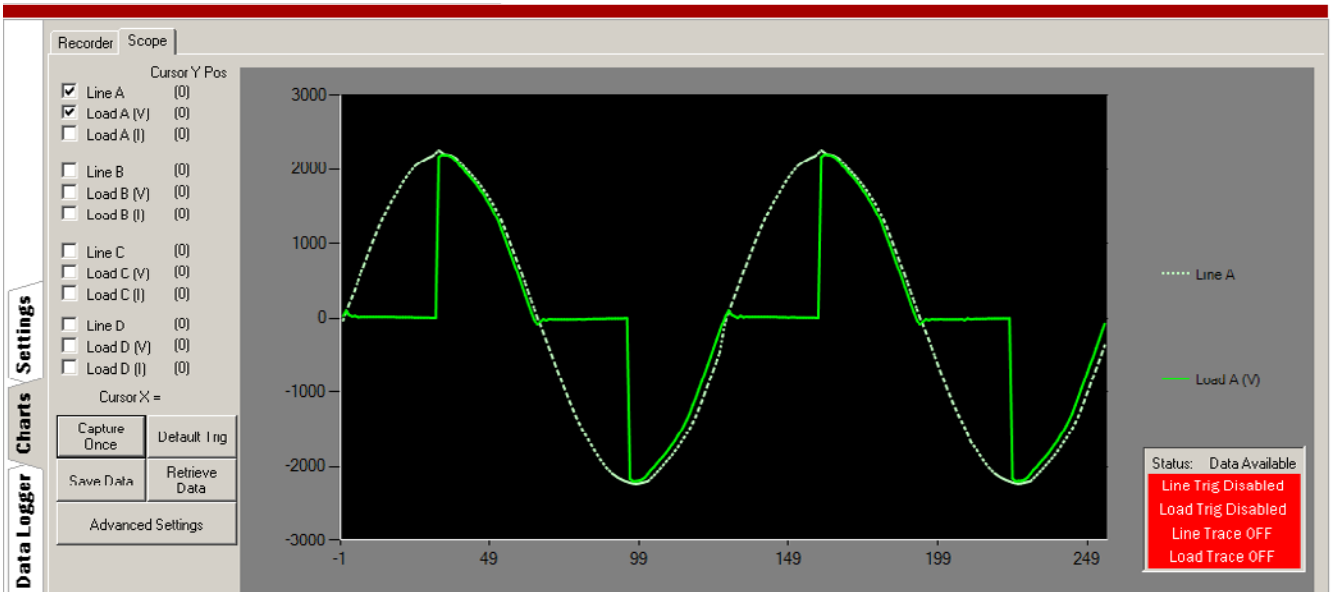


FIGURE 7.01

The scope feature records the line voltages, load voltages and current waveforms for a period of 2 cycles. This data can then be viewed on the graph. The checkboxes beside the graph can turn ON/ OFF the desired waveform for viewing.

The graph has zooming capability by clicking-and-dragging a vertical window region. Undo the zoom using the newly presented "-" symbol on the horizontal and vertical scroll bar.

There is a status box on the lower right corner.

Status	
Data Available	Data has been collected and is ready to be retrieved
Waiting for Trigger	The trigger event has not occured yet.
No Data	No data has been collected.
Line / Load Trigger	
Enabled	Trace is Enabled, waiting for trigger
Disabled	Trace is Disabled
Line / Load Trace	
ON	Trace is ON, collecting Data
OFF	Trace is OFF

Snapshot/Capture Once button
Collects 2 cycles worth of data and displays the information on the graph.

Default Trig button
The controller is constantly collecting data. Over Current Trip is, by default, the only active trigger. After an Over Current Trip the controller stops collecting data and saves the last 2 cycles of data. The default trigger button resets the trigger so the controller will continually collect data again.

Save Data button
This saves the data that is displayed to a .csv file which can be imported into a spreadsheet program.

Retrieve Data button
As long as the Status indicator on the lower right corner indicates “Data Available”, data can be retrieved from the controller and displayed on the graph.

7.2.1 Advanced Settings button

When the Advanced Setting button is pressed, a new window appears.

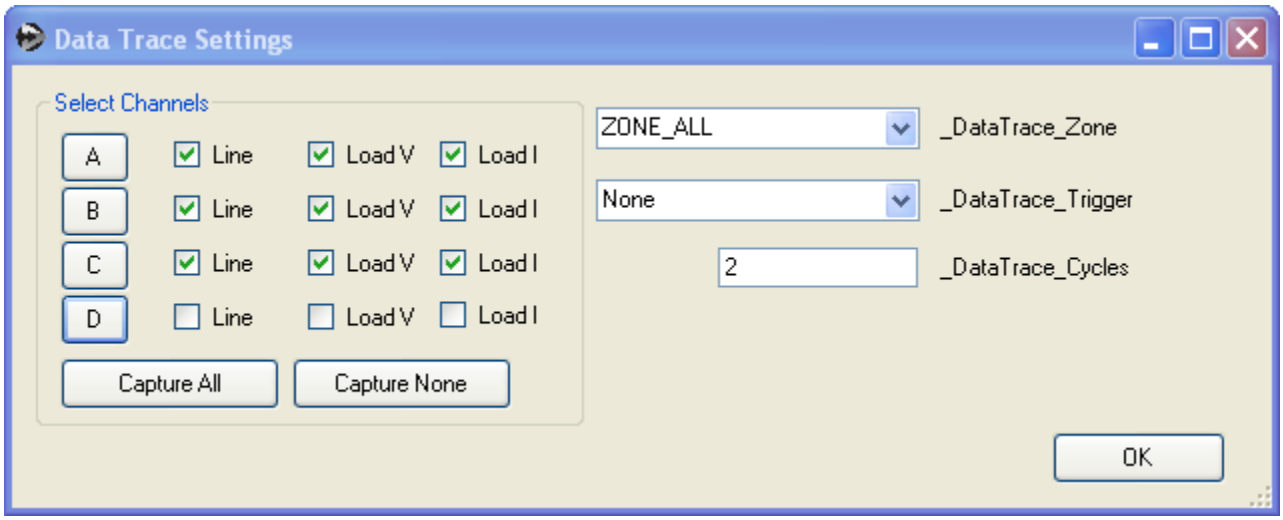


FIGURE 7.02

Select Channels
Pick the channels that are desired to be saved.

Data Trace Zone Drop box
Choose which zone the trigger will be active for. If Zone All is used, the data will be saved for the first zone to trigger the event.

Data Trace Trigger Drop box

Setting	Description
None	Starts on the next AC line, positive half cycle
Run	When controller is in Run state
Zero Cross	Next Zero Cross fire pulse
Zero Cross Positive	Next Zero Cross fire pulse on the positive half cycle
Zero Cross Negative	Next Zero Cross fire pulse on the negative half cycle
Limit	Any limit (Voltage, Current, Power)
Shorted SCR	Shorted SCR event
Over Current Trip	Over Current Trip event

Data Trace Cycles

Range: 0 – 100 Cycles (0 = continuous)
After trigger, data is collected until the set number of cycles, then the trace stops and holds data for the last two cycles collected.

For example: If Data Trace Cycles = 10, 10 cycles of data will be collected and the last 2 cycles will be saved for viewing.

8. DATA LOGGER TAB

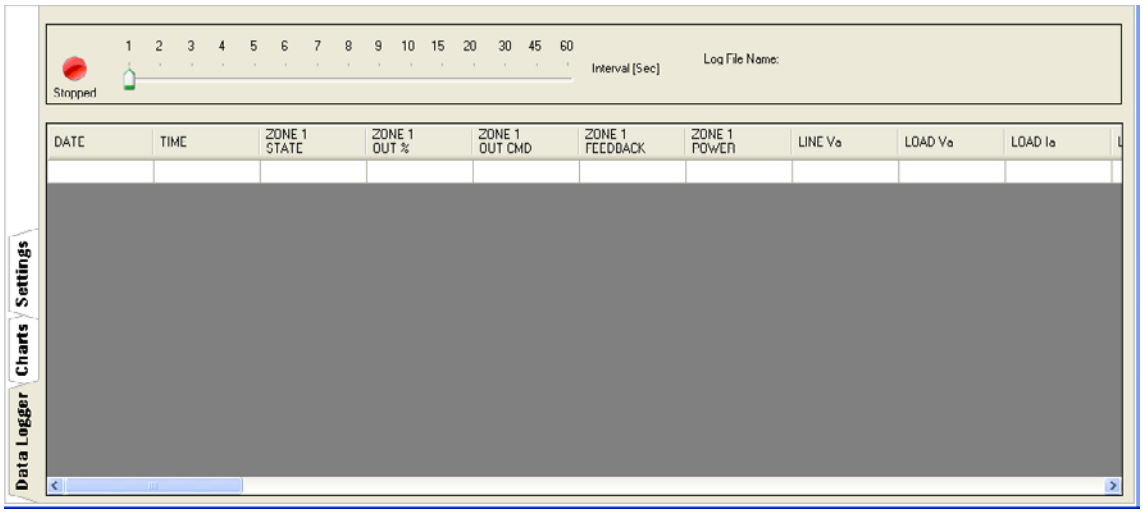


FIGURE 8.00

The Datalogger Tab is a vertical tab found to the left of the active tab screen. This tool logs the runtime data for the FUSION Power Controller to a .csv file which can be imported into a spreadsheet program. The tool is useful for logging process cycles and machine start-ups.

Start the logger by first selecting the log interval in seconds and then click the red button. You will be prompted for the name and location to save the file. The logger will log the data to the file at the selected interval as long as the program remains running and the USB communications remain intact. Select the red button again to stop the logging.

